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TERSİNE ÇEVRİLMİŞ SINIF MODELİNİN ÖZEL GEREKSİNİMLİ ÇOCUKLARIN MOTİVASYON VE ÖZ YETERLİK DÜZEYLERİNE ETKİSİ*

THE EFFECT OF THE FLIPPED CLASSROOM MODEL ON THE MOTIVATION AND SELF-EFFICACY OF CHILDREN WITH SPECIAL NEEDS

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Tersine Çevrilmiş Sınıf Modelinin Özel Gereksinimli Çocukların Motivasyon ve Öz Yeterlik Düzeylerine Etkisi

ÖZ

Bu araştırmanın amacı, tersine çevrilmiş sınıf modelinin özel gereksinimli çocukların motivasyon ve öz yeterlik düzeylerine etkisini incelemektir. Çapraz desen araştırma modeline göre tasarlanan araştırmaya 13 zihinsel yetersizliği olan, 14 özel öğrenme güçlüğü olan ve 16 tipik gelişim gösteren öğrenci olmak üzere toplam 43 katılımcı dahil edilmiştir. Müdahale sürecinde katılımcılar iki ay boyunca geleneksel yöntemle, iki ay boyunca da tersine çevrilmiş sınıf modeli ile beden eğitimi ve spor dersini işlemişlerdir. Araştırma verileri Kişisel Bilgi Formu, Beden Eğitimi Motivasyon Ölçeği ve Çocuklar İçin Öz-Yeterlik Ölçeği kullanılarak toplanmıştır. Veriler grup içi karşılaştırmalarında Paired t-testi, tekrarlı ölçümler için iki yönlü ANOVA (3x3) testi ile analiz edilmiştir. Elde edilen bulgulara göre tersine çevrilmiş sınıf modeli ile işlenen dersler sonunda katılımcıların içsel, dışsal ve motivasyonsuzluk alt boyutları ile akademik, sosyal, duygusal ve toplam öz yeterlik puanlarında istatistiksel olarak anlamlı farklılık görülmüştür. Sonuç olarak tersine çevrilmiş sınıf modeli hem zihinsel yetersizliği olan bireylerde hem de özel öğrenme güçlüğü yaşayan bireylerde motivasyon ve öz yeterlik düzeylerini artırmada etkilidir. Tersine çevrilmiş sınıf modelinin, kapsayıcı eğitim uygulamalarında alternatif bir yaklaşım olarak kullanılmasının yanı sıra, gelecek çalışmalarda farklı engel türleri, yaş grupları ve disiplinlerde modelin etkililiğinin değerlendirilmesi önerilmektedir.

Anahtar Kelimeler: tersine çevrilmiş sınıf, motivasyon, öz yeterlik

The Effect of the Flipped Classroom Model on the Motivation and Self-Efficacy of Children with Special Needs

ABSTRACT

The aim of this study was to investigate the effects of the flipped classroom model on the motivation and self-efficacy levels of children with special needs. The study was designed using a crossover research design and included a total of 43 participants, consisting of 13 with intellectual disabilities, 14 with specific learning disabilities, and 16 with typical development. During the intervention, physical education and sports classes were delivered through traditional instruction for two months and through the flipped classroom model for another two months. Data was collected using the Personal Information Form, the Physical Education Motivation Scale, and the Self-Efficacy Scale for Children. For within-group comparisons, paired t-tests were employed, while repeated measures were analyzed using a two-way ANOVA (3x3). The findings demonstrated statistically significant differences across participants' intrinsic motivation, extrinsic motivation, and lack of motivation subdimensions, as well as in their academic, social, emotional, and total self-efficacy scores, with results favoring the flipped classroom model. These results indicate that the flipped classroom approach is effective in enhancing both motivation and self-efficacy among individuals with intellectual disabilities and those with learning difficulties. In addition to its potential as an alternative strategy in inclusive education practices, future studies are recommended to evaluate the effectiveness of this model across different disability groups, age levels, and subject areas.

