Cluster analysis on Malaysian student's achievement goals orientation in mathematics from multiple goal perspective

Mohd Rustam Mohd Rameli[1]*, Azlina Mohd Kosnin[1], Yeo Kee Jiar[1], Zakiah Mohamad Ashari[1]

[1]Faculty of Education, Universiti Teknologi Malaysia
*Corresponding author E-mail: mrustam2@utm.my

Abstract

This study examined students' achievement goal orientation by applying multiple goals perspective in learning Mathematics. This person-centered approach study involved 969 Malaysian upper secondary school students from 20 selected schools. Results of correlational analysis showed that all the four goal orientations (mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance) correlated moderately (r=.151-.475) to each other. This suggests that students could adopt more than one goal orientation simultaneously. By means of cluster analysis, the notion of simultaneous adoption of goal orientations is supported from which five distinct clusters were extracted, namely mastery-oriented (mean value is higher for the mastery-approach and mastery-avoidance goal), approach-oriented (mean value is higher for mastery and performance-avoidance goal), avoidance-oriented (mean value is higher for mastery and performance-approach goal), demotivated (low mean value for all types of goals) and success-oriented (high mean value for all types of goals). Success-oriented cluster had the highest frequency of students (f=271, 28.0%) while only 3.6% (f=35) of the students were in the demotivated cluster. This study extends the knowledge of how students adopt multiple goals in Mathematics learning. The results have significant impact on mathematics education context of Malaysia.

Keywords: *Achievement Goals Orientation, Multiple Goals, Cluster Analysis*

1. Introduction

The focus of Mathematics learning today emphasizes the development of Mathematics competence among students as well as prepare them to pursue their academic goals [1]. Therefore, the process of learning Mathematics should involve active participation of students. Understanding reasons for students setting up certain goals in learning Mathematics and how the goals influenced the academic achievement are very important as students will show various kinds of behaviours for different achievement situations [2].

Achievement goal orientation has always been studied for its relationship with academic achievement, not only in the school setting which includes the primary and secondary schools, but has included university students as well [3]. Achievement goal orientation is related to the elements of perseverance such as constant interest in learning [4] and positive learning behaviour such as being active and responsible in learning [5]. Previous studies have shown that students with different achievement goal orientation profiles lead to different of subjective well-being [6].

Nowadays, students are facing the 21st century education challenges which require them to be more self-directed and independent. However, social influence in the Mathematics learning process such as the existence of pressure from the school and high expectations from parents are undeniable. These factors lead to conflict in determining the type of achievement goal orientation to be adopted by students in the learning process. As a consequence, the combination of goal orientation profiles is more relevant to be studied in recent studies. The significance of goal orientation exploration is that it helps in understanding students' motivation which is related to achievement in the class environment [7, 8].

2. Multiple Goals Perspective

The theory as the foundation to explain achievement goal orientation is known as achievement goal theory [9]. This theory is a dominant framework used to conceptualize students' motivation in schools or, specifically, their achievement motivation in learning [10]. Generally, this theory is related to the idea that a student will give meaning to his or her specific achievement situation. The meaning involves comprehensive purpose to involve themselves in the achievement goal orientation behaviour to achieve a targeted goal [11].

In this study, the main perspective for achievement goal orientation is Multiple Goals Theory that is used in determining students' achievement goal orientation profile in learning Mathematics. Multiple Goals Perspective states that individuals can use more than one goal at once simultaneously and there are various ways of how achievement goal influenced learning [12]. From the research findings, it shows that different goal configurations are related with different positive and negative effect [13]. In this study, Multiple Goal Perspective is synchronised with the research objectives to examine students' achievement goal orientation profile which is a combination of more than one type of dominant goals used by students in learning Mathematics.

3. Methodology

3.1. Participants

Participants of this study were 969 secondary four students (age=16 years old) from 20 selected schools in the State of Johor, Malaysia. They included 425 (43.9%) male and 544 (56.1%) female students. Selection of the participants was established through cluster sampling.

