Boys’ Goal Orientations, Self-Concept and Achievement during the Transition from Single Sex to Coeducation [R]

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Self-concept and goal theories have played prominent roles in motivation and achievement related research over the last 25 years. In a recent paper, Dowson, Barker, and McInerney (2004) advanced the hypothesis that the two theories taken together provide a more adequate explanation of student academic achievement than either self-concept or motivational goal variables alone. The present study tested the Dowson et al., (2004) cross-theoretical hypothesis in a longitudinal study of a non-government school in South Australia during its transition from single sex to coeducation.

Mathematics Self-Concept, General-School, mastery and performance goal orientations and academic achievement were measured in elementary and secondary boys from the single sex school over a three year period before, during and after the introduction of coeducation. Structural Equation Modelling analyses were conducted using the Dowson et al., (2004) preferred causal order of goal orientation, self-concept and achievement. Results confirm the causal relationships between goals, self-concept and achievement advocated by Dowson et al (2004), and extend the cross-theoretical hypothesis to students at elementary grade levels. Insights afforded by cross-theoretical analyses are of particular value in the current educational climate where concerns about gender differences in achievement are evident in many countries and single sex/coeducational controversies continue unabated.

The interplay of self and purpose has been the focus of much research on motivation (Maehr & McInerney, 2004), with self-concept theory (Marsh, 1993) and goal theory (Ames, 1992) each providing considerable research initiatives and useful insights into student academic achievement. Over the last twenty five years relationships between academic self-concept and academic achievement have become well established as has their domain specificity (Marsh & Craven, 2006). Similarly, a large body of research has confirmed the significant role played by students’ personal goal orientations on their motivation and achievement related behaviours at elementary and secondary school levels (Meece, Anderman & Anderman, 2006). However, in a recent paper Dowson, Barker and McInerney (2004) advanced the hypothesis that the self-concept and goal orientation theories taken together provide a more adequate explanation of student academic achievement than either self-concept or motivational goal variables alone. They cite some cross-theoretical studies in educational psychology in support of this hypothesis (see, Dowson et al., 2004) which they specifically tested in a series of longitudinal Structural Equation Modelling (SEM) analyses of data from 1,515 secondary students in New South Wales. They found that the self-concept and goal orientation theories worked together in a causally defined manner to influence student academic achievement (Dowson et al., 2004, p. 207), with students’ motivational goals an important antecedent of their academic self-concept which was related more directly to their achievement in Mathematics and English. The present study tested the Dowson et al., (2004) cross-theoretical hypothesis and causal ordering of variables through a Structural Equation Modelling analysis of data from a three year longitudinal study conducted in a non-government school in South Australia during its transition from a single boys’ school to a coeducational institution. The study focussed on the boys’ goal orientations in mathematics, Mathematics Self-Concept, with General-School Self-Concept and achievement measures also included.

School and classroom environments can influence students’ motivation, self-perceptions, academic engagement and achievement (Meece et al., 2006) as well as the interaction between their motivation and cognition (Pintrich, Marx & Boyle, 1993). At the student level, choice of task, level of engagement or activity and willingness to persist are generally considered to be the three traditional behavioural indices of motivation (Pintrich et al., 1993). Several studies have examined student motivation in relation to the transition from elementary to middle schooling (Eccles & Midgley, 1989; Wigfield, Eccles, Maclver, Reuman & Midgley, 1991) but not in relation to school reform efforts in general or gender based reforms of the school or classroom learning environments in particular (Meece et al., 2006). Over the last four decades reformatons of single sex (SS) schools into coeducational (CE) schools have occurred increasingly in several countries (Mael, 1998) but the transition from SS to CE has been investigated in only a handful of studies (Marsh, 1989; Marsh, Smith, Marsh & Owens, 1988; Yates, 2001; 2002a; 2002b; 2004a; 2004b; 2005) focussed predominantly on secondary schools (Mael, 1998). While student self-concept (Marsh, 1989; Marsh et al., 1988; Yates, 2004b) and goal orientations (Yates, 2002a) have been measured separately in these studies, causal relationships between these two variables and student academic achievement have not been considered.