Keywords: flipped classroom, motivation, self-efficacy

INTRODUCTION

In today's world, technological advancements have led to significant transformations in education, as in many other fields[1]. The integration of new technologies into education enhances learning processes by making them more effective and student-centered, thereby improving instructional quality and contributing to sustainable education. In this context, the development of active learning approaches, such as the flipped classroom model (FCM), has become increasingly important[2,3].

The FCM has increasingly been adopted as a pedagogical approach in recent years. In this model, direct instruction typically occurs outside the classroom through resources such as videos, enabling students to review the materials in advance and enter the classroom with prior knowledge. From the perspective of Cognitive Load Theory[41], this self-paced nature of the FCM is particularly beneficial for learners who may struggle with information processing. By moving direct instruction off-site, learners can manage the intrinsic cognitive load of the material without the pressure of real-time processing found in traditional lectures allowing them to pause and replay content until mastery is achieved[4]. During class, under the guidance of the instructor, they engage in asking questions and consolidating their understanding of the content[4,5,6,7]. As a result, classroom time is dedicated to active student participation, interaction, feedback, and reflective evaluation of the learning process[8]. Supported by information and communication technologies, this approach provides students with on-demand access to course materials, allowing them to regulate their learning pace and granting greater flexibility in the learning[9,10]. Such flexibility offers significant opportunities for learners with diverse learning speeds and needs, particularly those with special educational requirements such as learning disabilities or intellectual impairments. In this regard, the FCM aligns closely with the principles of Universal Design for Learning (UDL)[39]. By offering multiple means of representation and engagement, the model inherently addresses the variability of learners, removing barriers to access and fostering an inclusive environment where instructional support is tailored to individual needs.

Students with special educational needs face a range of challenges that may hinder their academic achievement due to their unique learning requirements[11,12]. Within this context, two of the most critical factors that require support in their educational processes are motivation and self-efficacy. Learners with learning difficulties often experience diminished motivation toward academic tasks and fragile perceptions of self-efficacy as a result of repeated failures and persistent low achievement[13,14,15,16]. Yet, self-efficacy plays a pivotal role in shaping individuals' beliefs, motivation, and behaviors. Students with higher levels of self-efficacy tend to demonstrate greater resilience when confronted with challenges, develop more effective coping strategies, and sustain their motivation[11]. The relationship between the FCM and these psychological constructs can be grounded in Self-Determination Theory (SDT)[40] and Bandura's Social Cognitive Theory[34]. According to SDT, fulfilling the basic psychological needs of autonomy and competence is essential for intrinsic motivation. The FCM supports autonomy by giving students control over their learning pace[4]. Concurrently, in line with Bandura's (1997) theory, the model facilitates 'mastery experiences'—the most influential source of self-efficacy[34]. When students with special needs successfully grasp preliminary concepts at home, they enter the classroom feeling competent, which interrupts the cycle of failure and boosts their academic self-efficacy.

A review of the literature reveals that research on the education of individuals with special needs has predominantly been conducted with teachers, parents, and pre-service teachers, whereas studies directly involving individuals with special needs remain uncleared. Yet, students with mild intellectual disabilities or specific learning difficulties are often capable of articulating their own educational experiences[17,18,19]. Moreover, within this student group, research focusing specifically on technology-supported FCM, particularly in relation to variables such as motivation and self-efficacy, is notably scarce[20,21]. Therefore, the aims of this study were to examine the impact of the FCM on the motivation and self-efficacy levels of children with special educational needs.

MATERIAL AND METHODS

Research Model

The study was designed using a cross-sectional research model, one of the quantitative research methods. During the intervention, participants attended physical education and sports classes conducted using the traditional method (TM) for two months, followed by two months of instruction using the flipped learning approach. Within the FCM, curriculum-aligned the Education Information Network (EBA) instructional videos were provided to the students in advance, ensuring that they arrived at the classroom well-prepared for the lessons. The content available on the EBA consists of videos selected in accordance with the curriculum learning outcomes covered during the implementation period (e.g., movement competence; active and healthy lifestyle). In addition, physical education and sports teachers prepared instructional videos aligned with these learning outcomes and uploaded them to the EBA system. Activities related to the learning outcomes, including fair play, healthy nutrition, the Olympic Games, and the introduction of different sports disciplines, were carried out with family support; students and their families were informed about each activity and instructional video. In this way, it was aimed to ensure that students participated in the lessons with a high level of readiness and were prepared for practical implementation.