3.2. Measures

The participants completed the Achievement Goals Questionnaire (AGQ) originally developed by Elliot and McGregor (2001). This self-report instrument measures mastery-approach (3 items), mastery-avoidance (3 items), performance-approach (3 items) and performance-avoidance (3 items) goal orientation in paticipants' Mathematics learning. The AGQ is a widely used survey to assess student's achievement goal orientation and has been proven to be a valid and reliable instrument [14, 15, 16].

4. Results

Correlational analysis showed a relatively low positive correlation between mastery goal (approach and avoidance) with performance goal orientation (approach and avoidance). Meanwhile, there is a moderate positive correlation between performance-approach and performance-avoidance goal orientation (Table 1). The correlational results serve as a strong empirical evidence to examine further student's adoption of achievement goals orientation in Mathematics by applying cluster analysis.

Hierarchical cluster analysis was done to determine the number of clusters corresponding to the research data. The outcome of Agglomeration Analysis shown in Table 2 shows that there are five clusters which fit the research data. The number of clusters gained from the significant different values of coefficient at the final five stages was from stage 964 to stage 963 with the biggest different value of coefficient of 1.605.

Classification of the five clusters was based on the comparison of relative minimum value for the four types of achievement goals orientations. The mean relative value is referred as the mean value comparison gained based on the minimum score value=1 and the maximum score value=4 for the usage of the Likert Scale. Descriptive analysis for each cluster is shown in Table 3.

Based on Table 3, the mean relative value for cluster 1 is higher for the mastery-approach and mastery-avoidance goal orientation. Based on these attributes, cluster 1 is named mastery-oriented cluster (MAO). For clusters 2 and 3, the mean value is higher for mastery-avoidance and performance-avoidance goal (Cluster 2) and the mean value is higher for mastery-approach and performance-approach goals orientation (Cluster 3). Based on these attributes, cluster 2 is named avoidance-oriented cluster (AVO) while cluster 3 is approach-oriented (APO). Finally, cluster 4 has recorded a low mean value whereas cluster 5 recorded a high mean value for all types of achievement goals orientation. In line with that, cluster 4 is named as demotivating (DEM) cluster and cluster 5 as success-oriented (SUO).

For the number of respondents for each cluster, cluster 5 (success-oriented) recorded the highest respondent frequency f=271 (28.0%), followed by cluster 2 (avoidance-oriented cluster) (f=263, 27.1%) and cluster 3 (approach-oriented cluster) (f=209, 21.6%). Meanwhile, cluster 1 (mastery-oriented cluster) recorded 191 respondents (19.7%) while cluster 4 (demotivating cluster) recorded the lowest frequency value which was 35 respondents (3.6%). To conclude, there are five types of students' achievement goals orientations that are different form each other.

Table 1: Intercorrelation between achievement goals orientation with mathematics anxiety

Achievement Goals Orientation	Mastery-Approach	Mastery-Avoidance	Performance-Approach	Performance-Avoidance
Mastery-Approach	1	.151**	.396**	.279**
Mastery-Avoidance		1	.270**	.369**
Performance-Approach			1	.475**
Performance-Avoidance				1

** The correlations are significant at the level 0.01 (2-tail)

Table 2: Agglomeration Analysis

Stage	Coefficients	Coefficient Difference
954	2.989	-
955	3.056	3.056 – 2.989=0.067
956	3.057	3.057 – 3.056=0.001
957	3.153	3.153 – 3.057=0.096
958	3.244	3.244 – 3.153=0.091
959	3.444	3.444 – 3.244=0.200
960	3.616	3.616 – 3.444=0.172
961	3.985	3.985 – 3.616=0.369
962	4.338	4.338 – 3.985=0.353
963	4.487	4.487 – 4.338=0.149
964	6.092	6.092 – 4.487=1.605
965	6.125	6.125 – 6.092=0.033
966	6.999	6.999 – 6.125=0.874
967	7.168	7.168 – 6.999=0.169
968	8.076	8.076 – 7.168=0.908

