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The Investigation of the Secondary School Students' Acceptance Levels of Flipped Mathematics Classroom

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Abstract: *In this study, it is aimed to determine the secondary school students' acceptance levels of flipped mathematics classrooms and to examine their acceptance levels in terms of gender, grade level, internet access, and perception of ability in learning mathematics alone at home. Another aim of the present study is to determine whether students' autonomous learning levels predict their acceptance levels of flipped mathematics classrooms. The research was carried out using descriptive and correlational survey models. The study group for the research consisted of 345 secondary school students. The Personal Information Form, Flipped Mathematics Classroom Acceptance Scale, and Autonomous Learning Scale were used as data collection tools. As a result of the research, it was determined that the students' acceptance of flipped mathematics classrooms was at a good level. While the acceptance levels of the students did not differ according to the variables of gender and grade level, statistically significant differences were determined in terms of the variables of internet access and the perception of ability in learning mathematics alone at home. In addition, it was determined in the present study that students' autonomous learning levels were statistically significant predictors of their acceptance levels of flipped mathematics classrooms.*

Keywords: *Flipped classroom, Mathematics, Acceptance level, Autonomous learning.*

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INTRODUCTION

Technological changes and developments have greatly affected the function and structure of educational institutions. As a result of the reflections of technological developments on education, different learning and teaching methods have begun to be investigated (Talan & Gülseçen, 2018). In addition, the COVID-19 pandemic, which emerged in 2019, has left deep effects on psychological, social life, economic, health, and, most importantly, on education all over the world (Can, 2020). With these effects, there has been a paradigm shift in learning worldwide, and most institutions in the world have switched from face-to-face education in the traditional classroom to digital learning via distance education (Mulenga & Marbán, 2020). One of the models that attracted attention with the COVID-19 pandemic was the blended learning model (Shrivastava & Shrivastava, 2022). Numerous studies have been conducted using the blended learning model (e.g., Ma & Lee, 2021; Sankar et al., 2022; Srivatanakul, 2023; Zagouras et al., 2022). The blended learning model is explained as combining online and face-to-face learning experiences (Garrison & Kanuka, 2004). It offers innovative educational solutions by effectively integrating traditional classroom teaching with mobile learning and online activities (Rao, 2019). One of the blended learning models is the flipped classroom model (Hayırsever & Orhan, 2018; Staker & Horn, 2012).

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The flipped classroom model is a "blended" teaching approach that requires students to complete individual learning tasks before class in preparation for the learning activities they will carry out with their peers in the relevant course (Jong, 2023). A flipped classroom is explained as in-class activities being carried out outside the classroom and out-of-class activities being carried out in the classroom (Karadeniz, 2015). The flipped classroom model provides the opportunity for more practices and activities in the classroom by enabling students to comprehend the content of the course through outside-of-class studies (Yıldız-Durak, 2017). Akgün and Atıcı (2017) concluded in their study that the success of students in a flipped classroom increased; they participated more actively in the lesson; they remembered what they learned better; and they were more motivated towards the lesson.

The flipped classroom model has attracted the attention of many researchers, and many studies have been conducted on the model in different disciplines such as foreign languages (Andujar et al., 2020), geography (Graham et al., 2017), history (Oura et al., 2018), chemistry (Candas et al., 2022), and physics (Hinojo-Lucena et al., 2020). One of the disciplines in which the flipped classroom model has been frequently studied is mathematics (e.g., Ağırman, 2023; Bhagat et al., 2016; Bolatlı & Korucu, 2020; Katsa et al., 2016; Wei et al., 2020; Zengin, 2017). When the studies are examined, there are national and international studies determining that the use of the flipped classroom model in mathematics education improves the academic success of students (e.g., Ağırman, 2023; Akdeniz, 2019; Bhagat et al., 2016; Bolatlı & Korucu, 2020; Katsa et al., 2016; Tekin, 2018; Wei et al., 2020; Zengin, 2017), motivation (Bhagat et al., 2016; Bolatlı & Korucu, 2020; Katsa et al., 2016), attitude towards mathematics (Tekin, 2018), self-efficacy (Algarni & Forgues, 2022), class participation (Clark, 2015; Çevikbaş, 2018; Zeineddine, 2018). Despite the positive results obtained in the national and international literature, it is possible to say that the use of the flipped class model is not widespread in our country (Hayırsever & Orhan, 2018). As a matter of fact, it is stated that many learning methods, such as computer-assisted learning, web-based learning, and distance education, are used in the Turkish education system due to technological developments, but these methods are not accepted enough due to reasons such as lack of face-to-face interaction and classroom environment and separation from the social environment (Gençer, 2015). Similarly, it is stated that students have difficulty accepting the learning culture in a learning process that takes place in the form of lessons at home and homework at school (Demiralay, 2014). In line with the explanations made, it is considered important that the flipped classroom model be accepted by students in order to obtain the positive outcomes mentioned in mathematics lessons and to apply the model effectively. At this point, it is thought that it is necessary to determine the current acceptance status of students and investigate the affecting factors in order to improve their acceptance status.