Participants

The study sample consisted of students aged 11–13 years attending the upper levels of primary education in Kocaeli, including those diagnosed with specific learning difficulties (SLD), students with mild intellectual disabilities (ID), and typically developing (TD) peers. The sample size was determined using the G*Power software. Based on an effect size of $f = 0.25$, $\alpha = 0.05$, and $\beta = 0.80$ (% power), the minimum required sample size was calculated to be 36 participants. A total of 43 students were included in the study, comprising 13 students with ID, 14 students with SLD, and 16 TD students.

Data Collection

Before the intervention, participants' demographic information, as well as pre-test data on motivation and self-efficacy, were collected. At the conclusion of the two-month traditional intervention, mid-test data assessing the effects of the traditional approach on motivation and self-efficacy were gathered; these were considered the post-test data for the traditional intervention. Following the traditional intervention, the physical education and sports course was conducted using the FCM for a period of two months.

To evaluate the effects of the FCM, post-test data on participants' motivation and self-efficacy were collected at the end of this period. During the data collection process, the questions were read aloud by the teacher while students with SLD and ID completed the scales, and the students provided their responses. The evaluation process was conducted under the supervision of the school psychologist and the guidance counselor at the school where the implementation took place.

Data collection tools

The demographic characteristics of the participants were collected using a personal information form developed by the researchers. The Physical Education Motivation Scale (PEMS) was employed to assess participants' motivation levels, while the Self-Efficacy Scale for Children (SESC) was used to measure their self-efficacy.

Physical Education Motivation Scale: To assess the motivation levels of the students participating in the study, the PEMS developed by Sulz et al., (2016)[22] and whose validity and reliability were confirmed by Akbulut and Öncü (2023)[23] was used. The scale consists of 9 items rated on a 5-point Likert-type scale and comprises three sub-dimensions: Intrinsic Motivation (IM), Extrinsic Motivation (EM), and Lack of Motivation (LM).

Self-Efficacy Scale for Children: The SESC was used to assess students' self-efficacy. This scale was originally developed by Muris (2001, 2002)[24,25] and its validity and reliability were tested by Telef and Karaca (2012)[26]. The scale consists of 21 items rated on a 5-point Likert scale and comprises three subdimensions: Academic Self-Efficacy (ASE), Social Self-Efficacy (SSE), and Emotional Self-Efficacy (ESE). The total score ranges from 21 to 105, with higher scores indicating higher levels of self-efficacy and lower scores indicating lower levels. The total self-efficacy (TSE) score is calculated by summing the items corresponding to each subdimension.

Data Analysis

Data was analyzed using the SPSS Statistics program (version 28.0). The Kolmogorov-Smirnov test was conducted to assess the normality of the data, and the results indicated that the data were normally distributed. For within-group comparisons, paired-samples t-tests were performed, while two-way repeated measures ANOVA (3×3) was applied for repeated measurements. Effect sizes were calculated using partial eta-squared (n_p^2) for repeated measures ANOVA and Cohen's d for pairwise comparisons. The magnitudes of the ES were classified as trivial (0.0–0.2), small (0.2–0.6), moderate (0.6–1.2), large (1.2–2.0), and very large (>2.0)[27]. Statistical significance was set at $p < 0.05$.

Research Publication Ethics

This study was approved by the Bursa Uludağ University Social and Human Sciences Research and Publication Ethics Committee on 24 February 2023, with decision number 2023-02.

