Science Motivation of University Students: 
Achievement Goals as a Predictor

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Abstract The objective of this investigation is to make a study of the relationship between achievement goals and science motivation. Research data were collected from 295 university students. Achievement goals and science motivation scales were utilized as measure tools. The link between achievement goals orientation and science motivation was investigated by statistical package for social sciences. Correlation analysis demonstrated that sub dimensions of achievement goals; related positively to science motivation. Besides, the connection between achievement goals and science motivation still requires further research because of some limitations. Thus, in addition to intervention strategies, further investigation should include more factors for achievement goals and investigate its effect on adolescents’ science motivation. Findings were discussed with regard to the relevant literature.

Keywords Achievement Goals, Science Motivation, Stepwise Regression Analysis

1. Introduction

The theory of achievement goals explains why various levels of success in individuals with the similar competence and level of intelligence develops out of the different features of motivation and goals that they set so as to be successful [17]. This theory was investigated to demonstrate how the achievement level of students may be different with the same intelligence and ability capacity [14]. The achievement goal orientations have been comprehensively examined by some educational scientists in the area of educational psychology [1] and they described it a combinatorial design of beliefs, characteristics, and influences that produce purposes of behavior [2]. According to the achievement goal theory, students differ from each other with regard to their achievement behaviors. These different aspects of students are related to distinctive emotional, motivational, cognitive, and behavioral outcomes [33]. Individuals are influenced by the beliefs about themselves which have an effect on how they perform a task or what they really do. If a person considers that some characteristics such as intelligence can be developed, they gear up for to improve it and this stimulates them to do much better at school [15].

Achievement goals are “proficiency-relevant goals that a person makes an effort in success environment” [16]. They were conceptualized by Elliot and McGregor [15] in a 2x2 framework. A 2x2 framework of achievement goal orientations has been propounded that involves mastery (e.g., motivated to comprehend the material and improve their skills) and performance (e.g., related to comparing themselves with other students) goal orientations. A mastery-approach (M-ap) goal orientation (i.e., a desire to maximize learning and ability development), and a mastery-avoidance (M-av) goal orientation, (i.e., a concern of losing some skills or the inability to master all the materials) are the two models that can be gained by students. Achievement goals were described by Elliot and McGregor [15] as a 2x2 framework. (1) M-ap goals – the target searches for learning and knows well the assignment. (2) M-av goals - keeping off the assignment due to sense of imperfection and inadequacy of succession the assignment. (3) Performance approach (P-ap) – concentrating upon doing better than other people. (4) Performance avoidance (P-av) – keeping off fulfilling insufficient comparing with others. The practicability of 2x2 achievement goal orientations pattern was investigated and experimental reinforcement was explored for the differentiation of the 2x2 goal orientations pattern. According to McKeachie and Urband [31] investigated the relationships of the individual achievement targets, apprehensions of the schoolroom aim pattern and states of the utilization of personal handicapping ways among the students. As a conclusion of their research, students who were lower in
task aims handicapped and P-av goals more than the students who were lower in P-av goals and higher in task aims. There was a little effect of P-ap goals level from the point of the link between handicapping and task aims. A research performed by Kaplan and Maehr [22], about the achievement goals, is possible to act in enabling the psychological well-being of students. Positive psychological well-being was in relationship with task aims and apprehension of the school as stressing task aims. Moreover, adverse psychological well-being was related to ego aims and apprehension the school as stressing ego aims. According to Pajares and others [36], task aims were in negative relationship with science apprehension. P-av goals were in positive relationship with science apprehension. Researchers detected a significant relationship between task aims and P-ap goals in the science field.