There are studies on the acceptance of flipped classroom in the literature. Demiralay (2014) examined the process of adoption of the lesson at home, and homework at school model by school administrators, teachers, students, and parents within the framework of Diffusion of Innovations Theory. Agyei and Razi (2022) investigated high school students' acceptance of flipped classroom in English lessons within the framework of the Unified Theory of Acceptance and Use of Technology (UTAUT) model. There are also studies investigating the factors affecting university students' adoption of flipped learning (e.g., Alyoussef, 2022; Cai et al., 2019). Additionally, there are studies investigating the acceptance of flipped classroom by instructors of English language (Abd Rahman et al., 2021), science and technology (Plageras et al., 2023), computer science (Bakheet & Gravell, 2020), higher education (Long et al., 2019) within the framework of the UTAUT model. When the studies on flipped classroom in Turkey were examined, it was determined that the research was mostly conducted at the undergraduate level and in the foreign language education, and its effect on student success was investigated (Ekmekçi, 2019; Özbay & Sarıca, 2019). The results of review studies on flipped classrooms (Ekmekçi, 2019; Özbay & Sarıca, 2019) indicated that studies conducted both in mathematics education and at the secondary school level were limited. Also, no studies on the acceptance of flipped mathematics classrooms have been found. For this reason, it was deemed important to investigate the secondary school students' acceptance levels of a flipped mathematics classroom.

In this study, in addition to determining students' acceptance levels of flipped classroom, it was deemed important to investigate the factors affecting their acceptance levels. In the studies on flipped classroom, gender (Adams et al., 2018; Hao, 2016a), grade level (Adams et al., 2018; Kazu & Kurtoğlu, 2020), and internet access (Yildiz-Durak, 2018; Wut et al., 2022) variables were examined. In addition, in the flipped learning model, learners have various responsibilities that require learner autonomy, such as accessing information from different sources, taking responsibility for learning, and acquiring the habit of independent learning (Kozikoğlu et al., 2021). For this reason, it is thought that students' perception of ability in learning mathematics alone at home and their autonomous learning levels may be related to their acceptance levels of flipped mathematics classroom. In this study, students' acceptance of flipped mathematics classroom was investigated in terms of gender, grade level, internet access, perception of ability in learning mathematics alone at home and autonomous learning. Since there is no other research in the literature examining secondary school students' acceptance levels of flipped mathematics classroom in terms of the variables discussed within the scope of this study, it is thought that this research will contribute to the literature.

METHOD

Research model

This research was conducted using descriptive and correlational survey models. In the study, a descriptive survey model was used to determine the secondary school students' acceptance levels of flipped mathematics classrooms. The comparative causal approach models were used to examine students' acceptance levels of flipped mathematics classrooms in terms of gender, grade level, internet access, and perception of ability in learning mathematics alone at home. Whether students' autonomous learning levels predict their acceptance of flipped mathematics classrooms was investigated with a correlational approach.

