

An Investigation of the Relationship between Motivation and Academic Achievement of Pre-service Chemistry Teachers

Kimya Öğretmeni Adaylarının Motivasyon ve Akademik Başarıları Arasındaki İlişkinin İncelenmesi

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Abstract

The main purpose of this study was to explore the relationship between academic achievement and motivation. In addition, motivational differences between gender and year level were investigated. Pre-service chemistry teachers (n=168) completed the Academic Motivation Scale (AMS) which was prepared by Vallerend (1992) as an instrument. The AMS consisted of 28 Likert-type scale questions related to intrinsic motivation (to know, toward accomplishment, and to experience stimulation), extrinsic motivation (identified, introjected, and external regulation) and amotivation. The results indicated that there is only one significant relationship that is between academic achievement and two intrinsic motivation subscales (to know and to experience stimulation). Besides, females got higher scores in all motivation types. The results show only significant differences between males and females for intrinsic motivation to experience stimulation. With regard to year level, there is significant difference in motivation by year in one subscale of extrinsic motivation introjected.

Keywords: chemistry education, motivation, academic achievement, gender, year level

Öz

Bu çalışmanın temel amacı, motivasyon ile akademik başarı arasındaki ilişkiyi araştırmaktır. Bunun yanında, cinsiyet ile sınıflar arasındaki motivasyon farklılıkları da incelenmiştir. Kimya öğretmen adayları (n=168) ölçek olarak Vallerand'ın 1992'de hazırladığı Akademik Motivasyon Ölçeği'ni (AMÖ) doldurmuştur. Akademik Motivasyon Ölçeği (AMÖ) içsel motivasyon (öğrenmek için, başarıya doğru ve uyarım yaşama), dışsal motivasyon (farkına varılmak, içe yansımış ve dış kontrol) ve motivasyonsuzluk alt ölçeklerini içeren 28 tane Likert tarzı sorudan oluşmaktadır. Analiz sonuçlarında , akademik başarı ile sadece iki içsel motivasyon (bilgi ve uyarım yaşama) arasında anlamlı bir ilişki bulunmaktadır. Ayrıca, kızlar motivasyon alt boyutlarında erkeklere göre daha yüksek değerler almaktadır. Kızlarla erkekler arasında anlamlı fark sadece içsel motivasyon- uyarım yaşama alt ölçeğinde bulunmaktadır. Sınıf farkını göz önüne aldığımızda ise, sınıflar arasında tek fark dışsal motivasyon- içe yansımış alt ölçeğinde gözlenmektedir.

Anahtar Sözcükler: Kimya eğitimi, motivasyon, akademik başarı, cinsiyet, sınıf.

Introduction

Motivation, a force that energizes and directs behaviour toward a goal could certainly be perceived as one of the most important psychological concepts in education (Eggen & Kauchak,1994). Self-determination theory (SDT) is an one of the useful theories developed for understanding individuals' motivation (Deci & Ryan, 1985, 2000). SDT suggests that the impetus

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of motivated behavior is having the experience of choice (autonomy) and emotion of efficacy in actions (competence), along sense appropriate enclosed to the important others in individual's environment (relatedness).

Probably, the most differentiating characteristic of SDT from other motivation theories is that this theory suggests motivation as a multidimensional concept that not only varies in level, but also kind. Deci and Ryan (1985,1991) proposed that there are three main types of motivation which are intrinsic motivation, extrinsic motivation and amotivation.