RESULTS

Table 1. Comparison of Motivation Scores (paired t-test)

Parameter	Group	n	Method	Pre-Test Mean ± SD	Post-Test Mean ± SD	t	p	Cohen's d
IM	ID	13	TM	7,69 ±1,84	7,92±1,44	-,334	,744	-,093
			TM+ FCM	7,69 ±1,84	14,69±,48	-13,491	<,001	-3,742
	SLD	14	TM	8,64±1,98	7,78±1,18	1,385	,189	,370
			TM+ FCM	8,64±1,98	14,92±,26	-11,053	<,001	-2,954
	TD	16	TM	11,5±2,89	13,43±2,55	-2,623	,019	-,656
			TM+ FCM	11,5±2,89	14,93±,25	-4,823	<,001	-1,206
EM	ID	13	TM	7,61±1,7	7,3±1,31	,519	,613	,144
			TM+ FCM	7,61±1,7	14,3±,85	-11,094	<,001	-3,077
	SLD	14	TM	8,5±1,82	7,64±1,54	1,135	,277	,303
			TM+ FCM	8,5±1,82	14,21±,89	-9,723	<,001	-2,599
	TD	16	TM	10,43±2,47	12,56±2,96	-3,232	,006	-,808
			TM+ FCM	10,43±2,47	13,93±1,52	-4,518	<,001	-1,130
LM	ID	13	TM	7,38±1,44	7,53±1,39	-,257	,801	-,071
			TM+ FCM	7,38±1,44	4,92±1,38	4,064	,002	1,127
	SLD	14	TM	8,14±1,46	7,21±,8	2,008	,066	,537
			TM+ FCM	8,14±1,46	4,92±1,73	6,826	<,001	1,824
	TD	16	TM	6,75±3,27	5,81±2,16	1,174	,259	,294
			TM+ FCM	6,75±3,27	4,06±1,23	3,501	,003	,875

IM; intrinsic motivation, EM; extrinsic motivation, LM; lack of motivation, ID; intellectual disabilities, SLD; specific learning difficulties, TD; typically developing, TM; traditional method, TM+ FCM; traditional method + flipped classroom model

For the IM parameter, no significant difference was observed between pre-test and post-test scores in individuals with ID when using the TM ($p > 0.05$). However, when the FCM was applied in addition to the TM, a statistically significant increase was observed ($p < 0.05$), with very large effect size (Cohen's $d = –3.742$). In individuals with SLD, no significant difference was found in the TM ($p > 0.05$), whereas the addition of the FCM led to a significant increase ($p < 0.05$), with a very large effect size (Cohen's $d = –2.954$). TD individuals showed a significant increase in IM under both the TM and the FCM added to the TM ($p < 0.05$), with the FCM producing a large effect size (Cohen's $d = –1.206$).

For the EM parameter, no significant difference was observed between pre-test and post-test scores in individuals with ID in the TM ($p > 0.05$). However, when the FCM was applied in addition to the TM, a statistically significant increase was found ($p < 0.05$), with a very large effect size (Cohen's $d = –3.077$). In individuals with SLD, no significant difference was detected in the TM ($p > 0.05$), whereas the addition of the FCM resulted in a significant increase ($p < 0.05$), with a very large effect size (Cohen's $d = –2.599$). TD individuals showed a significant increase in EM under both the TM and the FCM added to the TM ($p < 0.05$), with the FCM producing moderate effect size (Cohen's $d = –1.130$).

For the LM parameter, no significant difference was observed between pre-test and post-test scores in individuals with ID in the TM ($p > 0.05$). However, when FCM was applied in addition to TM, a statistically significant decrease was found ($p < 0.05$), with moderate effect size (Cohen's $d = 1.127$). In individuals with SLD, no significant difference was detected in the TM ($p > 0.05$), whereas the addition of the FCM resulted in a significant decrease ($p < 0.05$), with a large effect size (Cohen's $d = 1.824$). TD individuals showed no significant change under the TM ($p > 0.05$), but a significant decrease was observed when the FCM was applied in addition to the TM ($p < 0.05$), with a moderate effect size (Cohen's $d = 0.875$).