Study group

The study group for the research consisted of 345 students (48.1% of whom were female) studying in two secondary schools in Malatya in the fall semester of the 2022-2023 academic year. 31% of the students participating in the research were in the 5th grade, 24.1% in the 6th grade, 25.8% in the 7th grade, and 19.1% in the 8th grade. In the beginning of the application, the aim and scope of the research were explained to the students, and the data collection tool was applied to students who volunteered to participate in the research.

Data collection tools

In this research, the Personal Information Form, the Flipped Mathematics Classroom Acceptance Scale, and the Autonomous Learning Scale were used as data collection tools.

Personal information form: With the Personal Information Form, students' gender (female, male), grade level (5th, 6th, 7th, and 8th grades), internet access (no access, insufficient, partially sufficient, sufficient), and perception of ability in learning mathematics alone at home (insufficient, partially sufficient, sufficient) were obtained.

Flipped Mathematics Classroom Acceptance Scale: The Flipped Mathematics Classroom Acceptance Scale was developed by the Açıkgül and Fırat (2023) to measure secondary school students' acceptance levels of flipped mathematics classrooms. During the scale development process, the pilot study was carried out with the participation of secondary school students (5th-8th grades) studying in the city of Adıyaman. The scale includes the Performance Expectancy (PE), Effort Expectancy (EE), Facilitating Conditions (FC), Hedonic Motivation (HM), and Behavioral Intention (BI) factors, which are included in the UTAUT proposed by Venkatesh et al. (2003), and the Technology Self-Efficacy (TSE) factor. The scale is a 5-point Likert type, and the answer options are: strongly disagree, slightly agree, moderately agree, mostly agree, and completely agree. As a result of Exploratory Factor Analysis (EFA) conducted within the scope of construct validity studies, a 6-factor structure consisting of 38 items and explaining 77.826% of the variance was obtained, which included 6 items in the PE factor, 3 items in the EE factor, 6 items in the FC factor, 6 items in the HM factor, 6 items in the BI factor, and 11 items in the TSE factor. Confirmatory Factor Analysis (CFA) results showed that the 6-factor structure was confirmed in a different study group. Cronbach's alpha and Composite Reliability Coefficients showed that the scores obtained from the scale were reliable (Açıkgül & Fırat, 2023).

In the present study, the construct validity of the scale for the scores obtained from 345 students was investigated with second-order CFA. CFA results (χ^2/df=1234.63/657=1.879, RMSEA=0.051, IFI=0.98, RFI=0.95, CFI=0.98, GFI=0.84, AGFI= 0.82, RFI= 0.95, NFI=0.96, NNFI=0.98, and SRMR=0.080) showed that the scale had construct validity and total points could be obtained from the scale. Additionally, the Cronbach alpha internal consistency coefficient for the participants of this study was calculated as 0.948. It can be said that the data obtained from the measurement tool has a good level of reliability for the participants of this study (Kline, 2011).

Autonomous Learning Scale: The Autonomous Learning Scale was developed by Macaskill and Taylor (2010) to evaluate students' autonomous learning levels. The scale adapted to Turkish culture by Arslan and Yurdakul (2015). The scale has a 5-point Likert-type response option and consists of 12 items. As a result of the EFA conducted by Macaskill and Taylor (2010) with the participation of 214 first-year psychology students, a 2-factor structure was obtained, explaining 25.55% and 24.04% of the variance, respectively. In the original version of the scale, Cronbach's alpha values were calculated as 0.73 for the first factor, 0.76 for the second factor, and 0.78 for the overall scale (Macaskill & Taylor, 2010). 752 secondary school students between the ages of 11 and 16, enrolled in three public schools in different regions of the city of Sakarya, Turkey, participated in the adaptation study of the scale carried out by Arslan and Yurdakul (2015). CFA results performed with the data obtained (χ^2=207.03, df= 53, RMSEA=0.062, IFI=0.96, CFI=0.96, GFI=0.96, AGFI= 0.94, RFI=0, 93, NFI=0.94, NNFI=0.95, and SRMR=0.044) showed that the two-factor structure consisting of 12 items in the original scale was confirmed. In addition, item-total correlation coefficients ranging between 0.29 and 0.59 and Cronbach's alpha internal consistency coefficient of α=0.80 provided evidence of the validity and reliability of the scale adapted to Turkish culture (Arslan & Yurdakul, 2015).

