Eurasian Journal of Educational Research 72 (2017) 1-22

Eurasian Journal of Educational Research

www.ejer.com.tr

# Investigating Relationships between Undergraduate Students' Flow Experience, Academic Procrastination Behavior, and Calculus Course Achievement

Aysenur ALP[1] Semra SUNGUR[2]

ARTICLE INFO

*Article History:*

Received: 16 Aug. 2017

Received in revised form: 27 Oct. 2017

Accepted: 21 Nov. 2017

DOI: 10.14689/ejer.2017.72.1

*Keywords*

Flow, procrastination, achievement, Calculus course

ABSTRACT

**Purpose:** Calculus is generally offered as a freshman-year course and is a prerequisite for some advanced STEM-related courses in some undergraduate programs. However, some students experience difficulties in Calculus courses, leading to lower levels of achievement. Thus, there is a need to examine the factors which may be related to students' achievement in Calculus courses. According to relevant literature, procrastination can diminish students' achievement. Additionally, flow emerges as an important factor that may be related to students' achievement and procrastination, but these relationships have not been studied in the context of Calculus courses.

The purpose of this study was twofold. Firstly, undergraduate students' academic procrastination was examined in relation to dimensions of flow experiences in a Calculus-I course. Secondly, undergraduate students' academic achievement in Calculus-I course was explored in relation to their academic procrastination and dimensions of flow experiences. **Research Methods:** A total of 117 undergraduate students (54% female and 46% male, $M_{age}$=23.00) from various departments participated in an online survey. **Findings:** Multiple regression analysis showed that among flow-experience dimensions, "concentration on the task at hand" was negatively related to procrastination. In addition, two-step hierarchical regression analysis indicated that procrastination negatively predicted achievement in the first step. However, in the second step, only the "challenge-skills balance" dimension of flow positively predicted achievement. **Implications for Research and Practice**: In Calculus courses, if students are given tasks that foster their focus, their procrastination behavior can be diminished. In addition, if they are given tasks that are appropriate to their level and skills, their academic achievement can be predictably higher. In this context, real-life applications should relate to students' own interests and skills. Therefore, their academic achievement can be higher.



[1] Corresponding Author: Middle East Technical University, TURKEY, aysenur.alp@metu.edu.tr
ORCID: https://orcid.org/0000-0002-9291-5157

[2] Middle East Technical University, TURKEY, ssungur@metu.edu.tr
ORCID: https://orcid.org/0000-0002-3372-6495

## Introduction

When people are engaged in an activity that involves high concentration, high enjoyment, and losing track of time, they are said to be at the state of optimal experience, which is called *flow* (Csikszentmihalyi, 1975; 1997). In a flow state, individuals perceive themselves as successful regarding their performance, and this perception gives them pleasure. Individuals do the activity for its own sake, and there is no other further goal (Nakamura & Csikszentmihalyi, 2002). Csikszentmihalyi (1975) initially identified four elements related to flow state: control, attention, curiosity, and interest. These four elements were later elaborated, and nine elements of flow state were defined (Csikszentmihalyi, 1996): (1) There are clear goals for every step of the way (i.e. in flow, individuals know what should be done and in what order). (2) There is immediate feedback for one's actions (i.e. in flow, individuals know how well they are doing and they are aware of their performance). (3) There is a balance between challenges and skills (i.e. individuals feel that their abilities are well matched to the opportunities for action). (4) Action and awareness are merged (i.e. in flow, individuals are aware of what is here and now). (5) Distractions are excluded from consciousness (i.e. in flow, individuals' concentration is focused on what they are doing; they are not thinking about anything else). (6) There is no worry of failure (i.e. in flow, individuals are not afraid of what they are doing because they don't have full control of their actions; the action is done automatically). (7) Self-consciousness disappears (i.e. in flow, individuals are too involved in what they are doing). (8) The sense of time becomes distorted (i.e. in flow, individuals forget time, and hours may pass by in what seem like a few minutes). (9) The activity becomes autotelic (i.e. in flow, everything that individuals do is worth doing for its own sake) (Csikszentmihalyi, 1996).

Flow has been found to be related to adaptive outcomes such as satisfaction with life, hedonic balance, and psychological well-being (Bassi, Steca, Monzani, Greco, & Delle Fave, 2014; Collins, Sarkisian, & Winner, 2009). Research has also demonstrated that flow experiences improve students' academic satisfaction and achievement (Carli, Delle Fave, & Massimini, 1988; Heine, 1996; Joo, Joung, & Sim, 2011; Nakamura, 1988). For example, in a study with undergraduate students, Seo (2011) reported that flow is positively related to academic achievement. Mendelson (2007) also found a positive relationship between flow and exam scores, as indicated by both exam scores and GPA. Moreover, undergraduate students' flow was found to have a direct effect on achievement in an Application of Computers course (Joo, Oh, & Kim, 2015). Additionally, considering the nine elements of flow state, Shernoff, Csikszentmihalyi, Shneider and Shernoff (2003) showed that when students (a) experience challenging tasks, (b) feel that their skills are balanced with the challenge, and (c) control their climate, they are highly engaged in the learning environment. Moreover, Kim and Seo (2013) found that action-awareness merging, autotelic experience, and transformation of time were significant positive predictors of achievement behaviors. The latter two studies revealed that relationships between flow and academic outcomes can differ across different dimensions of flow. Thus, it appears that research on flow should focus on its specific dimensions rather than examining flow as a single construct. Accordingly, in the current study, students' flow experiences were examined in terms of the dimensions. In addition, flow experiences were examined specifically for a Calculus course. Accordingly, the findings here can shed light on whether other findings in the relevant literature can be generalized across different domains, such as art, sport, and mathematics.

With regard to flow studies in mathematics education, Seifert, Radu, and Doyle (2009) reported that flow is a deep cognitive experience for mathematics students. Moreover, a combination of challenge, concentration, and competence is important for experiencing flow. Mathematics students mostly experience flow alone and in an environment over which they have control. However, they also may experience flow while the mathematics instructor is working on a problem and they are concentrated on the instructor's explanations (Seifert et al., 2009). Additionally, according to Radu and Seifert (2011), flow experiences in mathematics include clear goals, challenge-skill balance, and intense concentration. In particular, engagement in mathematics requires a challenge-skill balance. Moreover, becoming engaged in solving math problems requires a clear goal of solving the problem, which furthermore assumes a certain degree of concentration. Overall, the aforementioned literature has suggested that among flow dimensions, the positive predictors of achievement behaviors are challenge-skills balance, clear goals, high control, and high concentration.