Table 2. Comparison of Self-Efficacy Scores (paired t-test)

Parameter	Group	n	Method	Pre-Test Mean ± SD	Post-Test Mean ± SD	t	p	Cohen's d
ASE	ID	13	TM	11,3±3,4	12,53±3,57	-2,421	,032	-,672
			TM+ FCM	11,3±3,4	33,76±,92	-22,813	<,001	-6,327
	SLD	14	TM	12,50±2,95	13,78±2,51	-1,070	,304	-,286
			TM+ FCM	12,50±2,95	33,85±1,09	-25,153	<,001	-6,722
	TD	16	TM	24,68±4,52	30,62±3,81	-4,221	<,001	-1,055
			TM+ FCM	24,68±4,52	34,75±,44	-8,648	<,001	-2,162
SSE	ID	13	TM	11,3±3,22	12,61±2,93	-3,157	,008	-,876
			TM+ FCM	11,3±3,22	33,76±1,16	-26,843	<,001	-7,445
	SLD	14	TM	12,92±2,92	13,57±2,65	-,537	,601	-,143
			TM+ FCM	12,92±2,92	33,57±1,28	-24,312	<,001	-6,498
	TD	16	TM	23,43±5,94	29,56±4,54	-3,433	,004	-,858
			TM+ FCM	23,43±5,94	34,43±1,2	-7,266	<,001	-1,817
ESE	ID	13	TM	11,23±3,08	12±2,88	-1,059	,310	-,294
			TM+ FCM	11,23±3,08	33,76±1,16	-24,207	<,001	-6,714
	SLD	14	TM	11,71±3,4	13,14±2,34	-1,415	,180	-,378
			TM+ FCM	11,71±3,4	34±,96	-21,538	<,001	-5,756
	TD	16	TM	20,62±4,81	28,5±5	-4,205	<,001	-1,051
			TM+ FCM	20,62±4,81	34,93±,25	-11,828	<,001	-2,957
TSE	ID	13	TM	33,84±9,2	37,15±8,7	-2,780	,017	-,771
			TM+ FCM	33,84±9,2	101,3±2,42	-25,889	<,001	-7,180
	SLD	14	TM	37,14±8,51	40,5±5,61	-1,160	,267	-,310
			TM+ FCM	37,14±8,51	101,42±2,59	-26,282	<,001	-7,024
	TD	16	TM	68,75±11,71	88,68±11,92	-4,448	<,001	-1,112
			TM+ FCM	68,75±11,71	104,39±1,02	-11,971	<,001	-2,993

ASE; academic self-efficacy, SSE; social self-efficacy, ESE; emotional self-efficacy, TSE; total self-efficancy, ID; intellectual disabilities, SLD; specific learning difficulties, TD; typically developing, TM; traditional method, TM+ FCM; traditional method + flipped classroom model

For the ASE subdimension, within-group comparisons revealed a statistically significant increase under both the TM and the FCM applied in addition to the TM ($p < 0.05$). The effect size for the increase under the TM was moderate (Cohen's $d = –0.672$), whereas the effect size for the FCM added to the TM was very large (Cohen's $d = –6.327$). In individuals with SLD, no significant change was observed in the TM ($p > 0.05$), but a statistically significant increase was found when the FCM was applied in the TM ($p < 0.05$), with a very large effect size (Cohen's $d = –6.722$). TD individuals showed a statistically significant increase under both methods ($p < 0.05$), with a very large effect size observed for the FCM added to the TM (Cohen's $d = –2.162$).

For the SSE subdimension, individuals with ID showed a statistically significant increase under both the TM and the FCM applied in addition to the TM ($p < 0.05$). The effect size for the increase in the TM was moderate (Cohen's $d = –0.876$), whereas the effect size for the FCM added to the TM was very large (Cohen's $d = –7.445$). In individuals with SLD, no significant change was observed in the TM ($p > 0.05$), but a statistically significant increase was detected when the FCM was applied in the TM ($p < 0.05$), with a very large effect size (Cohen's $d = –6.498$). TD individuals showed a statistically significant increase under both methods ($p < 0.05$), with a large effect size observed for the FCM added to the TM (Cohen's $d = –1.817$).