In the present study, the construct validity of the scale for the scores obtained from 345 students is investigated with second-order CFA. CFA results (χ^2/df= 106.93/52=2.056, RMSEA=0.056, IFI=0.98, RFI=0.96, CFI=0.98, GFI=0.95, AGFI= 0.92, RFI= 0.96, NFI=0.97, NNFI=0.98, and SRMR=0.039) showed that the scale had construct validity and total points could be obtained from the scale. In addition, the Cronbach's alpha internal consistency coefficient calculated by the study participants as α=0.882 showed that the scores obtained from the scale were sufficiently reliable (Kline, 2011).

Data analysis

During the data analysis phase, arithmetic mean and standard deviation values were calculated in order to determine the acceptance levels of the flipped mathematics classrooms of secondary school students. Then, the effects of gender, grade level, internet access, and perception of ability in learning mathematics alone at home on students' acceptance levels were examined using the F test. Simple linear regression analysis was conducted to determine the extent to which secondary school students' autonomous learning levels predicted their acceptance levels of flipped mathematics classrooms.

Before starting the F test analysis, it was determined that the skewness and kurtosis coefficients of the participants' scores for each level of the variables of gender, grade level, internet access, and perception of ability in learning mathematics alone at home were within ±1, and the scores were close to normal distribution. Additionally, Levene test results for each of the independent variables (gender: F(1,343)=5.990, p=0.015; grade level: F(3,341)=1.152, p=0.328; internet access: F(3.340)=1.563, p =0.198; perception of ability in learning mathematics alone at home: F(2,341)=0.625, p=0.536) showed that the variances were homogeneous. To determine the practical importance of the significant differences obtained as a result of the F test, Cohen's f effect size values were calculated. 0.10 was interpreted as "small", 0.25 as "medium", and 0.40 as "large" effect size (Cohen, 1988).

The normality of scores was examined before a simple linear regression analysis was performed. Skewness-kurtosis values in the range of ±1 (for acceptance scores, skewness = -0.464, kurtosis = -0.40, and for autonomous learning scores, skewness = -0.545, kurtosis = 0.0629) showed that acceptance and autonomous learning scores were close to normal distribution. The scatter plot drawn between autonomous learning and acceptance scores indicated that the relationship between the two variables was linear. The normality of the error terms was determined by drawing a Q-Q plot chart, and the homoscedasticity of the error terms was determined by drawing a scatter plot. For the correlation coefficient value (R), 0.10-0.29 was considered a "small" relationship, 0.30-0.49 was considered a "medium" relationship, and 0.50-1.0 was considered a "large" relationship (Cohen, 1988). For R^2 effect size values, <0.1 was interpreted as "weak", 0.11–0.3 as "small", 0.31–0.5 as "medium", >0.5 as "large" effect (Muijs, 2004). In interpreting the students' acceptance levels of flipped mathematics classroom, 1.00-1.80 was "strongly disagree", 1.81-2.60 was "somewhat agree", 2.61-3.40 was "moderately agree", 3.41-4.20 was "somewhat agree", and 4.21-5.00 was "completely agree".

FINDINGS

Secondary school students' acceptance levels of flipped mathematics classrooms

Findings regarding secondary school students' acceptance levels of flipped mathematics classrooms are presented in Table 1.

Table 1. Secondary school students' acceptance levels of flipped mathematics classroom (n=345)

Factor	$\overline{X}$	SD	Acceptance Level
PE	3.26	1.13	Moderately Agree
EE	3.03	1.09	Moderately Agree
FC	3.76	1.09	Mostly Agree
HM	3.41	1.04	Mostly Agree
BI	3.26	1.12	Moderately Agree
TSE	3.64	1.00	Mostly Agree
Total	3.45	0.82	Mostly Agree

According to the results in Table 1, students' acceptance averages for flipped mathematics classrooms varied between 3.03 and 3.76. The mean scores in the PE, EE, and BI factors were in the range of "Moderately Agree", FC, HM, TSE, and the overall scale were in the range of "Mostly Agree". According to these findings, it can be said that students' acceptance levels of flipped mathematics classrooms were at a moderate level in the PE, EE, and BI factors and at a good level in the FC, HM, TSE factors and on the overall scale.