Although there is extensive research on the relative merits of SS and CE, evidence of the efficacy of each school type for boys and girls is at best equivocal (Mael, 1998). Nevertheless, a plethora of studies over the last 25 years (see: American Association of University Women (AAUW), 1992; 1998 for reviews; Mael, 1998) attest to the dominance of males in CE classrooms at all levels (Barba & Cardinale, 1991; Brophy & Good, 1974; Jones, 1989; Lockheed, 1984; Sadker & Sadker, 1985). In mixed gender classrooms boys monopolise linguistic interactions (Baker, 1986; Becker, 1981; Sadker & Sadker, 1985; Sadker, Sadker & Thomas, 1981), receive more academic attention and support from teachers (Becker, 1981; Sadker & Sadker, 1985) while girls receive less teacher time, are less likely to participate and feel intimidated (AAUW, 1992; Mael, 1998; Mahony, 1985; Pollard, 1999). Several studies in mathematics confirm girls’ perceptions of being disadvantaged in coeducational settings (Forgasz & Leder, 1996; Gill, 1996; Milligan & Thomson, 1992; Parker & Rennie, 1995; Steinbeck & Gwizdala, 1995), but for boys single sex mathematics classes are perceived to be generally less supportive by teachers and students alike (Jackson & Smith, 2000; Rennie & Parker,
about the performance of boys are leading to a resurgence of interest in SS education introduction of CE into SS schools. Such studies are particularly salient at the present time when mounting concerns about the performance of boys are leading to a resurgence of interest in SS education in several countries (Datnow, Hubbard & Conchas, 2001; Leder & Forgasz, 1997; Parker & Rennie, 1994; Rennie & Parker, 1997; Sadker & Zittleman, 2004; Weaver-Hightower, 2005).

Goal orientation theory posits a relationship between students’ personal beliefs about the causes of school success, and their engagement and persistence in academic learning. Two contrasting pairs of motivational goals that typify students’ approach to learning have been identified in several studies (Pintrich & Schunk, 2002), where they have been variously labelled as task or ego involved goals (Nicholls, 1984), learning or performance goals (Dweck & Elliot, 1983), mastery or ability goals (Ames, 1992; Ames & Archer, 1988) and task versus ability goals (Maehr & Midgley, 1991). For the purposes of this paper the term task involvement is used to reflect students’ goal to be competitive with their fellow students. Task involvement and ego orientation are commonly examined as separate goal orientations (Pintrich et al., 1993), but causal relationships between them have not been investigated directly in mathematics. There is clear evidence that students can hold multiple goals in the classroom (Bouffard, Boisvert, Vezeau & Larouche, 1995; Harackiewicz, Barron & Elliot, 1998; Meece & Holt, 1993; Pintrich, 2000; Wentzel, 1992) and that multiple goal combinations have different motivation and achievement outcomes (Meece et al., 2006). While few researchers have demonstrated positive links between task goals and academic performance (Barron & Harackiewicz, 2001; Elliot & Church, 1997; Harackiewicz, Barron, Tauer, Carter & Elliot, 2000; Miller, Greene, Montalvo, Ravindran, & Nichols, 1996; Pintrich, 2000; Skaalvik, 1997) and ego goals are often associated with surface level learning strategies (Elliot & Harackiewicz, 1996; Graham & Golan, 1991; Kaplan, Middleton, Urnd, & Midgley, 2002, Meece, Blumfield & Hoyle, 1988.; Nolen, 1988) and self-handicapping (Urdan, Midgley, & Anderman, 1998), the two approach goals when combined have been positively associated with persistence and achievement outcomes, especially for university students (Elliot, McGregor, & Gable, 1999; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002). Furthermore, positive relationships between task involvement and academic self-concept have been found in several studies (Middleton & Midgley, 1997; Skaalvik & Skaalvik, 2005), but relations between ego orientation and academic self-concept are less conclusive (Skaalvik & Skaalvik, 2005). Gender differences have been found in task involvement in mathematics, with boys having less task involvement and lower achievement than girls (Yates, 1997; 2000b; 2002a). Boys’ task involvement in mathematics has also been found to decline during the elementary and middle school years in a cluster design sample study of the transition to coeducation (Yates, 2002a), but no gender differences in ego orientation were evident in either study.