For the ESE subdimension, individuals with ID exhibited a statistically significant increase when the FCM was applied in addition to the TM ($p < 0.05$), with a very large effect size (Cohen's $d = –6.714$). No significant change was observed in the TM ($p > 0.05$). In individuals with SLD, a statistically significant increase was also found when the FCM was applied in the TM ($p < 0.05$), with a very large effect size (Cohen's $d = –5.756$), while no significant difference was observed in the TM ($p > 0.05$). TD individuals

showed a statistically significant increase under both methods ($p < 0.05$), with a very large effect size observed for the FCM added to the TM (Cohen's d = –2.957).

For the TSE subdimension, individuals with ID demonstrated a statistically significant increase under both the TM and the FCM applied in addition to the TM ($p < 0.05$). The effect size for the FCM added to the TM was very large (Cohen's d = –7.180). In individuals with SLD, a statistically significant increase was observed only when the FCM was applied in the TM ($p < 0.05$), with a very large effect size (Cohen's d = –7.024), whereas no significant change was found in the TM ($p > 0.05$). TD individuals showed a statistically significant increase under both methods ($p < 0.05$), with a very large effect size for the FCM added to the TM (Cohen's d = –2.993).

Table 3. Comparison of motivational variables (two-way repeated measures Anova)

Parameter	Group	n	Pre-Test Mean ± SD	Mid-Test Mean ± SD	Post-Test Mean ± SD	Group Main Effect (F /n_p^2/p)	Time Main Effect (F /n_p^2/p)	Group × Time Interaction (F n_p^2/p)
IM	ID	13	7,69±1,84*ϕ	7,92±1,44*↓	14,69±,48	37,035	152,440	14,444
	SLD	14	8,64±1,98^α	7,78±1,18^↓	14,92±,26	,649	,792	,419
	TD	16	11,5±2,89 α ϕ	13,43±2,55↓	14,93±,25	<,001	<,001	<,001
EM	ID	13	7,61±1,7 ϕ*	7,3±1,31↓*	14,3±,85	21,394	122,199	12,135
	SLD	14	8,5±1,82 ϕ^	7,64±1,54↓^	14,21±,89	,517	,753	,378
	TD	16	10,43±2,47α ϕ	12,56±2,96	13,93±1,52	<,001	<,001	<,001
LM	ID	13	7,38±1,44 ϕ	7,53±1,39↓*	4,92±1,38	4,313	34,632	,636
	SLD	14	8,14±1,46 ϕ	7,21±,8↓	4,92±1,73	,177	,464	,031
	TD	16	6,75±3,27 ϕ	5,81±2,16	4,06±1,23	,020	<,001	,639

IM; intrinsic motivation, EM; extrinsic motivation, LM; lack of motivation, ID; intellectual disabilities, SLD; specific learning difficulties, TD; typically developing, *; There is a significant difference between ID and TD, ^; There is a significant difference between SLD and TD, ϕ; There is a significant difference between the pre-test and post-test, ↓; There is a significant difference between the mid-test and post-test, α; There is a significant difference between the pre-test and mid-test

For the IM parameter, the main effect of group revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni pairwise comparisons between the pre-test and mid-test ($p < 0.001$) and between the mid-test and post-test ($p < 0.001$). For the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and mid-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p = 0.016$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p = 0.010$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.005$), and at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$). No significant differences were detected at the post-test ($p > 0.05$).

For the EM parameter, the main effect of group revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni pairwise comparisons between the pre-test and post-test ($p < 0.001$) and between the mid-test

and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p = 0.006$) and between pre-test and post-test ($p < 0.001$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p = 0.002$) and between the SLD and TD groups ($p = 0.043$), and at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$). No significant differences were detected at the post-test ($p > 0.05$).

For the LM parameter, no significant differences were observed for the main effect of group ($p > 0.05$). The main effect of time revealed significant differences in post hoc Bonferroni pairwise comparisons between the pre-test and post-test ($p < 0.001$) and between the mid-test and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p = 0.002$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and post-test ($p < 0.001$). For time × group interactions at specific time points, a significant difference was observed at the mid-test between the ID and TD groups ($p = 0.018$). No significant differences were detected at the pre-test or post-test ($p > 0.05$).