Apart from flow, several studies have been conducted regarding academic procrastination, which is one of the maladaptive behaviors of students. According to Lay (1986), procrastination is a failure to finish what has to be done to attain goals. In other words, when individuals continue to fail to do what they should be doing to attain certain desirable goals, then procrastination behavior occurs. Moreover, Solomon and Rothblum (1984) defined procrastination as "the act of needlessly delaying tasks past the point of discomfort" (p. 503). Accordingly, academic procrastination involves delaying study-related activities, such as studying for an examination or writing a term paper (Klingsieck, Grund, Schmid, & Fries, 2013). Procrastination has been related to maladaptive outcomes in high school students, such as anxiety and low self-esteem (Besinck, Rothblum, & Mann, 1986), low examination grades and poor academic achievement (Beck, Koons, & Milgrim, 2000; Popoola, 2005; Tice & Baummestier, 1997), and amotivation (Lee, 2005). However, Seo (2011) found that procrastination (with its dimensions) was not a significant predictor of achievement for university students. Regarding the reasons for student procrastination, these behaviors are caused by low self-efficacy (Ferrari & Emmons, 1995), perfectionism (Onwuegbuzie, 2000), fear of failure (Rothblum, 1990), unclear directions (Schraw, Wadkins, & Olafson, 2007), and lack of time management and inability to concentrate (Noran, 2007). However, situational interest (Corkin et al., 2014), intrinsic motivation (Desrosiers, 2016), effort regulation (Rakes & Dunn, 2010), and conscientiousness (Ozer, 2012) were negatively related to academic procrastination.

At this point, it is important to note that because study behaviors can change across domains, examination of procrastination in a specific domain—such as mathematics—can have high predictive value (Choi 2005). According to Asikhia

(2010), many students, especially those in mathematics courses, do not study hard until the examination period, because mathematics is a demanding subject in terms of mathematical reasoning and problem solving. Akinsola, Tella, and Tella (2007) showed that many students perceive mathematics as high-demanding and difficult, and procrastination often occurs when a task is perceived as difficult or unpleasant. Mathematics also involves cognition effects and does not seem easy to anyone (Sutton, 1997). Moreover, some students often dislike mathematics as a subject, since it is often related to pain and frustration, and thus many students procrastinate in studying mathematics (Asikhia, 2010; Hopper, 2005). Considering this available literature, in the present study, students' procrastination and its relation with achievement were examined specifically for a Calculus course. The results have the potential to lead to specific implications for higher-education practices in Calculus courses.

Many researchers have also studied the relationship between flow and procrastination. In a study examining the relationship between students' flow, motivation, and procrastination, Lee (2005) found that a negative relationship exists between university students' flow and procrastination in an Educational Psychology course. In the study, the author included five dimensions of flow: clear goal, challenge-skill balance, concentration on the task, unambiguous feedback, and loss of self-consciousness. The author reported that in particular, college students' concentration on the task, clear goals, and loss of self-consciousness negatively predicted their procrastination behavior. In actuality, according to Messmer (2001), avoiding procrastination is important to experience the flow state. Messmer (2001) suggested that challenges stemming from poor planning can be offset by setting priorities, time management, focusing all one's attention on the immediate tasks and deadlines, and long-term goals. Moreover, Brinthaupt and Shin (2001) found that procrastination was positively related to action-awareness merging, challenge-skill balance, and unambiguous feedback, when considering all their current and recent courses.

Furthermore, Kim and Seo (2013) investigated the relationship between flow, self-regulation, active procrastination, and academic achievement in an Educational Psychology course. They found that challenge-skills balance was a significant positive predictor for active procrastination in both steps in the hierarchical regression analysis. According to Chu and Choi (2005), the relationship between procrastination and flow may vary depending on the type of procrastination. In fact, they found that active procrastinators (those who take volitional decisions to procrastinate and they finish their work before the deadlines) are better in flow than passive procrastinators (those who delay tasks until the last minute because they cannot manage their time effectively).

In this study, we will investigate the relationship between students' flow experience and procrastination behavior in Calculus I course. Procrastination will be measured with the Academic Procrastination Scale, developed by Aitken (1982) and adapted to Turkish by Balkıs (2006). This scale includes items which may suggest passive procrastination (e.g. "I delay starting things so long, I don't get them done by the deadline"), and flow will be examined in 9 dimensions using the Flow State-2 Scale (Jackson & Eklund, 2004; Asci, Caglar, Eklund, Altintas, & Jackson, 2007), which was adapted to the Calculus course. When different findings from previous literature are considered, the expectation is that all nine dimensions of flow experiences will be negatively related to (passive) procrastination.

Considerable research has also examined relationships between procrastination and academic achievement in different contexts (Bruinsma & Jansen, 2009; Chu & Choi, 2015; Seo, 2011). In their meta-analysis, Kim and Seo (2015) concluded that academic performance and procrastination are negatively correlated. For example, Duru and Balkıs (2014) found that academic procrastination in undergraduate students (from different departments in the faculty of education) negatively predicts their academic achievement. Moreover, passive procrastination negatively predicts undergraduate students' Human Anatomy exam grades and course grades (Hensley, 2014). With regard to the relationship between flow, procrastination, and achievement, Kim and Seo (2013) examined the relationship between flow, self-regulation, active procrastination, and achievement. They found that challenge-skills balance positively predicts active procrastination. When students procrastinated in their studies, they increased the level of challenge (either intentionally or unintentionally). Thus, they postponed their studies in order to establish a balance between the challenges of a situation and their skills (Csikszentmihalyi, 1997). Even though there are students who delay their studies in order to increase the challenge, not all students defer their studies because of this. For example, passive procrastinators felt pessimistic, and stressed especially about their ability to achieve when a deadline gets closer (Ferrari, Parker, & Ware, 1992). However, active procrastinators delayed their work intentionally, enjoying the feeling of being challenged in the last minute. Therefore, challenge-skill balance might be a unique feature of active procrastination, different from passive procrastination (Kim & Seo, 2013). They also found that action-awareness merging, transformation of time, and autotelic experience positively predicted academic achievement.

Keeping the aforementioned literature in mind, the current study aimed to provide a comprehensive picture of the relationship between each dimension of flow, procrastination, and achievement in a Calculus course. More specifically, the purpose of this study is to examine the extent to which flow experience predicts (passive) procrastination behavior, and to what extent flow and procrastination predict students' achievement. Based on the aforementioned studies, while a negative relationship is expected between (passive) procrastination and achievement, and negative relationships between passive procrastination and dimensions of flow, a positive relationship is expected between dimensions of flow and achievement.

### *Purpose and Significance of the Study*

The purpose of this study was twofold: (1) to examine to what extent students' flow experience (with its dimensions) predicts their academic procrastination in a Calculus I course, and (2) to explore to what extent students' academic procrastination and flow experience (with its dimensions) predict undergraduate students' achievement in a Calculus I course.

The present study aims to fill the gap in the literature in several ways. Firstly, even though some studies examine the relationship between students’ flow experience and procrastination in other domains (mostly Educational Psychology courses), flow has not been studied with its dimensions in examining both achievement and procrastination for Calculus (or mathematics). Thus, some clues can be obtained regarding how generalizable the findings in the relevant literature are concerning the proposed relations in different domains. If some differences are found, the findings can serve for more detailed practical implications for Calculus courses. Thus, this study has potential to make a contribution not only to educational psychology literature but also to mathematics education literature. In addition, the present study employed a different perspective than similar studies in the related literature (e.g. Brinthaupt & Shin, 2001; Seo, 2011). In these studies, researchers tried to determine whether procrastination is the reason for a flow state or not. They examined the relationship in terms of procrastinators’ experience of time pressure, which may result in a feeling of challenge for some students and a focus on one goal, which may in turn lead to a flow experience just before the deadline. They claim that procrastination can increase the flow state before a deadline. Since Chu and Choi (2005) claim that relationship between procrastination and flow may vary depending on the type of procrastination, it was hypothesized in the current study that if students experience flow state in their studies, they may not passively procrastinate in their academic studies, as Lee (2005) also found. Therefore, a negative relationship between flow and procrastination is expected in this study.