Intrinsic motivation refers to being engaged in an activity for itself and for the pleasure and satisfaction derived from participation (Deci, 1975). Intrinsic motivation is widely concerned to mirror the highest level of motivation, as the place of behavior is completely internal (Grolnick, 2002). This internalization is considered by some researchers as the base of human learning (Vansteenkiste, 2006) and it has been defined as "the process of transforming external regulations into internal regulations and, when the process functions optimally, integrating those regulations into one's sense of self" (Deci & Ryan, 1994: 120). Intrinsic motivation for a function is showed when the function is carried out of interest, enjoyment, or inherent satisfaction (Ryan & Deci, 2002; Vallerand & Ratelle, 2002). Intrinsic motivation can be divided into three parts, intrinsic motivation to know, intrinsic motivation toward accomplishments, and intrinsic motivation to experience stimulation, which are ordered of decreasing self-determination (Vallerand, 1992). Intrinsic motivation to know is that which reflects to a need or desire to understand and learn. Intrinsic motivation toward accomplishments when a behavior is performed to gain a sense of achievement and capability, and intrinsic motivation to experience stimulation includes participating in a function for pleasure or sensations.

Extrinsically motivated learners place their locus of behavioral control outside of themselves; their behaviors are shaped by external elements including rewards and punishments (Karsenti & Thibert, 1995). The most important issue with extrinsic motivation is that consistently performing a behavior for the lack of receiving a reward (or avoiding a punishment) undermine autonomy and may lead to both decreased persistence and increased feelings of control loss (Vansteenkiste, 2006). Extrinsic motivation is divided as integration, identification, introjections, and external regulation. Integrated regulation of extrinsic motivation is a function defined as global and is integrated into the person's behavior as a means to an end rather than for intrinsic pleasure. Moving down the continuum, identified regulation defines conditions in which individuals force themselves to take a function because they recognize that a function is universal for some reason (Petrie & Govern, 2004). Introjected regulation is managed by rewards and restrictions carried out by the individual themselves, whereas in external regulation, the rewards and restrictions are carried out by others (Vallerand, 1992). Externally regulated extrinsic motivation is the lowest type of motivation.

The absence of any self-determination is called amotivation (Deci & Ryan, 1985). It is also defined as the lack of both extrinsic and intrinsic motivation; amotivation is the demonstration of the belief that one's behavior is the result of something out of conscious (Cokley, 2001). A classic example is an amotivated college student who, because she does not identify a connection between her behaviors and future outcomes, cannot really explain why she attends to school (Karsenti & Thibert, 1995).

Recognizing student choices and motivation behind teaching is crucial for understanding motives for receiving responsibility for a chemistry education degree, the results of which could be used to manipulate teaching practices and the development of course works. Particularly, the findings of this study may help to encourage the development of educational strategies to develop intrinsic motivation among students to teach chemistry education. Intrinsic motivation can be improved by increasing understanding of success and adequacy such as relating participants in decision making, providing feedback and setting realistic goals (Swanson, 1995; Watts, Cashwell & Schweiger, 2004).

Developing intrinsic motivation among pre-service teachers is also crucial from the view of teacher enrollment, mainly since teaching is a profession struggling to attract and keep new graduates, with an estimated erosion rate of 30% for early career teachers (O'Brien & Goddard, 2006). There are many researches identifying motivation of teachers (Albrecht, Haapanen, & Hall, 2009; Spittle, Jackson & Casey, 2009; Unrau & Schlackman, 2006). Albrecht et al. (2009) tried to improve secondary school students' achievements using intrinsic motivation. They found that when the intrinsic motivation of students increased, their academic achievement also increased. Spittle, Jackson and Casey (2009) examined the reasons of becoming physical education teachers and explored the relationships of motivation and gender and year level. They also used Academic Motivational Scale prepared by Vallerand (1992) as instrument. They reported that females were more intrinsically motivated than males and third year students were lower in motivation than other year levels. Unrau and Schlackman (2006) investigated the effects of intrinsic and extrinsic motivation on reading achievement for urban middle school students. They reported that intrinsic motivation seemed to have a positive effect on reading achievement for Hispanic and Asian middle school students, whereas extrinsic motivation seemed to have a negative impact on reading achievement. Also, Arıoğul (2009) investigated the academic motivation of Turkish pre-service English teachers and found that first and fourth year students were more motivated than second and third year students and third year students were the least motivated. Besides, females and males had similar motivational levels and the intrinsic motivation was a sign of academic performance. However; in these studies, the relationship between motivation and academic achievement in chemistry pre-service teacher is rarely investigated. Therefore, this study helps understanding chemistry pre-service teachers' motivation and academic achievement.