Table 4. Comparison of self-efficacy variables (two-way repeated measures Anova)

Parameter	Group	n	Pre-Test Mean ± SD	Mid-Test Mean ± SD	Post-Test Mean ± SD	Group Main Effect (F /n_p^2/p)	Time Main Effect (F /n_p^2/p)	Group × Time Interaction (F n_p^2/p)
Academic Self-Efficacy	ID	13	11,3±3,4 ϕ*	12,53±3,57↓*	33,76±,92*	157,571	507,196	46,475
	SLD	14	12,50±2,95 ϕ^	13,78±2,51↓^	33,85±1,09^	,887	,927	,699
	TD	16	24,68±4,52 α ϕ	30,62±3,81↓	34,75±,44	<,001	<,001	<,001
Social Self-Efficacy	ID	13	11,3±3,22 ϕ*	12,61±2,93↓*	33,76±1,16*	107,141	394,536	31,606
	SLD	14	12,92±2,92 ϕ^	13,57±2,65↓^	33,57±1,28^	,843	,908	,612
	TD	16	23,43±5,94 α ϕ	29,56±4,54↓	34,43±1,2	<,001	<,001	<,001
Emotional Self-Efficacy	ID	13	11,23±3,08 ϕ*	12±2,88↓*	33,76±1,16*	112,143	485,872	28,529
	SLD	14	11,71±3,4 ϕ^	13,14±2,34↓^	34±,96^	,849	,924	,588
	TD	16	20,62±4,81 α ϕ	28,5±5↓	34,93±,25	<,001	<,001	<,001
Total Self-Efficacy	ID	13	33,84±9,2 ϕ*	37,15±8,7↓*	101,3±2,42*	177,762	629,653	47,267
	SLD	14	37,14±8,51 ϕ^	40,5±5,61↓^	101,42±2,59^	,899	,940	,703
	TD	16	68,75±11,71 α ϕ	88,68±11,92↓	104,39±1,02	<,001	<,001	<,001

ID; intellectual disabilities, SLD; specific learning difficulties, TD; typically developing, *; There is a significant difference between ID and TD, ^; There is a significant difference between SLD and TD, ϕ; There is a significant difference between the pre-test and post-test, ↓; There is a significant difference between the mid-test and post-test, α; There is a significant difference between the pre-test and mid-test

For the ASE parameter, the main effect of group revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni comparisons between the pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the

SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.005$), and at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$). At the post-test, significant differences were found between the ID and TD groups ($p = 0.011$) and between the SLD and TD groups ($p = 0.020$).

For the SSE parameter, the main effect of intervention revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni comparisons between the pre-test and post-test ($p < 0.001$) and between the mid-test and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.005$), and at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$). At the post-test, significant differences were found between the ID and TD groups ($p = 0.011$) and between the SLD and TD groups ($p = 0.020$).

For the ESE parameter, the main effect of intervention revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni comparisons between the pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$); at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$); and at the post-test between the ID and TD groups ($p = 0.002$) and between the SLD and TD groups ($p = 0.014$)..

For the TSE parameter, the main effect of intervention revealed statistically significant differences in post hoc Bonferroni pairwise comparisons between the ID and TD groups ($p < 0.001$), as well as between the SLD and TD groups ($p < 0.001$). The main effect of time showed significant differences in post hoc Bonferroni comparisons between the pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). Regarding the time × group interaction, post hoc

Bonferroni comparisons indicated significant differences in the ID group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); in the SLD group between pre-test and post-test ($p < 0.001$) and between mid-test and post-test ($p < 0.001$); and in the TD group between pre-test and mid-test ($p < 0.001$), pre-test and post-test ($p < 0.001$), and mid-test and post-test ($p < 0.001$). For time × group interactions at specific time points, significant differences were observed at the pre-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$); at the mid-test between the ID and TD groups ($p < 0.001$) and between the SLD and TD groups ($p < 0.001$); and at the post-test between the ID and TD groups ($p = 0.002$) and between the SLD and TD groups ($p = 0.003$).