The role of academic self-concept and its domain specific relationship with achievement are well known (see, meta-analyses by Hansford & Hattie, 1982; Holden, Moncher & Schinke, 1990). In mathematics there is an abundance of evidence that mathematics self-concept is strongly and positively related to mathematics achievement (for example, Marsh & Yeung, 1997; Skaalvik & Skaalvik, 2004; 2006), although few empirical studies have examined the causal relationships between these two variables (Skaalvik & Skaalvik, 2006). There is some evidence that at the elementary school level mathematics self concept is mainly a consequence of achievement (Skaalvik & Skaalvik, 2006) and does not affect later achievement (Skaalvik & Hagtvet, 1990). At the secondary level however, mathematics self-concept and mathematics achievement are causally and reciprocally related (Marsh, 1990; Marsh & Yeung, 1997; Skaalvik & Skaalvik, 2006). In the latter two longitudinal studies Skaalvik & Skaalvik (2006) did not find any evidence that the relationship between secondary level students’ self-concept and achievement was mediated by their goal orientations. While self-concept was measured through a modified six-item version of the Self Description Questionnaire-11 (SDQ-II) (Marsh, 1992b) and goal orientations predominantly through task and performance (ego) approach goals in the Skaalvik & Skaalvik (2006) studies, it is important to note that goal orientations were considered only as mediating variables in the structural equation modelling analyses they conducted. Their studies confirm the Dowson et al., (2004) findings that there is little direct evidence for the causal ordering of self-concept to goals to achievement.

Research Design

The present study was designed to investigate the Dowson et al., (2004) cross-theoretical hypothesis and causal ordering of relationships between goal orientations, academic self-concept and academic achievement of elementary and secondary level boys from a non-government, dual campus, single sex school during the period of the transition to a coeducational institution. The school’s transition from a single sex to coeducational institution occurred over a three year period. Data were gathered from all boys who were present in the school in its last year as a single sex boys’ school (Time 1). The same boys were then followed up the next year when coeducation was introduced (Time 2) as well as the year immediately following the introduction of coeducation (Time 3). The boys were in Grades 3 to 10 at Time 1 (T1) when the study commenced, Grades 4 to 11 at Time 2 (T2) and Grades 5 to 12 at Time 3 (T3). At T2 the Grade 7 boys were moved to the secondary school campus where a Middle School embracing Grades 7 to 10 was established.

It was necessary to confine the study to a consideration of the Mathematics and General-School domains of Academic self-concept as these were the only two areas common to the Self Description Questionnaire-1 (SDQ-I)
(Marsh, 1992a) and Self Description Questionnaire-II (SDQ-II) (Marsh, 1992b) that were used respectively to measure the elementary and secondary boys’ self-concept. In keeping with this subject area determination, goal orientations were measured only in relation to Task Involvement and Ego Orientation goals in Mathematics. However, it was not possible to obtain a measure of academic achievement in Mathematics for all of the boys over the three years of the study, as Mathematics was compulsory only up to Grade 10 and end-of-year mathematics school grades were thus not available for some of the boys in Grades 11 and 12 at T2 and T3 respectively. A more generic Word Knowledge (WK) measure of academic achievement, which has been found to be highly predictive of achievement (Fullarton, Lokan, Lamb & Ainley, 2004) was therefore chosen. The WK tests were developed originally for 10- year-olds, 14-year-olds and students in the final grade of secondary school to provide a control variable for verbal ability in an experimental study of reading comprehension in 15 countries conducted by the International Association for the Evaluation of Educational Achievement (IEA) (Thorndike, 1973; Walker, 1976). WK tests have been used subsequently in other IEA studies including the First and Second International Science Studies (Comber & Keeves, 1973; Rosier & Banks, 1990). A slightly modified version was used in the 1995 Third International Mathematics and Science Study Student Questionnaires in Australia as a student-level predictor because of the perceived increasing verbal nature of mathematics and science achievement tests.

**Aims**

1. To test the Dowson et al., (2004) cross-theoretical hypothesis that goal orientation and self-concept theories together explain academic achievement better than either theory alone; and
2. To confirm the Dowson et al., (2004) causal ordering of goals, self concept and achievement; by
3. Examining the goal orientations, academic self-concept and achievement in boys from a single sex school during the transition to coeducation.