Purpose of the study

Understanding the relationship between teachers' motivation and academic achievement is important for developing teachers' intrinsic motivation towards teaching and improving quality of the teachers. There are many studies about motivation of teachers but investigation of chemistry teachers' motivations is not adequate in the literature. Therefore; this study aims to; (1) explore the relationship between academic achievement and motivation; (2) examine the motivational difference between gender and year levels. Based on these two purposes the following research questions are investigated:

1. Is there any difference between genders and year level according to motivation?
2. What is the relationship between academic achievement and motivation?

Method

Participants

The research was conducted with 168 students attending chemistry education at the first, second, third and fourth grade in Middle East Technical University. A total of 168 students are willing to participate and give an overall response rate of 93.8%. The students of sample are 48 (28.6%) male and 120(71.4%) female which age between 19 and 23. When ordered by year level, 72 (42.8%) were first year, 28 (16.6%) were second year, 34 (20.2%) were third year and 34 (20.2%) were fourth year students.

Instrument

The Turkish version of AMS (Academic Motivation Scale) was used after the modifications made by researchers in this study (Appendix A). This version, similar to the original one consists of seven factors with four items each: intrinsic motivation to know, intrinsic motivation toward accomplishment, intrinsic motivation to experience stimulation, extrinsic motivation identified, extrinsic motivation introjected, extrinsic motivation external regulation and amotivation.

A questionnaire was used to measure intrinsic motivation, extrinsic motivation, and amotivation and students were asked to indicate their gender, current year level, and cumulative academic average (GPA). The Academic Motivation Scale (AMS) developed by Vallerand et al. (1992) was used as a measure of intrinsic, extrinsic and amotivation for going to 'college,' or in Turkish terminology, 'university'. The AMS consisted of 28 Likert-type scale questions relating to intrinsic motivation (to know, toward accomplishment, and to experience stimulation), extrinsic motivation (identified, introjected, and external regulation) and amotivation. Participants were asked to indicate to what extent the question corresponds to one of the reasons why they go to university/college on a scale of 1 (does not correspond at all) to 5 (corresponds exactly). Also, academic achievement was measured by cumulative academic average (GPA).

The Cronbach's alpha coefficients were found for each of the AMS subscales. The AMS subscales have adequate internal consistency with values ranging from 0.60 to 0.84 which were: intrinsic motivation to know 0.84, intrinsic motivation to accomplish 0.81, intrinsic motivation to experience stimulation 0.80, extrinsic motivation identified 0.60, extrinsic motivation introjected 0.73, extrinsic motivation external regulation 0.75 and amotivation 0.79 (Table 1). These values were nearly similar to those calculated by Vallerand et al. (1992) as he reported that all AMS subscales also showed acceptable temporal stability with an average test-retest correlation of 0.79 during a period of 1 month

Table 1.

Cronbach's Alpha Coefficients for Subscale Items of the AMS

Subscale	α (n=168)
Intrinsic motivation – to know	0.84
Intrinsic motivation – toward accomplishment	0.81
Intrinsic motivation – to experience stimulation	0.80
Extrinsic motivation – identified	0.60
Extrinsic motivation – introjected	0.73
Extrinsic motivation – external regulation	0.75
<u>Amotivation</u>	<u>0.79</u>

Procedure

The participants are completed the Turkish version of AMS during regular semester. Both oral and written instructions were given to students regarding the completion of the scale. They were assured about the confidentiality of their responses and they were encouraged to ask any questions about items. The questionnaire took approximately 15 minutes. Graduated of Natural Science and Applied ethical commission was granted to conduct the study.

Data Analysis

An independent sample t-test was conducted to test if the motivation of female was significantly different than motivation of male. Analyses of variance were used to explain if there were any significant differences in motivation between year levels. Where significant differences were found, post- hoc tests were conducted. Besides, Pearson's correlations carried out to investigate whether there is relationship between academic achievement and motivation.