Investigation of secondary school students' acceptance levels of flipped mathematics classrooms in terms of gender variable

Descriptive statistics regarding the acceptance levels of female and male students to flipped mathematics classrooms are presented in Table 2, and the F test results regarding the differentiation of acceptance levels in terms of gender variable are presented in Table 3.

Table 2. Descriptive statistics regarding the variable of gender

Gender	N	$\overline{X}$	SD
Female	166	3.55	0.72
Male	179	3.37	0.89
Total	345	3.45	0.82

Table 3. F test results regarding the variable of gender

	The source of variance	Sum of squares	df	Mean Square	F	p
Acceptance Level	Between Groups	2.697	1	2.697	4.073	0.044
	Within Groups	227.100	343	0.662		
	Total	229.797	344			

*p<0.01

As seen in Table 3, students' acceptance levels of flipped mathematics classrooms did not differ statistically significantly according to the gender variable (p>0.01).

Investigation of secondary school students' acceptance levels of flipped mathematics classrooms in terms of grade level variable

Descriptive statistics regarding the acceptance levels of students studying in the 5^{th}-8^{th} grade to flipped mathematics classrooms are presented in Table 4, and the F test results regarding the differentiation of acceptance levels in terms of the grade level variable are presented in Table 5.

Table 4. Descriptive statistics regarding the variable of grade level

Grade Level	N	$\overline{X}$	SD
5^{th} grade	107	3.57	0.87
6^{th} grade	83	3.37	0.80
7^{th} grade	89	3.44	0.77
8^{th} grade	66	3.40	0.80
Total	345	3.45	0.82

Table 5. F test results regarding the variable of grade level

	The source of variance	Sum of squares	df	Mean of Square	F	p
Acceptance Level	Between Groups	2.286	3	0.762	1.142	0.332
	Within Groups	227.511	341	0.667		
	Total	229.797	344			

*p<0.01

As seen in Table 5, students' acceptance levels of flipped mathematics classrooms did not differ statistically significantly according to the grade level variable (p>0.01).

Investigation of secondary school students' acceptance levels of flipped mathematics classrooms in terms of internet access variable

Descriptive statistics regarding students' acceptance levels of flipped mathematics classrooms in terms of the internet access variable are presented in Table 6, and F test results regarding the differentiation of acceptance levels in terms of the internet access variable are presented in Table 7.

Table 6. Descriptive statistics regarding the variable of internet access

Internet access	N	$\overline{X}$	SD
1. No access	15	2.80	1.07
2. Insufficient	20	2.67	0.83
3. Partially Sufficient	47	3.22	0.75
4.Sufficient	262	3.60	0.75
Total	344	3.46	0.82

Table 7. F test results regarding the variable of internet access

	The source of variance	Sum of squares	df	Mean of Squares	F	p	Difference (Scheffe)	Cohen f	Power
Acceptance Level	Between Groups	26.436	3	8.812	14.755	0.000*	4>1,2,3	0.36	0.999
	Within Groups	203.048	340	0.597					
	Total	229.484	343						

*p<0.01

As seen in Table 7, students' acceptance levels of flipped mathematics classrooms differed statistically significantly according to the internet access variable ($F(3,340) = 14.755$, $p<0.01$). Scheffe test results showed that the acceptance scores of students with sufficient internet access ($\bar{x}$=3.60) were statistically significantly higher than the acceptance scores of students no access ($\bar{x}$=2.80), insufficient ($\bar{x}$=2.67) and partially sufficient ($\bar{x}$=3.22). Additionally, Cohen's f=0.36 effect size value showed that the difference was at a moderate level.

Investigation of secondary school students' acceptance levels of flipped mathematics classrooms in terms of the perception of ability in learning mathematics alone at home

Descriptive statistics regarding students' acceptance levels of flipped mathematics classrooms in terms of the perception of ability in learning mathematics alone at home are presented in Table 8, and F test results regarding the differentiation of acceptance levels in terms of the perception of ability in learning mathematics alone at home are presented in Table 9.