**Method**

**Participants**

All boys present in Grades 3 to 10 in the non-government school participated in the study at T1 and were followed up at T2 and T3. Table 1 presents the number of boys participating and their respective grade levels at T1, T2 and T3.

**Instruments**

**Goal Orientations in Mathematics**

Task involvement and ego orientation dimensions of boys’ goal orientations towards mathematics were measured with Your Feelings in Mathematics: A Questionnaire (YFMQ) (Yates, 2000b; Yates, Yates & Lippett, 1995), a 25-item variant of the Motivation Orientation Scales (Duda & Nicholls, 1992; Nicholls, Cobb, Wood, Yackel, & Patashnick, 1990). Student interest and engagement in learning mathematics was measured by 15 task involvement goal items, their interpersonal competitiveness by six ego orientation items, with four additional filler items which occurred in random order. Each item commenced with the stem Do you really feel pleased in maths when ... followed by a statement that related to student mathematics behaviour. A typical task involvement item was something you learn makes you want to find out more (Item 15) while a typical Ego orientation in mathematics item was you score better on a test than others (Item 23). Boys rated each item on a five-point scale ranging from (1) a strong no to (5) a strong yes.

**Academic Self-Concept**

Boys’ academic self-concept was measured in relation to Mathematics Self-concept and General-School with designated items from the Self Description Questionnaire-1 (SDQ-1) (Marsh, 1992a) or Self Description Questionnaire-II (SDQ-II) (Marsh, 1992b). SDQ-1 items are rated on a five point scale with SDQ-II items rated on a six point scale.

**Academic Achievement**

**Word Knowledge Test 1 (WK1) and Word Knowledge Test 2 (WK2)** (Thorndike, 1973) were used to provide a reliable estimate of academic achievement across the grade levels. WK1 and WK2 are each composed of 40 word pairs which are rated as either the same or opposite in meaning. These two tests can be complied to form a single scale with the common items linking procedure.

**Procedure**

YFMQ, SDQ and Word Knowledge tests were administered by the classroom teacher or research assistant to all boys in their respective classrooms in October (Term 4) at T1, T2 and T3. Boys in Grades 3 to 7 in the single sex school were administered WK1 and SDQ-1 at T1, while boys in Grades 8 to 10 were given WK2 and SDQ-II. The same boys were followed up at T2 and T3 with WK1 and SDQ-1 administered to those in Grades 4 to 7 (T2) and Grades 5 to 7 (T3) and WK2 and SDQ-II to those in Grades 8 to 11 and Grades 8 to 12 at T2 and T3 respectively. Some Grade 9 students were also administered matched items from the SDQ-1 & SDQ-11 Mathematics Self-Concept and General School Self-Concept scales on a separate occasion.
Analyses

Factor analysis of Your Feelings in Mathematics: A Questionnaire indicated two separate scales of Task Involvement (TASK) and Ego Orientation (EGO) (Yates, 1997; Yates & Yates, 1996). Reliability and validity of TASK, EGO, the Mathematics Self-Concept and General-School items from SDQ-1 and SDQ-11, WK1 and WK2, were calibrated separately with the Rasch scaling procedure (Rasch, 1966) through Quest (Adams & Khoo, 1994) to bring each to a logit scale with interval properties and to overcome any sample-item interdependence problems (Wright & Masters, 1982). Omitted responses could also be allowed for with the use of the partial credit Rasch model procedure (Bond & Fox, 2001) in the scoring of the goal orientation and self-concept data. Thirteen TASK and five EGO items met item response theory (IRT) requirements, with misfitting items 20 and 21 deleted from the TASK scale and item 14 from the EGO scale (see, Yates, 2002a). Mathematics Self-Concept and General-School academic subscales from SDQ-1 and SDQ-II scales were examined separately and non-fitting items deleted. The SDQ-II items were then recoded to a five point scale so as to be equivalent to SDQ-I. Ratings of More False than True originally coded as 3 and More True than False coded as 4 in the SDQ-II were combined into a single rate of 3 to reflect the SDQ-I category of Sometimes False/Sometimes True. The Mostly True and True response categories, coded in SDQ-II as 5 and 6 respectively, were recoded as 4 and 5 to match SDQ-I (see, Yates, 2004b). Two single academic scales of Mathematics Self-Concept and General-School were then constructed, linked by the Grade 9 students who had answered the matched items from both questionnaires. The combined Mathematics Self-Concept scale contained 17 items and the General-School scale 16 items. Similarly, WK1 and WK2 were Rasch calibrated and three misfitting item deleted from WK1. A single Word Knowledge (WK) scale of achievement was then formed from WK1 and WK2, with the tests linked by the 12 items that were common to both tests. As some students were presented with the same test on more than one occasion, scoring of student WK responses at T2 and T3 was anchored to those students who answered all of the forty items in their respective WK1 or WK2 test at T1. This ensured that any practice effects would be taken into account and a more accurate measure of gains in academic achievement estimated. The final TASK, EGO, Mathematics Self-Concept, General-School and WK scales were composed of only those items that met IRT requirements.