Results

Relationship between the motivation and the academic achievement

The correlations present the results of Pearson's correlations conducted if there is relationship between academic achievement and the AMS subscale. These results indicated that there is only significant relationship between academic achievement and two intrinsic motivation subscales (to know and to experience stimulation). The sign of the Pearson Correlation Coefficient gives

us the direction of the relationship between the two variables. Pearson Correlation Coefficient of intrinsic motivation to know is $r = .362$ and it is positive so there is a positive correlation between the “academic achievement” and “intrinsic motivation to know” scores. Besides, Pearson Correlation Coefficient of intrinsic motivation to experience stimulation is $r = .367$, thus there is also positive correlation between “academic achievement” and “intrinsic motivation to experience stimulation” scores (Table 2). In addition to this, all subscales are positively correlated with each other except extrinsic motivation external regulation and amotivation with Pearson Correlation Coefficient ranging from 0.24 to 0.72. Also, they are negatively correlated with amotivation except extrinsic motivation external regulation.

Table 2.

Pearson Correlation Coefficient between GPA and Motivational Subscales

Motivational Subscale	r
Intrinsic motivation to know	0.362**
Intrinsic motivation to experience stimulation	0.367**

Gender

Generally, females got higher scores for all motivation types (Table 3). Independent sample t-tests show only significant differences between males and females for intrinsic motivation to experience stimulation. Females have greater scores than males for intrinsic motivation to experience stimulation. In addition, females and males have high scores especially intrinsic motivation to know, extrinsic motivation identified, extrinsic motivation external regulation. Also, the lowest score of subscales is obtained by amotivation.

Table 3.

Descriptive Statistics and t-test Result for Motivation by Gender

Motivational subscale	Gender				t	df	p
	Female		Male				
	M	SD	M	SD			
Intrinsic motivation – to know	3.89	0.79	3.50	0.88	-2.18	164	0.03
Intrinsic motivation – toward accomplishment	3.30	0.91	2.92	0.90	-1.87	165	0.07
Intrinsic motivation – to experience stimulation	3.47	0.79	2.95	0.69	-3.27	165	0.00
Extrinsic motivation – identified	4.00	0.68	3.68	0.84	-2.00	164	0.04
Extrinsic motivation – introjected	2.74	0.09	2.60	1.06	-0.65	166	0.52
Extrinsic motivation – external regulation	4.09	0.77	4.02	0.75	0.42	164	0.68
Amotivation	2.02	0.97	1.82	0.98	-0.96	166	0.36

Year Level

One- way ANOVA shows that there is significant difference motivation by year level (at the $p < 0.01$ level) in one subscale of extrinsic motivation introjected (Table 4). The Levene statistics indicated that the test of homogeneity of variance was nonsignificant, $p = 0.622$. Thus, Dunnett's C test was chosen as post- hoc testing and it is found that, the first year and third year level students differed significantly from one another. Amotivation scores for all years are quietly low. Besides, amotivation scores slightly decrease by increasing year level. Apart from amotivation, extrinsic motivation (introjected) subscales is also lower than other subscales (Table 4). Also, extrinsic motivation- external regulation scores are higher than other subscales for all year levels. The first year students are more motivated than other years.

Table 4.
Descriptive Statistics and F-test Statistics by Current Year Level

Motivational subscale	Current year level								F	df	p
	1 st year		2 nd year		3 rd year		4 th year				
	M	SD	M	SD	M	SD	M	SD			
Intrinsic motivation – to know	3.82	0.77	3.25	0.65	3.88	0.74	3.72	1.06	1.04	3	0.38
Intrinsic motivation – toward accomplish	3.17	0.87	2.50	0.92	3.35	0.91	3.26	1.03	1.47	3	0.23
Intrinsic motivation – to experience stim.	3.41	0.72	2.80	0.77	3.40	0.62	3.10	0.91	2.11	3	0.10
Extrinsic motivation – identified	4.06	0.67	3.63	0.80	3.73	0.72	3.88	0.86	1.13	3	0.19
Extrinsic motivation – introjected	2.93	0.92	1.83	0.86	2.28	0.87	2.97	0.89	5.66	3	0.00
Extrinsic motivation – external regulation	4.15	0.65	4.33	0.44	3.78	0.93	4.05	0.75	1.79	3	0.15
Amotivation	2.29	1.07	2.15	0.91	1.81	0.92	1.66	0.72	1.74	3	0.16