In addition, in this study, age was a covariate in the hierarchical regression analysis because some studies have found that age is significantly related with academic achievement in Calculus or mathematics achievement (Jarvis, 2000; Lunneborg & Lunneborg, 1966). Furthermore, the findings can have important implications for undergraduate programs in various departments, including engineering, mathematics, management, and statistics. In fact, the Calculus course is important for first-year students, and it is one of the high credit courses offered in the first year of academic programs. This course is important for all engineering, science, economics, mathematics, physics, and chemistry education students. After taking a calculus course, students are able to perform calculations and algebraic manipulations, specifically limits, differentiation, and integration. A student who is successful in this course gains several skills, such as applying differentiation in real-life situations.

The present study aimed to address following research questions:

1. To what extent do different dimensions of flow experiences predict students’ academic procrastination in a Calculus I course?
2. To what extent do different dimensions of flow and procrastination predict students’ academic achievement in a Calculus I course?

## Method

### *Research Sample*

Participants included 117 (54 males and 63 females) Turkish undergraduate students from 22 departments in 13 universities, who have taken the Calculus I course in their departments. They ranged in age from 19 to 40 years ($M_{age}$= 23, SD = 3.36). The participants were from the faculty of arts and sciences (*n* = 47), faculty of education (*n* = 6), faculty of engineering (*n* = 55) and faculty of economics and administration sciences (*n* = 9). The majority of the participants (42%) were seniors, and only 15% of them were freshmen. The percentages of sophomores and juniors were equal (21% each). More than half of the participants (60%) reported that they took Calculus I only once. The number of students who took the course twice was 22 (19.1%). The percentage of participants who took Calculus I three or four times were 8.7 and 4.3, respectively. Only 3.5% of participants reported that they took the course five times. Less than 1% of participants (0.8%) took Calculus I six or eight times. The percentage of the participants taking the course seven times was 2.6.

### *Research Instruments and Procedures*

The data were gathered through an online survey, which was shared via social media. Before students completed the survey, they were informed about the purpose of the study and that their participation was voluntary and anonymous, and they could withdraw from the study at any time. The students read and signed a consent form. The data collection process was finished in two weeks in May 2017.

*Flow.* Undergraduate students' perceived flow experience in the Calculus I course was measured by the 36-item Flow State-2 Scale (Jackson & Eklund, 2004). A validated Turkish version of the questionnaire (Asci, et al., 2007) was adapted to the Calculus I course. Students rated each item on a 5-point Likert scale (1-very wrong, 5-very true). The Flow State-2 Scale measures flow on nine dimensions: challenge-skill balance (4 items; e.g. "I was challenged, but I believed my skills would allow me to meet the challenge."; *α* = .71, when one item is excluded three-items *α* = .84), merging of action and awareness (4 items; e.g. "Things just seemed to be happening automatically"; *α* = .83), unambiguous feedback (4 items; e.g. "It was really clear to me how my performance was going."; *α* = .90), clear goals (4 items; e.g. "I knew clearly what I wanted to do"; *α* = .88), concentration on the task at hand (4 items; e.g. "My attention was focused entirely on what I was doing"; *α* = .90), sense of control (4 items; e.g. "I felt in total control of what I was doing in my Calculus course"; *α* = .90) loss of self-consciousness (4 items; e.g. "I was not concerned with what others may have been thinking of me."; *α* = .93), transformation of time (4 items; e.g. "the way time passed seemed to be different from normal"; *α* = .77, when one item is excluded three items *α* = .81), and autotelic experience (4 items; e.g. "I really enjoyed the experience"; *α* = .85). In the current study, a total of two items were excluded from challenge-skill balance and transformation of time subscales (1 item from each sub-scale) because removal of these items led to increases in the corresponding sub-scales. Moreover, due to high correlations of two dimensions (unambiguous feedback and sense of control) with other dimensions, leading to multicollinearity problems, these two dimensions were not included in the regression analyses. Therefore, out of 36 items, in total 10 flow items were excluded from this study. A CFA with the 26 items loading on 7 latent factors yielded the following fit: $S\text{-}B\chi2$(278, $N$= 117) = 360.525, $p < .01$, CFI = .962, SRMR = .054, RMSEA = .050 (90%-$CI$: .035 - .064).

*Procrastination.* Perceived academic procrastination in Calculus courses was measured by the 16-item Academic Procrastination Scale (Aitken, 1982). A validated Turkish version of the questionnaire (Balkıs, 2006) was adapted to Calculus course. Four items were excluded from the analysis (e.g. "I'm careful to return library books on time") because they did not ask about course-related activities, such as studying or doing homework. Students rated each item on a 5-point Likert scale (1-very wrong, 5-very true). All twelve items measured students' academic procrastination (12 items; e.g. "If I had an important project to do, I'd get started on it as quickly as possible"; $a$ =.92, after 2 items were excluded, $a$ =.93). The CFA conducted with the twelve items loading on one latent factor yielded the following fit indices: $S\text{-}B\chi2$(54, $N$= 117) = 119.264, $p < .01$, CFI = .928, SRMR = .054, RMSEA = 0.102 (90%-$CI$: .081 - .122). After considering modification indices, two items were excluded from the analysis because of low-fit indices. The second CFA was conducted using the remaining ten items and provided a good model fit: $S\text{-}B\chi2$(35, $N$= 117) = 58.646, $p <$ .01, CFI = .969, SRMR = .044, RMSEA = .076 (90%-$CI$: .045 - .104).

*Academic achievement.* Students' academic achievement in their Calculus courses was measured by their grades (0 to 100) at the end of their courses ($M_{grade}$ = 68.74, SD = 19.61).

### Data Analysis

In the current study, a multiple regression analysis was conducted in order to investigate academic procrastination in relation to dimension of flow experiences in the Calculus I course. Additionally, a two-step hierarchical regression analysis was carried out in order to examine students' achievement in the Calculus I course in relation to dimensions of flow and academic procrastination.

## Results

### Preliminary Analyses

Assumptions of regression analyses were checked in preliminary analyses, and means, standard deviations, and bivariate correlations among the variables were examined. Accordingly, multicollinearity, outliers, normality, linearity, homoscedasticity, and independence of residuals assumptions were checked prior to regression analyses. With regard to the multicollinearity assumption, all the bivariate correlation coefficients below 0.8 suggested that there was no violation of the multicollinearity assumption. In order to determine potential outliers, Mahalanobis distances were inspected. Absence of cases with Mahalanobis distances exceeding the critical value indicated that there were no potential outliers. Indeed, all Cook's distances were less than 1, so there were no cases which substantially influenced the regression equation. Then, linearity, homoscedasticity, and independence of residuals assumptions were checked by examining the standardized residuals to a standardized predicted plot, and it was found that all the assumptions were met (Pallant, 2005; Tabachnick & Fidell, 2001).