Case estimate scores were equated concurrently for the TASK, EGO, Mathematics Self-Concept, General-School and WK scales for all boys from Grades 3 to 10 at T1, Grades 4 to 11 at T2 and Grades 5 to 12 at T3. The concurrently equated scores were then entered into a Structural Equation Model, in the goal orientation - self-concept - achievement order indicated by Dowson et al., (2004) and analysed with AMOS (Analysis of Moment Structure) Version 5 (Arbuckle, 2003). As there was no clear indication from the research literature as to the order in which the task involvement or ego orientation variables should enter the model, two models were test initially, with TASK preceding EGO in one model and EGO preceding TASK in a second Model.

Results

The second Path Model in which EGO was entered before TASK emerged as the better fit to the data and is presented in Figure 1. A key to the Figure 1 variables is presented in Table 2, the Model fit indices in Table 3 and Path Model results in Table 4. Fit indices presented in Table 3 indicate that the model fitted the data very well. The Root Mean Square Error of Approximation (RMSEA) value of 0.000 is excellent as it should ideally be less than 0.05. Similarly, the Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI) values of 0.999 and 0.997 respectively are very close to the ideal value of 1.00 (Marsh, Balla & Hau, 1996). The results in Figure 1 show an interesting set of significant relationships between the variables, with the relationship between the goal orientation variables and achievement mediated by self concept. Ego orientation goals in mathematics have a strong positive effect on boys’ task involvement in mathematics. Task goals then have strong positive effects on both General-School and Mathematics Self-Concepts. General-School Self-Concept is strongly and positively related to Mathematics Self-Concept and to Academic Achievement, although the latter relationship is moderate. Mathematics Self-Concept has a very small negative effect on Academic Achievement which is shown in Table 4 to be significant only at the 0.07 level.

Discussion

Results from this study provide clear support for the Dowson et al., (2004) cross- theoretical hypothesis and confirm their causal ordering of goal orientation to self concept to achievement in the Structural Equation Model. Furthermore, as the Dowson et al (2004) hypothesis was tested on data from students at the secondary level only, this study extends the causal links between goals, self concept and achievement to students in the elementary levels. The Path model in Figure 1 and the results of the analysis presented in Table 4 indicate that boys’ motivational goal orientations were significant antecedents for their general-school and mathematics academic self-concepts in the transition from single sex to coeducation and in turn their self-concepts were directly related to their achievement. While significant relationships between General-School, Mathematics Self-Concept and achievement in the transition from single sex to coeducation at the student level have been reported elsewhere (Yates, 2004b), the slight negative relationship between Mathematics Self-Concept and achievement in Figure 1 is not unexpected as previous studies have confirmed that relationships between self concept and achievement are very domain specific (Marsh & Craven, 2006). However, this relationship should be explored further in a future study using a specific measure of mathematics achievement as the outcome variable.
The finding that the self-concept variables played a mediating role between goal orientations in mathematics and achievement in this study is of particular interest. For some time there has been an ongoing debate as to the causal relations between self-concept and academic achievement (Skaalvik & Skaalvik, 2006). Some researchers have suggested that it will be difficult to prove a causal direction between self-concept and achievement (Wigfield, Eccles & Pintrich, 1996), whereas others have found that the relationships are not only domain specific but reciprocal (Marsh, 1990; Marsh & Yeung, 1997, Marsh & Craven, 2006). Links between task oriented goals and academic achievement have been inconsistent (see, Meece et al, 2006) while ego orientation has been generally viewed as not promoting effective learning strategies (Elliot & Harackiewicz, 1996; Graham & Golan, 1991; Kaplan et al., 2002, Meece et al., 1988.; Nolen, 1988; Urdan et al., 1998). However, few studies have considered these three variables together in relation to mathematics and none have adopted the causal order suggested by the Dowson et al., (2004) hypothesis. In particular, it would be valuable to reanalyse the two longitudinal studies in mathematics conducted by Skaalvik & Skaalvik (2006) which found that relationships between self-concept and achievement were not mediated by goal orientation. Although the present study and that of Skaalvik & Skaalvik (2006) were conducted with different student samples and in different learning environments they each used similar instruments to measure goal orientation and self-concept. Thus the goal orientation, self-concept and achievement causal order indicated as being preferable in the Dowson et al., (2004) study and confirmed by the present findings should be applied to the Skaalvik & Skaalvik (2006) data and the results of their study re-evaluated.