Discussion

There are many studies that investigated motivation of teacher and students and examined the relationship between motivation and academic achievement, gender, year level. However, in the literature, there are a few studies especially about pre-service chemistry teacher's motivation. Therefore, this study was constructed on previous researches by investigating pre-service chemistry's motivations with respect to academic achievement, gender and year level. This research provides support for relationship between academic achievement and motivation (Ames, 1992; McInerney, 2001; Pintrich & Maehr, 1995; Wentzel, 1991). This suggests that pre-service chemistry teachers with high intrinsic motivation (to know and experience stimulation) may accomplish greater teacher career and it is helped to increase chemistry teachers' quality.

The first aim of this study was to explore relationship between motivation and academic achievement. Two intrinsic motivations (to know and to experience stimulation) were found as positive correlation between academic achievements. These findings revealed that students who have high average were more likely to be intrinsically motivated. Karsenti (1994) found significant relation school achievement (GPA) and motivation. Besides, past researches reported that extrinsic motivation was generally negatively related to achievement whereas intrinsic motivation positively related with achievement (Mitchell, 1992; Pintrich & Garcia, 1991; Harter & Connell, 1984). Understanding the relationship between academic achievement and motivation may help increase academic achievement of pre-service teachers.

The other aim was to examine the motivational differences between gender and year level. Females were found to be more motivated than males in all motivational subscales. Besides, intrinsic motivation to experience stimulation subscale is significantly different for females and males. The higher motivation of females is not easy to explain. Spittle, Jackson and Casey (2009) explained that it may be because of females having greater connectedness during their university period. But, it is only guess. Regarding year levels, the only statistically different motivational subscale was extrinsic motivation introjected and the first year and third year were significantly different. However, Spittle et al. found that third year students have significantly higher scores in amotivation than other year levels. Besides, it is observed that amotivation scores slightly decrease by increasing year level. It is may be due to increasing conscious with year levels. Apart from amotivation, extrinsic motivation (introjected) which refers management of rewards and restrictions by own, is also lower than others. In addition, the first year students are more motivated than other years. May be in the first year students are more excited and enthusiastic and more eager to learn.

Conclusion

In this study, there are mainly two purposes that explore the relationship between academic achievement and motivation and examine the motivational difference between gender and year levels. In the light of these purposes, firstly, it was found that there is a positive relationship between academic achievement and motivation, specifically, intrinsic motivation (to know and experience stimulation).

With regard to second purpose, the motivational differences between gender and year level were investigated. Females were found to be more motivated than males in all motivational subscales. Also, there is a significant difference between females and males in intrinsic motivation to experience stimulation subscale. As considering year level, depending on increasing year level, amotivation scores slightly decrease. Besides, amotivation scores were low for all years and high motivational scores were observed for first year students.

Limitations

The Turkish AMS version may not be converted accurate measures of students' motivation. Another problem the sample size may be low to conduct this study properly. The last problem is that α value of extrinsic motivation- identified is 0.60 in this study and 0.64 was found by Vallerand et al. (1992). In the next researches, to improve the instrument's reliability, this subscale may be considered and revised.

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Appendix A

Akademik Motivasyon Ölçeği

Her maddeyi dikkatli bir şekilde okuduktan sonra, sizi en iyi ifade ettiğini düşündüğünüz rakamı aşağıdaki ölçeği göz önüne alarak yuvarlak içine alınız

Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
1	2	3	4	5

Üniversiteye Niçin Geldiniz?