After checking the underlying assumptions, descriptive statistics and bivariate correlations were calculated (see Table 1). With regard to the dimensions of flow experience, the mean scores indicated that the highest mean score belonged to the 'loss of self-consciousness' sub-scale ($M$ = 3.49). On the other hand, the lowest mean score belonged to the 'concentration on the task at hand' sub-scale ($M$ = 2.6). Thus, it appeared that, compared to other flow dimensions, participants tend to have lower levels of flow experience regarding concentration on the tasks in Calculus courses, but higher levels of flow experience regarding loss of self-consciousness while involved in a task. In general, the mean scores around 3 suggested that participants had a moderate level of flow experience in almost all dimensions. With regard to procrastination, the mean score of 3.52 showed that participants' procrastination levels in Calculus course were not low. In addition, their mean achievement score appeared to be at a moderate level ($M$ = 68.74). Concerning the bivariate correlations, results indicated that age was positively related to achievement ($r$ = .21, $p < .05$), and procrastination was negatively related to achievement ($r$ = -.39, $p < .01$). In addition, procrastination was negatively and significantly correlated with all the dimensions of flow except loss of self-consciousness.

**Table 1**
*Means, Standard Deviations, and Bivariate Correlations of the Measured Variables*

| *Variables* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | 1 | | | | | | | | | |
| 2. Chall | .18 | 1 | | | | | | | | |
| 3. Act | .14 | .77** | 1 | | | | | | | |
| 4. Cgoal | .08 | .64** | .70** | 1 | | | | | | |
| 5. Focus | .14 | .71** | .77** | .76 | 1 | | | | | |
| 6. Loss | -.04 | .28** | .31** | .45** | .28** | 1 | | | | |
| 7. Time | .21* | .50** | .53** | .39** | .53** | .17 | 1 | | | |
| 8. Auto | .17 | .74** | .67** | .63** | .73** | .30** | .70** | 1 | | |
| 9. Procr | -.11 | -.51** | -.47** | -.53** | -.70** | -.18 | -.38** | -.58** | 1 | |
| 10. Ach | .21* | .51** | .47** | .41** | .50** | .08 | .22* | .42** | -.39** | 1 |
| M | 23.00 | 3.13 | 2.80 | 3.04 | 2.69 | 3.49 | 2.99 | 2.90 | 3.52 | 68.74 |
| SD | 3.36 | 1.05 | 0.93 | 1.04 | 1.09 | 1.20 | 1.10 | 1.13 | 1.00 | 19.61 |

Note. $*p < .05$, $**p < .01$; 2=Challenge-skill balance, 3=Merging of action and awareness, 4=Clear goals, 5=Concentration on the task at hand, 6=Loss of self-consciousness, 7=Transformation of time, 8=Autotelic experience, 9=Procrastination, 10=Achievement

*Inferential Statistics*

*Multiple regression analysis.* A multiple regression analysis was used to examine the students' academic procrastination in relation to their flow experiences in the Calculus I course. Procrastination was regressed on the dimensions of flow and the model was significant: ($F$ (7, 109) = 16.50, $p$ < .01, $R^2$= .51). As can be noticed in Table 2, concentration on the task at hand was found to be negatively associated with procrastination in the Calculus I course ($\beta$ = -.70, $p$ < .01). However, all the other dimensions were not significantly associated with student procrastination. It seems that when students have high concentration on the tasks, they have less tendency to procrastinate their studies in the Calculus course. In other words, when students cannot concentrate on the tasks, then they tend to procrastinate more.

**Table 2**
*Multiple Regression Analysis for Procrastination in Calculus Course*

| Predictors | Procrastination | | |
|---|---|---|---|
| | *B* | *SE* | *β* |
| 1. Chall | -.05 | .12 | -.05 |
| 2. Act | .26 | .14 | .24 |
| 3. Cgoal | -.03 | .11 | -.03 |
| 4. Focus | -.63 | .12 | -.70** |
| 5. Loss | .02 | .06 | .02 |
| 6. Time | .03 | .09 | .04 |
| 7. Auto | -.18 | .12 | -.21 |
| F change (7, 109) | | 16.50 | |

*Note.* *$p$ < .05, **$p$ < .01; 1=Challenge-skill balance, 2=Merging of action and awareness, 3=Clear goals, 4=Concentration on the task at hand, 5=Loss of self-consciousness, 6=Transformation of time, 7=Autotelic experience.

*Hierarchical regression analysis.* A hierarchical regression analysis was used to explore undergraduate students' academic achievement in the Calculus I course in relation to their procrastination and flow experiences. Achievement was regressed on age and procrastination in Step 1 and flow dimensions in Step 2. The models in Step 1 and 2 were significant: ($F$ (2, 114) = 12.84, $p$ < .01, $R^2$= .18) and ($F$ (7, 107) = 3.74, $p$ < .01, $R^2$ = .34) respectively. As can it be noticed in Table 3, age was found to be positively associated with students' achievement in the Calculus I course ($\beta$ = .17, $p$ < .05), while the relationship between procrastination and Calculus achievement was negative ($\beta$ = -.37, $p$ < .01). The results also showed in the second step of the analysis that, when flow dimensions are included in the model, procrastination does not significantly predict course achievement above and beyond all the other flow dimensions. However, the link between challenge-skill balance and Calculus achievement was found to be positive ($\beta$ = .30, $p$ < .05). This finding implies that when students feel that that their abilities are well matched to their opportunities for action, they have higher levels of achievement.

**Table 3**
*Hierarchical Two-Step Regression Analysis for Academic Achievement in Calculus Course*

| *Predictors* | Achievement | | | | | |
|---|---|---|---|---|---|---|
| | Step 1 | | | Step 2 | | |
| | *B* | *SE* | *β* | *B* | *SE* | *β* |
| 1. Age | 1.00 | .50 | .17* | .88 | .47 | .15 |
| 2. Procr | -7.34 | 1.67 | -.37** | -1.84 | 2.21 | -.09 |
| 3. Chall | | | | 5.58 | 2.64 | .30* |
| 4. Act | | | | 2.43 | 3.15 | .12 |
| 5. Cgoal | | | | .63 | 2.57 | .03 |
| 6. Focus | | | | 3.13 | 3.07 | .18 |
| 7. Loss | | | | -1.57 | 1.46 | -.10 |
| 8. Time | | | | -3.05 | 2.03 | -.17 |
| 9. Auto | | | | .58 | 2.70 | .03 |
| *F* change (7, 107) | 12.84 | | | 3.74 | | |

*Note.* **p* < .05, ***p* < .01; 2=Procrastination, 3=Challenge-skill balance, 4=Merging of action and awareness, 5=Clear goals, 6=Concentration on the task at hand, 7=Loss of self-consciousness, 8=Transformation of time, 9=Autotelic experience.