Table 3: Descriptive Analysis for each Cluster

Type of Achievement Goal	Cluster 1 MAO	Cluster 2 AVO	Cluster 3 APO	Cluster 4 DEM	Cluster 5 SUO
Mastery-Approach Goal Orientation	2.94	2.87	3.31	1.92	3.53
Mastery-Avoidance Goal Orientation	2.82	3.30	2.37	1.85	3.47
Performance-Approach Goal Orientation	2.35	2.99	3.39	1.90	3.77
Performance-Avoidance Goal Orientation	2.34	3.12	2.84	1.87	3.52
Respondents Frequency f (%)	191 (19.7%)	263 (27.1%)	209 (21.6%)	35 (3.6%)	271 (28.0%)

5. Discussion

The cluster analysis shows five existing clusters that fit with the data in the present study. These five clusters provides empirically parsimonious explanation together with definitions to support achievement goals orientation in the four-factor model [17]. The first cluster represents students that show high adoption of mastery-approach and mastery-avoidance goal orientation. The second and third clusters represent students that adopt more avoidance and approach valences of goal orientation respectively. The fourth and fifth clusters represent students with low and high adoption for all types of achievement goals orientation. The produced clusters are closely parallel to previous research findings [18].

Since cluster analysis was done descriptively, the discussion explains further by stating students' behaviour in a certain cluster based on observation found in previous studies. Based on the identified profile, the first cluster is students prone towards mastery of goal orientation (approach and avoidance) which, their learning and competency approach focus more on self-purpose which is self-development in Mathematics. This group of students emphasized learning and strived towards goals achievement that leads to self-advancement [19]. This matter portrays that the students are striving towards adaptive self-development in the learning context [18] specifically, in Mathematics.

Meanwhile, the learning approach for students from the second cluster that is avoidance-oriented is related to avoidance from letting others know about their lack of Mathematics competence including inability in learning or acquiring a knowledge. In addition, the avoidance action is not only avoidance from the inability to achieve self learning goals, but also avoidance from showing lack of competency compared to other individuals [17] in the Mathematics learning process. This group of students showed the behaviour of minimizing their effort to allocate study time that has led to maladaptive motivation effect such as low academic achievement [20]. Among the other features for students in this profile are that they are easily worried about failure or show passive behaviour in the learning process.

The third cluster (approach-oriented) refers to students who choose learning or use the competency approach related to advancement and self-development. The purpose of achieving self-advancement includes self-satisfaction or relative achievement compared to other individuals in the process of learning Mathematics [21]. In the meantime, students from the fourth cluster (demotivating) are those seen as not motivated in learning Mathematics. These students are claimed to be uninterested in increasing self-competence or showing their capabilities because they put in minimal effort in achievement situation [22]. Finally, students from success-oriented (cluster 5) are considered as students that strive towards achieving absolute success and are relatively successful in learning and understanding [20] the process of learning Mathematics. They show good performance, however, they are prone to failure exposure in comparison to the mastery-oriented students group. Previous studies have shown that success-oriented students are more at risk of exhaustion or boredom in their learning [20].

Mastery-approach goal orientation has been the source of motivation for students to get involve in the learning tasks. Other than that, students are motivated to complete the tasks with the hope that their achievements will be better or at least are not worse than their classmates [23]. In other words, even though mastery goal orientation centers around development compared to behaviour showing self-competence, however, grades are recognized as the foundation for mastery evaluation. Students may assess their competence on the current grade compared to the previous grade of their Mathematics achievement. Furthermore, grades are used to evaluate whether the personal standards are achieved.

Acknowledgement

References

[1] Pajares F (2001), Toward a positive psychology of academic motivation. *The Journal of Educational Research* 95(1), 27-35.

[2] Pintrich PR & Schunk D (1996), *Motivation in education: Theory, research, and applications.* Engelwood Cliffs, NJ: Prentice Hall.

[3] Steinmayr R & Spinath B, (2009a). The importance of motivation as a predictor of school achievement. *Learning and Individual Differences* 19, 80–90.