DISCUSSION AND CONCLUSION

This study comparatively examined the effects of the TM and the FCM on the motivation and self-efficacy levels of children with special needs. The findings indicate that the FCM has a significant positive impact on both learning motivation and self-efficacy in individuals with intellectual disabilities as well as in those with specific learning difficulties.

When examining motivation parameters, it was observed that instruction based on the FCM led to significant increases, particularly in IM and EM levels, whereas no statistically significant changes were detected under the traditional method. The high effect size observed for IM and EM in individuals with ID indicates the motivating effect of the FCM in this population. This finding aligns with the literature suggesting that the FCM promotes more active engagement in the learning process[28]. Similarly, the model demonstrated a strong effect in individuals with SLD when applied in addition to the TM.

Although typically developing individuals exhibited significant increases under both methods, the effect size was greater for the FCM, indicating that this model is effective not only for students with special needs but also for the general population. Regarding the LM parameter, a significant decrease was observed only under the FCM, whereas the TM did not produce a statistically significant reduction. The decline in LM among individuals with ID and those with specific learning difficulties suggests that the model reduces feelings of disinterest and reluctance toward learning.

The positive effects of the FCM on children with SLD support the view that this method may be beneficial in inclusive classrooms[29]. In contrast, Bergstresser (2018)[30] reported no significant differences in performance, motivation, or participation between flipped and traditional instruction for students with SLD (dyslexia). The discrepancy with the present study may be attributed to the nature of the subjects, as Bergstresser's study was conducted in academically focused courses such as history and science, rather than physically active subjects like physical education.

Botella et al. (2021)[3] found that the FCM increased intrinsic, identified, and integrated motivation, while EM and students' LM decreased following the intervention. Conversely, traditional instruction led to a significant decline in IM and identified motivation. Østerlie (2018)[31] reported that the FCM positively influenced physical education participation motivation among adolescents. Torres (2019)[32] observed increased learning motivation in students taught via the FCM. Similarly, López

Belmonte et al. (2019)[33] concluded that the use of the FCM enhanced both motivation and skills.

Similarly, in the self-efficacy dimensions, the effects of the FCM were found to be greater than those of the TM. In particular, the high effect sizes observed in academic, social, and emotional self-efficacy indicate that the FCM significantly enhances individuals' perceptions of self-efficacy. This finding aligns with Bandura's (1997)[34] self-efficacy theory, which emphasizes that active engagement in one's own learning processes supports perceived competence, achievement expectations, and self-confidence.

A review of the literature revealed no studies examining the impact of the FCM on self-efficacy specifically in individuals with special needs. Therefore, comparisons were drawn with studies conducted on typically developing populations. Ahmed and Indurkhya (2020)[35] demonstrated that the flipped classroom method improves students' knowledge, skills, participation, and self-efficacy. Choi (2014)[36] reported that the FCM is associated with significant gains in self-efficacy, although not with motivation. Latorre-Cosculluela et al. (2021)[37] suggested that FCM implementations in online formats can serve as a valuable resource for designing active learning environments that enhance university students' perceptions of self-efficacy. Jdaitawi (2020)[38] noted that the FCM helps increase student performance, strengthens engagement with the course, and supports self-efficacy through active learning strategies that maximize time spent in class. The findings suggest that the increase in participants' motivation and self-efficacy through the FCM can be attributed to its ability to allow students to learn at their own pace and according to their individual needs, as well as to actively engage them in the learning process.

Overall, the findings of this study indicate that FCM significantly and strongly enhances both motivation and self-efficacy in individuals with special needs. Based on these results, the FCM should be considered as an alternative approach in inclusive education practices. Educators and curriculum developers are encouraged to enhance its applicability through individualized digital content. Future research should examine the effectiveness of this model across different types of disabilities, age groups, and academic disciplines.

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