## Discussion and Conclusion

This study first explored undergraduate students' academic procrastination in relation to their flow experiences in a Calculus I course. Multiple regression analysis results showed that among flow experience dimensions, only students' concentration on the task at hand (focus) is negatively related to their procrastination. Therefore, as found in relevant literature (Lee, 2005), focus appears to be an important factor to consider to diminish students' procrastination behavior. In addition, hierarchical regression analysis showed that in Step 1, age and procrastination were significantly linked to achievement. While age was found to be positively related to achievement, procrastination was negatively related to achievement, consistent with related literature (Jarvis, 2000; Kim & Seo, 2015; Lunneborg & Lunneborg, 1966; Seo, 2011).

Hierarchical regression analysis also showed that in Step 2, when flow dimensions are included in the model, procrastination does not significantly predict course achievement above and beyond all the other flow dimensions. In Step 2, the balance between challenges and skills (i.e. individuals feel that their abilities are well matched to the opportunities for action) emerged as a powerful predictor of students' performance in Calculus. These findings suggest if they are provided with challenging activities that match well with their skills, their academic performance in Calculus appears to be better. On the other hand, results also showed that the relationships between remaining dimensions of flow and Calculus achievement were not significant. One of the reasons could be the small sample size, with students coming from various departments. Another reason could be that in Calculus courses, the most important factor seems to be the difficulties of the tasks. Therefore, students may not experience the other dimensions of flow (merging of action and awareness, having clear goals, concentrating on the task at hand, losing self-consciousness, feeling transformation of time, and feeling autotelic experience) if they don't have the balance between their skills and the challenge of the tasks. In other words, if they don't see that their skills and the task challenge are balanced (i.e. the tasks may be much more difficult than the students' skills, or the tasks may be much easier than the students' skills), students may not experience the other dimensions. Indeed, according to Csikszentmihalyi (1975, 2000), flow experience requires a balance between challenge and skills. Fong, Zaleski, and Leach (2015) also state that "Flow is an intrinsically motivating state of consciousness characterized by simultaneous perception of high challenge and skill" (p. 425). The challenge-skill balance as a primary antecedent of flow experience is not clear, and more research is necessary to clarify the effect of challenge-skills balance on flow in multiple fields (Fong et al., 2015). Thus, it is suggested that future research can examine in detail the relationships between students' flow experiences and the reasons of procrastination behaviors, integrating qualitative research designs. For example, in depth-interviews could be conducted with students.

Overall, the present study showed that students' concentration was negatively and significantly related to their procrastination behavior. This study has contributed to the relevant literature in demonstrating that among the dimensions of flow, concentration is a crucial element against procrastination in Calculus. When students don't concentrate on their Calculus studies, they may procrastinate their studying. In addition, this study was the first step in learning about what the most important dimension is—from the students' perspectives—to prevent procrastination behavior in students' Calculus studies. This study also showed that students' procrastination behavior is negatively and significantly related to students' performance in Calculus classes, leading to lower levels of achievement. This finding was in line with the relevant literature. Indeed, Kim and Seo (2015) found a similar result. In addition, in the current study, the balance between challenges and skills is found to be significantly related to the students' performance in Calculus classes, leading to higher levels of achievement; this provides a support for the available literature (Mendelson, 2007; Seo, 2011).

One of the strongest points of this study that sets it apart from previous research is that this study focused on a Calculus course and involved students from different departments, including engineering, business administration, economy, statistics, mathematics, and science and mathematics education. For these departments, a Calculus course is mandatory, and students must pass this course in order to continue their studies. Due to this importance of this course, it is worth taking a closer look and studying the relationship between flow, procrastination, and achievement in Calculus, in order to be able to make specific suggestions to improve students' achievement behaviors.

Accordingly, based on the current findings and the available literature, it is suggested that students are provided with tasks in Calculus courses that are conducive to their flow experience. In order to help students experience flow, the tasks should be interesting, challenging, and matched to students' abilities. In addition, the classroom environment should be free from stress, anxiety, and other negative emotions (Csikszentmihalyi, 2000; Schmidt, 2010). Considerable research also demonstrated that intrinsic motivation is related to flow experience (Choe, Kang, Soe, & Yang, 2015; Pintrich & Schunk, 2002). Therefore, in order to enhance students' flow experience—particularly fostering a balance between challenge and skills—instructors offering Calculus courses can create learning environments that are conducive to students' intrinsic motivation, satisfying their basic psychological needs of autonomy, competence, and relatedness (Deci & Ryan, 2000; 2002).

Accordingly, instructors can design a variety of interesting and challenging tasks and activities, among which students can choose. This can help students feel autonomous in their learning and experience more enjoyment. In addition, students can be expected to work in groups while dealing with activities, satisfying their need for relatedness. Moreover, especially to foster balance between challenge and skills, instructors should challenge students according to their abilities, by preparing some step-by-step tasks for students to achieve from easier to harder. Then, instructors should provide immediate feedback on students' performance and prepare the tasks in line with their capabilities, contributing to the satisfaction of their competence needs. For example, while instructing about differentiation, an instructor in mechanical engineering can provide students with velocity and acceleration. By requiring these students to calculate vehicles' velocity, it could further improve students' understanding of Calculus in daily life applications. Therefore, their skills and challenge can be balanced, and they can be interested in what they are doing and thus can be more creative.

In this aspect, STEM-related activities in Calculus courses also brings about a balance between challenge and skills. Hartzler (2000) found that integrated curricula were successful in teaching mathematics and science across all grade levels. Especially if engineering students learn Calculus and its applications in their own field, then they can be more successful and creative in their fields in their future career. Additionally, web-based or computer-based instruction can be implemented in Calculus courses. Indeed, Heo and Rha (2003) demonstrated that the different facets of web-based instruction including interactivity, navigation, and content are associated with flow. Lee, Han, Kim, and Lee (2007) also reported that students in learning environments with e-learning systems are more likely to experience flow.

### *Limitations and Recommendations*

There are some limitations of this study. Firstly, this is a cross-sectional study; thus, results do not imply any causation. In future research, longitudinal studies (since age is also an important factor for Calculus achievement) can be conducted to reveal cause-and-effect relations, and to investigate how these relationships change over time.

Secondly, data were collected through an online survey and the participants were from different departments, including engineering, management, mathematics, and education. Therefore, studies focusing on certain domains, such as engineering, can provide stronger and more explicit implications. If students from different departments and universities are included in future studies, hierarchical linear modelling (HLM)—a type of regression analysis appropriate for multilevel data—

should be used to analyze the data (Raudenbush & Bryk, 2002). Such multilevel analysis methods also allow for examining cross-level interactions among the variables (Roudenbush & Bryk, 2002).

Thirdly, the sample size in the current study was not large. In fact, the number of students from different departments was not sufficient to conduct HLM. In future studies, researchers can work with larger samples, using HLM and also demonstrating the generalizability of the findings.

Fourthly, in the present study, not all students were administered the online survey right after completing the Calculus course. As a result, some students may have experienced difficulty while responding to the survey items in reflecting their actual experiences in Calculus course, depending on the time span between data collection and course completion. Thus, in future studies, researchers are advised to administer surveys to students immediately after they complete the Calculus course.