1.1. Science Motivation

Improving all science literacy of the students is the aim of science instruction, so it is indispensable to encourage students to comprehend important science notions, to recognize the significance of science and improvement in technology, to comprehend the disposition of science, and to voluntarily maintain their education of science at school [NRC, 1996]. Therefore, student cognition and the affective components of cognition should be addressed together by researches in science teaching and learning. Inside of the effective factors, motivation is crucial since motivation of students plays a crucial role in their notional conversion processes [23,24,34,35]. In that vein, students’ motivation plays another fundamental role in critical thinking and learning strategies of students [19,21,42]. On the other hand, according to Napier and Riley [28], motivation has significant influence on science learning achievement. Together with environmental and social contribution, both talent and ambition are necessary in learning [26,44]. Current views of learning refer to the significance of the idea that both cognition, motivation and will of students are fundamental elements on account of prosperous achievement and learning [20,40]. Students' motivation becomes visible in their efficient participation in the process of learning, eager approach of difficult learning tasks, dense diligence sacrifices along the utilization of strategies in active learning, permanency in accomplishing problem solving and learning considering difficulties [7,32,35,43]. Considerably motivated individuals who are more worried about own process of learning and results, demonstrate larger progress, more advanced levels of mastery, and attempt higher reassurance and positive effect than inadequate motivated students [40,43]. Literature review shows that many examinations about science motivation were fulfilled. Accordingly, Glynn and others (2011) investigated the students’ motivation to study science. Findings suggest that the motivation elements - self-determination, self-efficacy, motivation of intrinsic, motivation of career and motivation of grade act a significant role in individuals’ science achievement. Meece and Jones [29] researched gender differences in mid-school individuals’ confidence, motivation goals, and ways of learning in science lessons. Their study showed a few gender differences. Male students reported more confidence in their science capabilities compared to female students. Stake [41] examined the dimension of social stimulations that conducts the relationship of position and motivation of science and self-reliance. The results demonstrated that stimulation from parents, instructors from school, and friends were each unconnected variables of science motivation. Another study of Bryan and others (2011) examined the motivation of 14–16 year old learners to learn science. According to the findings, the intrinsic motivation, self-efficacy, self-determination, and achievement of the students were in relationship. The investigation claims that teachers of science had better use social patterns and tasks of collaborative-learning to facilitate motivation, achievement and interest of students’ in science lessons.

1.2. The Present Study

Researches in the area of motivation were performed with achievement goals theory as a fundamental direction in field of education [25,28,40] and, to our knowledge, any research has not been examined on achievement goals in science motivation. Therefore, the present examination’s goal is to conduct the connections between achievement goals and science motivation. In the current investigation the science motivation has been taken into consideration as a result and achievement goals as the predictor. That there is a positive relationship between achievement goals and science motivation was hypothesized by the researchers [3,8,10,11,12,14,30,38].

2. Method

2.1. Participants

The investigation’s participators were 295 students from university, it was consisted of 170 females (57%) and 125 males (43%) University of Sakarya, Turkey. Ages of the students were between 18 and 36 and the participants’ mean age was 20.2 (sd=1.9) years and GPA scores ranged from 1.40 to 3.87.

2.2. Instruments

Achievement goals questionnaire: Achievement Goals Questionnaire consists of a 12-item paper-and-pencil scale which was adapted to Turkish by Arslan and Akın [5]. There are four subscales in the scale. The Turkish version of the Achievement Goals Questionnaire’s confirmatory factor analysis was calculated. According to the applied analysis, the items loaded on four factors [5]. Confirmatory factor analysis’s results demonstrated that the four-dimensional model was well fit.
Science Motivation Scale: Science Motivation Scale is a 21 item paper-and-pencil scale. It was adapted to Turkish by Arslan, Yılmaz, Akcaalan, Yılan and Cavdar[6]. This scale has six sub-scales. For confirmatory factor analysis of the Turkish version of the Science Motivation Scale was calculated and analysis showed that the items loaded on six factors [6]. Results of confirmatory factor analysis showed that the six-dimensional model was well fit.

2.3. Procedure

Participants were demanded to give knowledge about the term at school and were informed to spare some time and read each item carefully. The questionnaires were applied to the individuals in group sets in the schoolrooms. The counterbalance was administrated for the measures. The participants were acquainted with the aims of the investigation prior to application of questionnaires.

2.4. Procedure and Data Analysis

Participants were selected by the convenience sampling method. The convenience sampling was utilized in order to select the participators due to the participants’ accessibility and closeness to the researcher [9]. In this research, so as to determine the connection between individuals’ science motivation and achievement goals, correlation and regression analysis were performed.

3. Findings

3.1. Descriptive Data and Inter-correlations

In Table 1, preliminary correlation analysis shows that M-ap (r=.40), M-av (r=.44), P-ap (r=.52), P-av (r=.47) are related positively associated with science motivation. In Table 2, multiple regression analysis is demonstrated that the independent variables are dimensions of between achievement goals and the dependent variable is science motivation.

Table 1. Descriptive statistics and inter-correlations of the variables

| Variables       | M-ap | M-av | P-ap | P-av | Science motivation |
|-----------------|------|------|------|------|--------------------|
| M-ap            | —    |      |      |      |                    |
| M-av            | .59**|      |      |      |                    |
| P-ap            | .62**| .59**|      |      |                    |
| P-av            | .56**| .57**| .73**|      |                    |
| Science motivation | .40**| .44**| .52**| .47**|                    |