It is clear from the results of this study that goal orientation theory can provide insights in studies of SS and CE school reform in addition to those afforded by the self-concept theory which has been used previously (Marsh, 1989; Marsh et al., 1988; Yates, 2004). While the present study was confined to boys who experienced the transition from the single sex to the coeducational learning environment, it is clear that the findings add to the growing body of knowledge about causal relationships between goal orientations, self concept and achievement and the manner in which such variables should be ordered. Furthermore, the findings go some way to explicating the role of ego goals and how they interact with task involvement within a motivational approach framework, at least for boys. Task involvement has been shown to be positively related to academic self-concept in previous studies (Middleton & Midgley, 1997; Skaalvik & Skaalvik, 2005) but to date relationships between ego orientation and academic self concept have been less conclusive. These constructs have generally been investigated as separate entities, and although it has been realised that students can hold multiple personal goals (Bouffard et al., 1995; Harackiewicz et al., 1998; Meece & Holt, 1993; Pintrich, 2000; Wentzel, 1992) and that approach goals can and do work together (Elliot et al., 1999; Harackiewicz et al., 2002), the exact nature of the causal relationship between them has not been investigated previously. In future studies it will be of interest to see whether the same relationships hold for girls, whether they are evident when ego and task avoidance goals (Elliot & Church 1997; Elliot & Harackiewicz, 1996) are considered and when the effects of other types of classroom and school reforms are taken into account.

About the Author

Dr Shirley M. Yates gained her Speech Pathology and teaching qualifications in New Zealand where she also obtained a BA and MA (Hons) at Auckland University. She gained her MEd at Adelaide University and PhD at Flinders University. She is the recipient of 19 research grants and has published a book, five book chapters and several refereed articles in journals and conference proceedings in three major research areas of Children’s Psychosocial Characteristics, Mathematics Education, and Effective Teaching and Learning. She has developed a multimedia computer based questionnaire for the early detection of pessimism in young children, funded by the Channel 7 Children’s Research Foundation of South Australia and is currently investigating teacher perceptions of curriculum reforms in mathematics.

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References


Figure 1: Path Model

Table 1: Number of boys by grade level at Time 1, Time 2 and Time 3

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<th>Grades</th>
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<th>6,7,8</th>
<th>7,8,9</th>
<th>8,9,10</th>
<th>9,10,11</th>
<th>10,11,12</th>
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Table 2: Key to the Path Model Variable Names

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<td>EGO</td>
<td>Ego Orientation in Mathematics</td>
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<tr>
<td>TASK</td>
<td>Task Involvement in Mathematics</td>
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<tr>
<td>GENERAL SCHOOL</td>
<td>General-School Academic Self-Concept</td>
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<td>MATHEMATICS</td>
<td>Mathematics Self-Concept</td>
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<td>WORD KNOWLEDGE</td>
<td>Academic Achievement</td>
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Table 3: Model fit Indices

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<th>AGFI</th>
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Table 4: Path Model Results

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<th>C.R.</th>
<th>P</th>
<th>Standardized Estimate</th>
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<tr>
<td>Criterion</td>
<td>Predictors</td>
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<td>.021</td>
<td>-1.768</td>
<td>0.077</td>
<td>-0.06</td>
</tr>
</tbody>
</table>