In addition, future research can focus more on the reasons for procrastination in studying Calculus, and how students can experience flow, especially the balance between challenge and skills, in Calculus and mathematics in general. There is a need for interviewing students and finding out in which situations students have flow (or not) in their Calculus studies.

Finally, high correlations of two dimensions of flow experience (unambiguous feedback and sense of control) with other dimensions, lead to multicollinearity problems. Hence, these two dimensions were not included in the regression analyses. Therefore, flow could not be examined with all its dimensions, and future research could address this gap.

## References

Aitken, M. E. (1982). *A personality profile of the college student procrastinator*. Dissertation Abstracts 43A, 722-723.

Akinsola, M. A. & Tella, A. (2007). Correlates of academic procrastination and mathematics achievement of university undergraduate students. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(4), 363-370.

Asci F.H., Caglar E., Eklund R., Altintas A. & Jackson S. (2007) Optimal performans duygu durum-2 olcekleri'nin uyarlama calismasi. [The adaptation study of dispositional flow scale-2 and flow state scale -2] *Hacettepe Journal of Sport Sciences, 18*, 182-196.

Asikhia, O. A. (2010). Academic procrastination in mathematics: Causes, dangers and implications of counselling for effective learning. *International Education Studies, 3*(3), 205-210.

Baker, F. A., & MacDonald, R. A. (2013). Flow, identity, achievement, satisfaction and ownership during therapeutic songwriting experiences with university students and retirees. *Musicae Scientiae, 17*, 131-146.

Balkıs, M. (2006). *Ogretmen adaylarının davranislarindaki erteleme egiliminin, dusunme ve karar verme tarzları ile iliskilerinin incelenmesi, [The relationships between student teachers' procrastination behaviors, and decision-making styles]* Yayınlanmamis Doktora Tezi. Dokuz Eylul Universitesi Egitim Bilimleri Enstitusu, İzmir.

Bassi, M., Steca, P., Monzani, D., Greco, A., & Delle Fave, A. (2014). Personality and optimal experience in adolescence: Implications for well-being and development. *Journal of Happiness Studies, 15*(4), 829-843.

Beck, B. L., Koons, S. R., & Milgrim, D. L. (2000). Correlates and consequences of behavioral procrastination: The effects of academic procrastination, self-consciousness, self-esteem and self-handicapping. *Journal of Social Behavior and Personality, 15*(5), 3-13.

Beswick, G., Rothblum, E. D., & Mann, L. (1988). Psychological antecedents to student procrastination. *Australian Psychologist, 23*(2), 207-217.

Brinthaupt, T. M., & Shin, C. M. (2001). The relationship of academic cramming to flow experience. *College Student Journal, 35*(3), 457-472.

Bruinsma, M., & Jansen, E. P. (2009). When will I succeed in my first-year diploma? Survival analysis in Dutch higher education. *Higher Education Research & Development, 28*(1), 99-114.

Carli, M., Delle Fave, A., & Massimini, F. (1988). The quality of experience in the flow channels: Comparison of Italian and U.S. students. In M. Csikszentmihalyi & I. Csikszentmihalyi (Eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp.288-306). Cambridge, Cambridge University Press.

Choe, K., Kang, Y., Seo, B. S., & Yang, B. (2015). Experiences of learning flow among Korean adolescents. *Learning and Individual Differences, 39*, 180–185.

Chu, A. H. C., & Choi, J. N. (2005). Rethinking procrastination: Positive effects of "active" procrastination behavior on attitudes and performance. *The Journal of Social Psychology, 145*(3), 245-264.

Collins, A. L., Sarkisian, N., & Winner, E. (2009). Flow and happiness in later life: An investigation into the role of daily and weekly flow experiences. *Journal of Happiness Studies, 10*(6), 703-719.

Corkin, D. M., Shirley, L. Y., Wolters, C. A., & Wiesner, M. (2014). The role of the college classroom climate on academic procrastination. *Learning and Individual Differences, 32*, 294-303.

Csikszentmihalyi, M. (1975). Play and intrinsic rewards. *Journal of Humanistic Psychology, 15*(3), 41-63.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York, NY: Harper & Row.

Csikszentmihalyi, M. (1996). *Flow and the psychology of discovery and invention.* New York: Harper Collins.

Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York: Basic Books.

Csikszentmihalyi, M. (2000). *Beyond boredom and anxiety*. San Francisco: Jossey Bass.

Deci, E. L., & Ryan, R. M. (2000). The "what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.

Deci, E. L., & Ryan, R. M. (2002). The paradox of achievement: The harder you push, the worse it gets. In J. Aronson (Eds.), *Improving academic achievement: Impact of psychological factors on education* (pp. 61-87). San Diego: Academic Press.

Duru, E., & Balkis, M. (2014). The role of academic procrastination tendency on the relationships among self-doubt, self-esteem and academic achievement. *Education and Science, 39*(173), 274–287.

Ferrari, J. R., & Emmons, R. A. (1995). Methods of procrastination and their relation to self-control and self-reinforcement: An exploratory study. *Journal of Social Behavior and Personality, 10*(1), 135-142.

Fong, C. J., Zaleski, D. J., & Leach, J. K. (2015). The challenge–skill balance and antecedents of flow: A meta-analytic investigation. *The Journal of Positive Psychology, 10*(5), 425-446.

Hartzler, D. S. (2000). *A meta-analysis of studies conducted on integrated curriculum programs and their effects on student achievement* (Doctoral dissertation, [Sl: sn]).

Heine, C. (1996). *Flow and achievement in mathematics.* Unpublished doctoral dissertation, University of Chicago.

Hensley, L. C. (2014). Reconsidering active procrastination: Relations to motivation and achievement in college anatomy. *Learning and Individual Differences, 36*, 157-164.

Heo, G., & Rha, I. J. (2003). Optimal flow experience in Web based instruction. *Korea Association of Computer Education Papers, 6*(2), 71-79.

Hopper C. H. (2005). Mathematics anxiety. *The study skills workshop* (pp. 117).

Jackson, S. A., & Eklund, R. C. (2004). *The flow scales manual*. Morgantown, WV, USA: Fitness Information Technology, Inc.

Jackson, S. A., Thomas, P. R., Marsh, H. W., & Smethurst, C. J. (2001). Relationships between flow, self-concept, psychological skills, and performance. *Journal of Applied Sport Psychology, 13*(2), 129–153.

Jarvis, T. J. (2000). Class size and teacher effects on student achievement and dropout rates in university-level calculus. Preprint. Retrieved from http://www.math.byu.edu/~jarvis/classsize/class-size.html

Joo, Y. J., Joung, S., & Sim, W. J. (2011). Structural relationships among internal locus of control, institutional support, flow, and learner persistence in cyber universities. *Computers in Human Behavior, 27*(2), 714-722.

Joo, Y. J., Oh, E., & Kim, S. M. (2015). Motivation, instructional design, flow, and academic achievement at a Korean online university: A structural equation modeling study. *Journal of Computing in Higher Education, 27*(1), 28-46.

Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences, 82*, 26-33.

Klingsieck, K. B., Grund, A., Schmid, S., & Fries, S. (2013). Why students procrastinate: A qualitative approach. *Journal of College Student Development, 54*(4), 397-412.

Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality, 20*(4), 474-495.

Lee, E. (2005). The relationship of motivation and flow experience to academic procrastination in university students. *The Journal of Genetic Psychology, 166*(1), 5-15.

Lee, E., Han, K., Kim, S., & Lee, Y. (2007). A study on teaching–learning strategies for flow experience in e-learning environment. *Journal of Korea Association of Computer Education, 10*, 21–30.

Lunneborg, P. W., & Lunneborg, C. E. (1966). The differential prediction of college grades from biographic information. *Educational and Psychological Measurement, 26*(4), 917-925.

Mendelson, N. (2007). *The functional mediation of flow between achievement anxiety, academic procrastination, and academic performance.* Ph.D. dissertation, Fordham University, United States -- New York. Dissertations & Theses: Full Text database. (Publication No. AAT 3255013).

Messmer, M. (2001). Becoming a peak performer. *Strategic Finance, 82*, 8-10.

Nakamura, J. (1988). Optimal experiences and the uses of talent. In M. Csikszentmihalyi & I. Csikszentmihalyi (Eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 319-326). Cambridge, Cambridge University Press.

Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In Snyder & Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). New York: Oxford University Press.

Noran, F. Y. (2000). Procrastination among students in institutes of higher learning: challenges for K-Economy. [Online] Available:

http://www.mahdzan.com/paper/procrastinate/Accessed on 10th Oct. 2017.

Onwuegbuzie, A. J. (2000). Academic procrastinators and perfectionistic tendencies among graduate students. *Journal of Social Behavior and Personality, 15*(5; SPI), 103-110.

Ozer, A. (2012). Procrastination: Rethinking trait models. *Education & Science/Egitim ve Bilim*, 37(166), 303-317.

Pallant, J. (2005). *SPSS survival manual: A step by step guide to data analysis using SPSS for Windows (Version 12)*. Sydney: Allen & Unwin.

Pintrich, P. R., & Schunk, D. H. (2002). *Motivation in education: Theory, Research, and Applications,* Second Edition, Merrill Prentice Hall, Columbus, Ohio.

Popoola, B. I. (2005). A study of the relationship between procrastinatory behaviour and academic performance of undergraduate students in a Nigerian University. In *the African Symposium: An Online Journal of African Educational Research* (p. 60).

Puca, R. M., & Schmalt, H. D. (1999). Task enjoyment: A mediator between achievement motives and performance. *Motivation and Emotion, 23*, 15-29.

Radu, O. and Seifert, T. (2011). Mathematical Intimacy within Blended and Face-to-face Learning Environments. *In European Journal of Open, Distance and E-Learning, Special issue: Best of EDEN 2010*. Retrieved on September 26, 2017, from http://www.eurodl.org/?p=special&sp=articles&inum=3&article=444

Rakes, G. C., & Dunn, K. E. (2010). The impact of online graduate students' motivation and self-regulation on academic procrastination. *Journal of Interactive Online Learning, 9*(1), 78-93.

Rothblum E.D. (1990) Fear of Failure. In: Leitenberg H. (eds) *Handbook of social and evaluation anxiety*. Springer, Boston, MA.

Schmidt, J. (2010). Flow in education. In E. Baker, P.P. Petereson, & B. Mcgraw (Eds.), *International encyclopedia of education* (3rd ed., pp. 605–611). London: Elsevier.

Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: A grounded theory of academic procrastination. *Journal of Educational Psychology, 99*(1), 12-25.

Schüler, J. (2007). Arousal of flow experience in a learning setting and its effects on exam performance and affect. *Zeitschrift für Pädagogische Psychologie, 21*(3/4), 217-227.

Seifert, T., Radu, O. & Doyle, A. (2009). *Flow: An emotional experience in mathematics problem solving*. Paper presented at the Third International Symposium of Mathematics and its Connections to the Arts and Sciences, Moncton, Canada.

Seo, E. H. (2011). The relationships among procrastination, flow, and academic achievement. *Social Behavior and Personality: An International Journal, 39*(2), 209-217.

Shernoff, D. J., Csikszentmihalyi, M., Shneider, B., & Shernoff, E. S. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly, 18*(2), 158-176.

Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of Counseling Psychology, 31*(4), 503-509.

Sutton, S. (1997). Finding the glory in the struggle: Helping our students thrive when math gets tough. *Math Instruction Bulletin, 81*(586), 43-52.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics* (4th edn). NewYork: HarperCollins.

Tall, D. (1993). Students' Difficulties in Calculus. *Proceedings of Working Group 3 on Students' Difficulties in Calculus,* ICME-7, Québec, Canada: 13–28.

Tice, D.M, & Baumeister, R.F. (1997). Longitudinal study of procrastination, performance, stress and health: The costs and benefits of dawdling. *Psychological Science 8*(6), 454-458.

## Öğrencilerin Analiz Dersindeki Akış Deneyimi, Akademik Erteleme Davranışı ve Akademik Başarısı Arasındaki İlişkilerin İncelenmesi

**Atıf:**

Alp, A., & Sungur, S. (2017). Investigating relationships between undergraduate students' flow experience, academic procrastination behavior, and calculus course achievement. *Eurasian Journal of Educational Research,* 72, 1-22, DOI: 10.14689/ejer.2017.72.1

### Özet

*Problem Durumu:* Üniversitelerde çeşitli bölümlerde (işletme ve iktisat bölümleri, mühendislik bölümleri, temel bilimler -matematik, istatistik, fizik, kimya, biyoloji- ve ilgili eğitim bilimleri) Analiz dersleri zorunlu ders olarak akademik programlarda yer almaktadır. Analiz dersleri genelde birinci sınıf öğrencilerine verilmektedir ve en yüksek kredili derslerden biridir. Ayrıca çoğu bölümde ön koşullu ders olarak okutulmaktadır. Bu dersi alan öğrenciler, limit, türev ve integral gibi temel konularda bilgi sahibi olmakta ve bu derste başarılı olanlar kendi alanlarında bu teorik bilgileri uygulama yeteneklerini geliştirmektedirler. Fakat, Analiz derslerinde lisans öğrencilerinin başarı düzeyi beklenenin altında kalmaktadır. İlgili alanyazına göre öğrencilerin akademik erteleme davranışının da başarıyı negatif yönde etkilediği bilinmektedir. Fakat, alanyazında, üniversite öğrencileri bağlamında, öğrencilerin motivasyonları çeşitli teorileri baz alarak ölçülmeye çalışılmış olsa da Analiz dersleri başarısına yönelik ve öncelikle "Akış" deneyimine odaklanan geniş çapta araştırmalar yapılmamıştır. Ayrıca, öğrencilerin akademik başarısının, akış deneyimi ve akademik erteleme davranışı arasındaki ilişki Analiz dersleri kapsamında çalışılmamıştır.