- | | | | | | |
|---|---|---|---|---|---|
| 1. İlerde daha yüksek maaşlı bir iş bulmam için en az üniversite diplomasına ihtiyacım var | 1 | 2 | 3 | 4 | 5 |
| 2. Yeni şeyler öğrenmek beni mutlu ve tatmin ediyor. | 1 | 2 | 3 | 4 | 5 |
| 3. Üniversite eğitiminin ilerde kariyer seçiminde bana daha çok yardımcı olacağını düşünüyorum. | 1 | 2 | 3 | 4 | 5 |
| 4. Gerçekten üniversiteye gitmekten hoşlanıyorum. | 1 | 2 | 3 | 4 | 5 |
| 5. Aslında, bilmiyorum; üniversitede boşa vakit geçirdiğimi hissediyorum. | 1 | 2 | 3 | 4 | 5 |
| 6. Çalışmalarında kendimi aşma zevkine ulaşmak için. | 1 | 2 | 3 | 4 | 5 |
| 7. Kendime üniversite diploması alabileceğimi kanıtlamak için . | 1 | 2 | 3 | 4 | 5 |
| 8. İlerde daha prestijli bir iş bulmak için | 1 | 2 | 3 | 4 | 5 |
| 9. Daha önce görmediğim yeni şeyleri keşfederkenki hazzı tatmak için . | 1 | 2 | 3 | 4 | 5 |
| 10. Sonuçta üniversite bana girmek istediğim iş dünyasının kapılarını açacak. | 1 | 2 | 3 | 4 | 5 |
| 11. Üniversite benim için eğlencedir. | 1 | 2 | 3 | 4 | 5 |
| 12. Daha önce üniversiteye gitmek için iyi sebeplerim vardı; ancak, şimdi devam edip etmemem gerektiğinden endişeliyim. | 1 | 2 | 3 | 4 | 5 |
| 13. Kendi özel yeteneklerimde, kendimi aşma zevkine ulaşmak için. | 1 | 2 | 3 | 4 | 5 |
| 14. Gerçek şu ki üniversite derecesi aldığımında kendimi önemli hissedeceğim. | 1 | 2 | 3 | 4 | 5 |
| 15. İlerde "iyi bir hayat" istiyorum. | 1 | 2 | 3 | 4 | 5 |
| 16. İlğimi çeken konularda, bilgimi genişletme zevkine ulaşmak için. | 1 | 2 | 3 | 4 | 5 |
| 17. Üniversite kariyer yönelimimde, daha iyi tercih yapmama yardım edecek. | 1 | 2 | 3 | 4 | 5 |
| 18. İlginç hocalarla tartıştığımda aldığım zevki tatmak için. | 1 | 2 | 3 | 4 | 5 |

19. Niçin üniversiteye gittiğimi anlayamıyorum ve açıkçası çok da umrumda değil.	1	2	3	4	5
20. Zor akademik aktiviteleri başarıma sürecince aldığım zevki hissetmek için	1	2	3	4	5
21. Kendime akıllı olduğumu göstermek için.	1	2	3	4	5
22. İlerde daha iyi maaş almak için.	1	2	3	4	5
23. Benim çalışmalarım, beni ilgilendiren birçok konuda öğrenmeye devam etmeme imkan veriyor.	1	2	3	4	5
24. Üniversite derecemın benim çalışma yeterliliğimi artıracığına inanıyorum.	1	2	3	4	5
25. Birçok ilginç konuyu okuduğumda tatminkar hissettiğim için.	1	2	3	4	5
26. Üniversitede ne yapıyorum bilmiyorum ve anlamıyorum.	1	2	3	4	5
27. Üniversite, çalışmalarımda mükemmelliğe ulaşmak için araştırma yapma zevkine ulaşmama fırsat veriyor.	1	2	3	4	5
28. Çalışmalarımda başarılı olabileceğimi kendime göstermek istiyorum.	1	2	3	4	5

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