**p < .01

Table 2. Summary of Stepwise Multiple Regression Analysis for Variable Predicting Science Motivation

| Variables     | B    | SEβ | β   | T    | p     | R    | R²   | F    | p    |
|---------------|------|-----|-----|------|-------|------|------|------|------|
| Step 1        |      |     |     |      |       |      |      |      |      |
| M-ap          | 3.2  | .44 | .39 | 7.37 | .00   | .39  | .15  | 54.3 | .00  |
| Step 2        |      |     |     |      |       |      |      |      |      |
| M-ap          | 1.7  | .53 | .21 | 3.32 | .00   | .47  | .22  | 24.0 | .00  |
| M-av          | 2.2  | .45 | .31 | 4.9  | .00   |      |      |      |      |
| Step 3        |      |     |     |      |       |      |      |      |      |
| M-ap          | .44  | .55 | .05 | .80  | .42   |      |      |      |      |
| M-av          | 1.3  | .45 | .18 | 2.85 | .005  | .54  | .30  | 31.5 | .00  |
| P-ap          | 2.8  | .49 | .37 | 5.62 | .00   |      |      |      |      |
| Step 4        |      |     |     |      |       |      |      |      |      |
| M-ap          | .32  | .55 | .03 | .57  | .56   |      |      |      |      |
| M-av          | 1.1  | .46 | .16 | 2.4  | .01   | .55  | .30  | 3.26 | .07  |
| P-ap          | 2.2  | .58 | .30 | 3.87 | .00   |      |      |      |      |
| P-av          | .94  | .52 | .13 | 1.80 | .07   |      |      |      |      |

*p < .01 (Mastery-approach (M-ap) ,mastery-avoidance (M-av) ,Performance approach (P-ap), Performance avoidance (P-av)
M-ap is the first factor from study entering the equation first, accounting for 15% of the variance in predicting science motivation. M-av is the second step accounting for an additional 7% variance. P-ap is the third step accounting for an additional 7% variance. P-av is the fourth step accounting for an additional 1% variance. The last regression models M-ap, M-av, P-ap, and P-av on as predictors of science motivation accounts for 30% of the variance in science motivation. The standardized beta coefficients indicates the relative influence of the variables in last model with M-ap, M-av, P-ap all significantly influencing science motivation but P-av does not predict significantly, and M-ap was strongest predictor of science motivation.

4. Discussion and Conclusion

The present research’ primary goal was to analyse the relationship between science motivation and achievement goals. Whether achievement goals would predict students’ science motivation or not was another important aim of the study. The findings unambiguously proved the hypotheses of the examination as correct. Preliminary correlation analyses indicated that M-ap, M-av, P-ap, P-av were positively associated to science motivation. Stepwise regression analysis findings demonstrated that M-ap, M-av, P-ap, P-av significantly predicted students’ science motivation level. The findings of correlation and regression analyses confirmed the hypothesis and the significance of achievement goals to gain a clear understanding of science motivation. The results of the study confirmed that the science motivation’s significant predictor of was related to achievement goals. In the achievement goal theory, the motivation of common interest was based on by the singular antecedents and consequences of students’ goal accepting [27,30,19]. Researchers in the field of motivation found that higher grades were in relationship with P-ap goals [11]) and hence they should not be taken into consideration as non-adaptive for student learning. Dowson and McInerney [12] emphasized that work-avoidance was an essential side of school motivation. Especially this orientation was related to a a large quantity of diligence lessening strategies. In his study, Was [39] demonstrated that perceptions about motivation might be important for strategy of students achievement tasks in school achievement. Importance of individuals' different tendencies which effect their motivational perception was proved by some other researchers. For example, in another study of Dweck and colleagues [14] proposed that motivational model created a focus on varied aims, strategies of cognitive, influences and behavior. Besides the similar results of Tapola and Niemivirta [37], they proved that learning environment of students’ perceptions and preferences varied in term of differences motivational tendencies. According to Tuan, Chin, Shieh [38], it was asserted that the permanence of motivation about the individuals’ achievement indicated that motivation of students was markedly related to science achievement scores gained previously and currently. In another study, Bryan, Glynn, Kittleson [8] indicated the motivation to learn science might make it possible for students to comprehend information in science, describe fundamental questions of science, make evidence-based inferences and reach a verdict with regard how human activity influences the natural world. Additionally, the more dominant scales of students’ motivation were, the more active roles they took in terms of science learning [30]. Within this context, Andrei, Izabela and Valentina [3] indicated that a higher motivation or an intentional learning improved its reproductive performance only if it was associated with a more laborious processing of the material learned. As a result, the present findings strengthen our conception of the link between science motivation and achievement goals. In contrast with expressed limitations, this research extensively investigated a large spectrum of social risk factors for achievement goals and science motivation with a wide sample of individuals as students and specified essential correlates. Following studies had better include more components for achievement goals and investigate its effects on adolescents’ science motivation, alongside intervention strategies.

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