*Araştırmanın Amacı:* Bu araştırmanın 2 temel amacı bulunmaktadır. İlk olarak, lisans öğrencilerinin Analiz I derslerindeki akademik erteleme davranışlarının, akış deneyimin alt boyutlarıyla (görev zorluğu-beceri dengesi, eylem-farkındalık

birleşimi, belirlenmiş hedefler, göreve odaklanma, kendilik farkındalığının azalması, zamanın dönüşümü, amaca ulaşma deneyimi) ilişkilendirilerek incelenmesi amaçlanmıştır. İkinci olarak, lisans öğrencilerinin Analiz I dersindeki akademik başarısının, akademik erteleme davranışı ve akış deneyiminin alt boyutlarıyla ilişkilendirilerek incelenmesi hedeflenmiştir. Bu amaçlar doğrultusunda, bu çalışmada aşağıdaki sorulara cevap aranacaktır:

1. Analiz I dersi öğrencileri için akış deneyiminin alt boyutları akademik erteleme davranışını ne derece yordamaktadır?
2. Akış deneyimi ve akademik erteleme davranışı ne derecede Analiz I dersi başarısını yordamaktadır?

*Araştırmanın Yöntemi:* Toplamda 117 lisans öğrencisi çeşitli bölümlerden çevrimiçi ankete katılmıştır. Öğrencilerin yaş ortalaması 23'tür (%54 kız ve %46 erkek). Öğrenciler her Likert tipi maddeyi 1'den 5'e kadar derecelendirmişlerdir (1-çok yanlış, 5-çok doğru). Lisans öğrencilerinin Analiz dersindeki akış deneyimi, 36 maddeden oluşan ve 9 alt boyutu olan Akış Durum-2 Ölçeği ile ölçülmüştür. Ölçeğin geçerli Türkçe çevirisi Analiz dersine adapte edilerek kullanılmıştır. Gerekli görülen maddeler çıkarıldıktan sonra, 26 maddeden oluşan ve 7 örtük faktöre yüklenen modelin doğrulayıcı faktör analizi sonuçları şu şekildedir: S-B$\chi$2(278, *N*= 117) = 360.525, $p < .01$, CFI = .962, SRMR = .054, RMSEA = .050 (90%-*CI*: .035 - .064). Lisans öğrencilerinin Analiz dersindeki akademik erteleme davranışı 12 maddeden oluşan Akademik Erteleme Ölçeği ile ölçülmüştür. Ölçeğin geçerli Türkçe çevirisi Analiz dersine adapte edilerek kullanılmıştır. Gerekli görülen 2 madde çıkarıldıktan sonra, 10 maddeden oluşan modelin doğrulayıcı faktör analizi sonuçları şu şekildedir: S-B$\chi$2(35, *N*= 117) = 58.646, $p < .01$, CFI = .969, SRMR = .044, RMSEA = .076 (90%-*CI:* .045 - .104).

*Araştırmanın Bulguları:* İkili korelasyon sonuçları, yaşın başarıyla pozitif ilişkili olduğunu ($r = .21$, $p < .05$), ve akademik erteleme davranışının başarıyla negatif ilişkili olduğunu ($r = -.39$, $p < .01$) göstermiştir. Ayrıca, akademik erteleme davranışı kendilik farkındalığının azalması alt boyutu hariç akış deneyiminin bütün alt boyutlarıyla negatif ilişkili olduğunu göstermiştir. Çoklu regresyon analizinde, akademik erteleme davranışı bağımlı, akış deneyimin alt boyutları bağımsız değişken alınarak regresyon modeli oluşturulmuştur ve model anlamlı bulunmuştur: (F (7, 109) = 16.50, $p < .01$, $R^2$= .51). Çoklu regresyon analizi, akış kavramının alt boyutlarından olan, odaklanma'nın, akademik erteleme davranışını negatif yordadığını göstermiştir ($\beta = -.70$, $p < .01$). Ayrıca, iki aşamalı hiyerarşik regresyon analizi, ilk aşamada (F (2, 114) = 12.84, $p < .01$, $R^2$= .18) akademik erteleme davranışının Analiz dersindeki akademik başarıyı negatif şekilde yordadığını ($\beta = -.37$, $p < .01$), ikinci aşamada (F (7, 107) = 3.74, $p < .01$, $R^2 = .34$) ise akademik erteleme davranışının akademik başarıyı yordamadığını ve sadece akış deneyiminin alt boyutlarından olan görev zorluğu-beceri dengesi'nin Analiz dersindeki akademik başarıyı pozitif şekilde yordadığını ($\beta = .30$, $p < .05$) göstermiştir.

*Araştırmanın Sonuçları ve Önerileri:* Bu çalışmada ilk olarak lisans öğrencilerinin Analiz dersindeki akademik erteleme davranışı ve akış deneyiminin alt boyutları arasındaki ilişki incelenmiştir. İkinci olarak bu iki kavramın Analiz dersindeki akademik başarı arasındaki ilişki incelenmiştir. Bulgulara göre, akış deneyimin bir alt boyutu olan "göreve odaklanma" akademik erteleme davranışını negatif şekilde yordamaktadır. Bir diğer bulguya göre akademik erteleme davranışı akademik başarıyı negatif şekilde yordarken, "görev zorluğu-beceri dengesi" Analiz dersindeki akademik başarıyı pozitif olarak yordamaktadır. Dolayısıyla, Analiz derslerinde bu iki kavrama önem verilmelidir: "göreve odaklanma" ve "görev zorluğu-beceri dengesi". Eğer öğrencilerin odaklanmasını sağlayan görevler verilirse, erteleme davranışının azalması tahmin edilebilir. Ayrıca eğer öğrencilere onların yeteneklerine ve düzeylerine uygun aktiviteler kolaydan zora doğru hazırlanırsa başarılarının artması tahmin edilebilir. Ayrıca öğrencilerin bu görevleri seçmede onlara sorumluluk ve seçme hakkı verilmesi, kendi yeteneklerinin de farkında olmasını sağlayabilir. Bu bağlamda, ders kapsamında gerçek hayata uygun ve her öğrencinin yeteneğine göre ödevler verilebilir. Bunun bir örneği, son yıllarda uygulamaya başlanan FeTeMM (Fen, Teknoloji, Mühendislik ve Matematik) eğitimidir. Disiplinler arası çalışmalar ve projeler, Analiz derslerinde hem öğrencilerin ilgilerini artırarak odaklanmasını kolaylaştırabilir, hem de öğrencilerin yeteneklerine uygun olması sağlanarak, onların başarılarını artırmada yardımcı olabilir. Bu çalışmanın yanında sonraki çalışmalar, hem daha çok katılımcı sayısıyla yapısal eşitlik modeli kullanarak, bu değişkenler arasındaki ilişkileri doğrudan ve dolaylı etkileri bakımından inceleyebilirler. Ayrıca öğrencilerle yapılacak olan birebir görüşmeler, öğrencilerin Analiz dersindeki akış deneyimi, erteleme davranışları ve akademik başarısı arasındaki ilişkiyi anlamada önemli bir rol oynayacaktır.

*Anahtar Sözcükler:* Akış, erteleme davranışı, başarı, Analiz dersi.