[4] Muraven M & Baumeister RF (2000), Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin* 126, 247–259.

[5] Boekaerts M (1997), Self-regulated learning: A new concept embraced by researchers, policy makers, educators, teachers, and students. *Learning and Instruction* 7(2), 161–186.

[6] Tuominen-Soini H, Salmela-Aro K & Niemivirta M, (2008), Achievement goal orientations and subjective well-being: A person-centred analysis. *Learning and Instruction* 18, 251–266.

[7] Somuncuoglu Y & Yildirim A (1999), Relationship between achievement goal orientations and the use of learning strategies. *The Journal of Educational Research* 92(5), 267-277.

[8] Wolters CA (1998), Self-regulated Learning and college students' regulation of motivation. *Journal of Educational Psychology* 90(2), 224-235.

[9] Elliot AJ (1997), Integrating the ''classic'' and ''contemporary'' approaches to achievement motivation: A hierarchical model of approach and avoidance achievement motivation. In Maehr, M.L & P. R. Pintrich (Eds.). *Advances in Motivation and Achievement* (pp. 143–179). Greenwich, CT: JAI Press.

[10] Elliot AJ (1999), Approach and avoidance motivation and achievement goals. *Educational Psychologist* 34(3), 169–189.

[11] Molden DC & Dweck CS (2000), Meaning and motivation. In C. Sansone, & J. M. Harackiewicz (Eds.), *Intrinsic and extrinsic motivation: The search for optimal motivation and performance* (pp. 131–159). San Diego, CA: Academic Press.

[12] Maehr ML & Zusho A (2009), Achievement goal theory: The past, present, and future. In K. R. Wentzel & A. Wigfield (Eds.), *Handbook of motivation at school* (pp. 77–104). New York: Taylor Francis.

[13] Harackiewicz JM, Barron KE, Pintrich PR, Elliot AJ & Thrash TM (2002), Revision of achievement goal theory: Necessary and illuminating. *Journal of Educational Psychology* 94, 638–645.

[14] Lieberman DA & Remedios R (2007), Do undergraduates' motives for studying change as they progress through their degrees? *British Journal of Educational Psychology* 77, 379−395.

[15] Putwain DW & Daniels RA (2010), Is the relationship between competence beliefs and test anxiety influenced by goal orientation? *Journal of Learning and Individual Differences* 20, 8–13.

[16] Putwain DW, Sander P & Larkin D (2013), Using the 2 × 2 framework of achievement goals to predict achievement emotions and academic performance. *Learning and Individual Differences* 25, 80–84.

[17] Elliot AJ & McGregor HA (2001), A 2×2 achievement goal framework. *Journal of Personality and Social Psychology* 80(3), 501–519.

[18] Tuominen-Soini H, Salmera-Aro K & Niemivirta M (2011), Stability and change in achievement goal orientation: A person-centered approach. *Contemporary Educational Psychology* 36, 82-100.

[19] Tuominen H, Salmela-Aro K, Niemivirta M & Vuori J (2004), *Adolescents' achievement goal orientations, goal appraisals, and subjective well-being: A person- centered approach.* Proceedings of the Third International Biennial SELF Research Conference: Self-Concept, Motivation and Identity, Where to from here, Berlin, Germany.

[20] Tuominen-Soini H, Salmela-Aro K & Niemivirta M, (2008), Achievement goal orientations and subjective well-being: A person-centred analysis. *Learning and Instruction,* 18, 251–266.

[21] Senko C, Durik AM, Patel L, Lovejoy CM & Valentiner D (2013), Performance-approach goal effects on achievement under low versus high challenge conditions. *Learning and Instruction* 23, 60-68.

[22] Kaplan A & Maehr ML (2007), The contributions and prospects of goal orientation theory. *Educational Psychological Review* 19, 141–184.

[23] Senko C & Miles KM (2008), Pursuing their own learning agenda: how mastery- oriented students' jeopardize their class performance. *Contemporary Educational Psychology* 33, 561-583.