Table 8. Descriptive statistics regarding the variable of perception of ability in learning mathematics alone at home

Perception of ability	N	$\overline{X}$	SD
Insufficient	40	2.89	0.85
Partially sufficient	149	3.33	0.75
Sufficient	155	3.72	0.77
Total	344	3.46	0.82

Table 9. F test results regarding the variable of perception of ability in learning mathematics alone at home

	The source of variance	Sum of squares	df	Mean of Squares	F	p	Difference (Scheffe)	Cohen f	Power
Acceptance Level	Between Groups	25.903	2	12.952	21.708	.000*	3>2,1 2>1	0.36	0.999
	Within Groups	203.451	341	0.597					
	Total	229.355	343						

*p<0.01

As seen in Table 9, students' acceptance levels of the flipped mathematics classroom differed statistically significantly according to their perception of their ability in learning mathematics alone at home ($F(2,341) = 21.708$, $p<0.01$). According to the Scheffe test results, the acceptance scores of the students who perceived themselves as sufficient in learning mathematics alone at home ($\bar{x}$= 3.72) were statistically significantly higher than the acceptance scores of the students who perceived themselves as partially sufficient ($\bar{x}$= 3.33) and insufficient ($\bar{x}$= 2.89). Also, it was determined that the acceptance scores of students who perceived themselves as partially sufficient ($\bar{x}$=3.33) were statistically significantly higher than the acceptance scores of students who perceived themselves as insufficient ($\bar{x}$=2.89). Cohen's f =0.36 effect size value showed that the difference is moderate.

Investigation of whether secondary school students' autonomous learning levels predict their acceptance levels of the flipped mathematics classrooms

Descriptive statistics on whether secondary school students' autonomous learning levels predict their acceptance levels of flipped mathematics classrooms are presented in Table 10, and the simple linear regression analysis results are presented in Table 11.

Table 10. Descriptive statistics (N=345)

	$\overline{X}$	SD
Flipped learning acceptance	3.45	0.82
Autonomous Learning	3.60	0.83

Table 11. Simple linear regression analysis results

Variables	B	Standart Error	Beta	t	p
Constant	1.826	0.174		10.526	.000*
Autonomous Learning	0.452	0.047	0.461	9.626	.000*
R = 0.461	R^2= 0.213				
$F_{(1,343)}$=92.661	p= .000				

p<0.01

As seen in Table 11, there was a moderate and statistically significant relationship between secondary school students' autonomous learning scores and flipped mathematics classroom acceptance scores (R = 0.461, R^2 = 0.213; F (1,343) = 92.661, p = .000). According to this finding, students' scores on autonomous learning explained 21.3% of the variance in acceptance scores of flipped mathematics classrooms. Considering the standardized regression coefficient, it was determined that students' autonomous learning scores predicted the acceptance scores of flipped mathematics classrooms at a statistically significant level (β= 0.461, p<0.01). On the other hand, the R^2 = 0.213 value indicated a small effect.

DISCUSSION & CONCLUSION

This study was conducted to determine secondary school students' acceptance levels of flipped mathematics classrooms and to investigate their acceptance levels in terms of gender, grade level, internet access, and perception of ability in learning mathematics alone at home variables. Additionally, it was aimed to determine whether students' autonomous learning levels predicted their acceptance levels of flipped mathematics classrooms.

In the study, it was found out that secondary school students' acceptance levels of flipped mathematics classrooms were at a good level. Aydın (2020) used the flipped classroom method in teaching the subject of operations on whole numbers in 7th grade and stated that the students had positive opinions, such as that they liked the application, that it attracted their attention, and that they wanted it to be used in other lessons. Gençer (2015) stated that 6th grade students accepted the flipped classroom model. Abeysekera and Dawson (2015) stated that despite the lack of specific evidence regarding the effectiveness of the flipped classroom approach, it has been adopted with great enthusiasm. Balcı (2023) mentioned that secondary school students found the use of the gamified flipped classroom model regarding the algorithm instructive and entertaining, but technological inadequacies had a negative impact on the process. But Yavuz and Kahraman (2021) stated that secondary school students who are accustomed to traditional methods did not adopt the flipped learning model in the first weeks. Similarly, Chen et al. (2014) stated that the model was effective at the higher education level, students were satisfied with the course, their participation in the course increased, and their study efforts increased, but it was concluded that some students did not fully adopt the model because they continued their old passive learning habits. On the other hand, students' readiness for flipped classrooms is also considered important in their acceptance of flipped classrooms (Hao, 2016b). Açıkgül and Fırat (2023) also determined that secondary school students' readiness for flipped mathematics classrooms was at a good level.

In the study, it was observed that students' acceptance levels of flipped mathematics classrooms did not differ significantly in terms of gender and grade level variables. Similarly, Chen et al. (2016) did not find any difference in terms of gender variable in high school students' views on course design in flipped mathematics classrooms. Açıkgül and Fırat (2023) and Kazu and Kurtoğlu (2020) determined that the readiness of secondary school students for flipped classrooms did not differ according to gender and grade level variables.

There may be limitations due to internet access in flipped classrooms (Görü Doğan, 2015). When secondary school students' acceptance levels of flipped mathematics classrooms were examined in terms of internet access, a significant difference was observed in favor of those who have internet access. Similarly, it has been stated that internet access affects students' readiness for flipped classrooms (Hao, 2016a; Kazu & Kurtoğlu, 2020; Yildiz-Durak, 2018). Balcı (2023) pointed out the importance of internet access in the application of the model and emphasized that information about students' internet access should be collected before the application and that students' deficiencies should be eliminated.

In the flipped learning model, students have important learning responsibilities, especially in out-of-school learning (Kozikoğlu et al., 2021). In this study, it was determined that the acceptance levels of flipped mathematics classrooms differed statistically significantly in favor of those who considered themselves more sufficient in terms of their perception of ability in learning mathematics alone at home. On the other hand, the flipped classroom structure is seen to be associated with student autonomy as it requires students' active participation in learning (Chen et al., 2014; Han, 2015; Jenkins et al., 2017; Kozikoğlu et al., 2021). Supporting this situation, the study found a moderate and statistically significant relationship between secondary school students' autonomous learning scores and flipped mathematics classroom acceptance scores. Considering the standardized regression coefficient, it was determined that students' autonomous learning scores predicted the acceptance scores of flipped mathematics classrooms at a statistically significant level. From here, it can be stated that if students' autonomous learning levels increase, the acceptance level of flipped mathematics classrooms may also increase. On the other hand, the R^2 value indicated a small effect. In their study with teachers, Kozikoğlu et al. (2021) concluded that as the autonomy supporting behavior of teachers increases, the perception of self-efficacy in flipped learning also increases.

Future directions

Some suggestions can be made in line with the results of the research. In this study, it was determined that the acceptance levels of the flipped mathematics classrooms of secondary school students were at a good level. Considering that half of the students (n=152) have not participated in flipped mathematics classrooms before, it is recommended to provide detailed information about flipped classrooms and ensure that they participate in flipped classroom practices. On the other hand, it was determined that secondary school students' acceptance scores of flipped mathematics classrooms differed at a statistically significant level in terms of internet access and competence perception for learning mathematics alone at home. How these differences affect flipped classrooms can be investigated in detail through qualitative studies.

In addition, the study investigated to what extent students' autonomous learning acceptance scores predicted their acceptance scores in flipped mathematics classrooms. As a result of the research, it was determined that the scores on autonomous learning explained 21.3% of the variance in the acceptance scores of flipped mathematics classrooms. With new research, the predictive ability of different variables that may be related to acceptance level scores can be examined.

Declarations on Ethical Standards
Financial support There is not received any financial support to conduct this research and/or publication of the article.
Conflicts of interest There is no conflict of interest regarding the publication of this article.
Ethical Approval. It has been confirmed by Social and Human Sciences Scientific Research Ethics Committee that the research process does not pose an ethical problem.

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