Comparison of face-to-face and online flipped learning: academic achievement, epistemological and pedagogical beliefs

Şeyma Şahin
Ministry of National Education, Duzce, Turkey, and
Abdurrahman Kılıç
Duzce University, Duzce, Turkey

Abstract
Purpose – The ultimate objective of this study is to compare the impact of face-to-face and online flipped learning on students’ academic achievements and their perspectives on learning and teaching, offering valuable insights to the field.

Design/methodology/approach – The study utilized a quasi-experimental research method that involves pre-test and post-test control groups.

Findings – The results indicated that face-to-face and online flipped learning positively impacted learning, with comparable contributions to academic achievement. However, we found that online flipped learning did not affect students’ beliefs about learning and teaching, while face-to-face flipped learning positively influenced them.

Originality/value – As distance learning becomes increasingly important in our modern era, this research aims to explore the use of active learning methods, including discussion, writing, animation, drawing, association, analysis, knowledge measurement and games, in virtual learning environments, such as online flipped learning. The study seeks to enhance the existing literature on the impact of face-to-face and online flipped learning models on student success. Additionally, it aims to address a significant gap in the literature by determining the effect of these models on students’ epistemological and pedagogical beliefs, which can impact their motivation, learning outcomes, academic achievements and decision-making processes.

Keywords Academic achievement, Epistemological belief, Face-to-face flipped learning, Online flipped learning, Pedagogical belief

Paper type Research paper

Introduction
Beliefs are personal values that influence an individual’s actions and decisions (Soleimani, 2020). These values are often implicit and subjective, shaped by personal experiences (Österholm, 2015). Beliefs encompass a wide range of attitudes, perceptions, values, decisions, ideologies, concept systems, concepts, implicit theories, dispositions, internal mental processes, rules of practice, action strategies and perspectives (Qiu et al., 2021). Our perception of reality and understanding of the world around us is based on interconnected belief systems formed by social norms (Usó-Doménech and Nescolarde-Selva, 2016).

Epistemology is a branch of philosophy that is concerned with understanding knowledge. Researchers in this field aim to investigate and clarify the origin, limitations and nature of knowledge. Epistemology also involves the study of individual beliefs, theories and perceptions about the learning process (Hofer and Pintrich, 1997). Epistemological beliefs play a crucial role in an individual’s psychological, sociological and philosophical development, as well as their attitudes and actions. Those with advanced epistemological beliefs have the ability to analyze events critically and creatively, which enhances their scientific thinking skills (Demir and Aknoğlu, 2010). Positive epistemological beliefs can also influence an individual’s motivation, learning strategies and outcomes (Paulsen and Wells, 1998). Therefore, individuals with these
beliefs tend to be more effective learners, achieve tremendous academic success and engage in lifelong learning (Kaleci and Yazıcı, 2018).

Pedagogical belief refers to an individual’s philosophy, principles and viewpoints regarding learning and teaching in educational settings. Both educators and learners share the responsibility of acquiring knowledge, and effective instructional techniques are crucial for achieving this goal (Namoco and Zaharudin, 2021). The classroom practices of educators are greatly influenced by their pedagogical beliefs (Tondeur, 2019), and the belief systems of teacher candidates are particularly significant as they shape their future decision-making and actions in the field of education (Soysal et al., 2018).

The beliefs we hold are heavily influenced by our environment and the way we are taught (Namoco and Zaharudin, 2021). The learning environment plays a critical role in shaping the beliefs of both students and pre-service teachers (Paulsen and Wells, 1998). Studies have shown that the teaching strategies used during the learning process can significantly impact a student’s beliefs (Hofer, 2004). Therefore, it is essential for educators to prioritize the development of higher-level epistemological and pedagogical beliefs in higher education to prepare future teachers to become exceptional educators and ensure effective learning (Brownlee, 2004). To develop more sophisticated beliefs about knowledge and learning, students can adopt a constructivist approach and take charge of their learning (Kahsay, 2019).

Flipped learning is an innovative educational approach that prioritizes student engagement and leverages technology and collaboration to enhance the learning experience. In contrast to traditional classrooms, where students are often passive listeners to a teacher’s lectures and homework assignments, flipped learning reverses this dynamic. In the flipped learning model, students are provided with digital materials to review independently before class and then participate in collaborative activities during class to deepen their understanding of the subject matter. This approach was first developed by Bergmann and Sams (2012) in Colorado and has since been adopted by educators nationwide to improve the quality and efficacy of in-person instruction.

The advancement of technology, communication and telecommunication has had a significant impact on distance education, resulting in the emergence of new structures (Toplu and Gökçearslan, 2012). Nowadays, online learning has become the standard, particularly during crises such as the COVID-19 outbreak of 2020, which had a significant influence on educational institutions worldwide (Genc et al., 2020). With the growing demand for online learning, there is a need to improve its quality. To achieve this, student-centered teaching strategies have been adapted to distance education. The flipped learning method is believed to significantly enhance the value and quality of online education (Tang et al., 2020). In this approach, students complete course-related tasks before attending live classes, allowing them to engage in high-level learning during online classroom activities (Kian et al., 2022).

In recent times, many studies have focused on flipped learning. Some of these studies have evaluated the effectiveness of online approaches through single-group experimentation. The results obtained from these studies indicate that the online flipped learning approach contributes to the development of students (Annamalai et al., 2021; Kian et al., 2022; Musa et al., 2021). Students thought that the model was adapted to the online format without any problems (Beason-Abmayr et al., 2021). Although some difficulties had a negative impact on the effectiveness of teaching, students had a relatively positive perception of online flipped learning (Hung, 2022). The model also improved self-directed learning and metacognitive awareness in students (Khodaei et al., 2022).

Other studies have compared online flipped learning approaches with traditional distance or face-to-face learning approaches. Some studies concluded no difference between the academic achievements of students educated through the online flipped learning approach and those educated through the traditional distance learning approach (Aktın Aslan, 2022).
However, other studies have concluded that the online flipped learning approach has a more positive effect on academic performance than the traditional distance learning approach (Purwanti et al., 2022; Romero-García et al., 2018). A control-experiment group study by Stöhr et al. (2020) compared the online flipped learning approach and the traditional face-to-face learning approach. It was determined that the online flipped learning approach and the traditional face-to-face learning approach did not create a statistically significant difference in the student’s academic performance.

There have been only a few experimental studies that have compared the effectiveness of face-to-face and online flipped learning. These studies were conducted by Hew et al., 2020, and Jia et al., 2023. However, no comparison study has been conducted to evaluate the impact of face-to-face and online flipped learning models on students’ epistemological and pedagogical beliefs.

Lo and Hew (2022) conducted an analysis of thirty-three studies on the online flipped learning model that were published between 2020 and 2021. According to their research findings, the classroom learning activities in these studies didn’t entirely align with the student-centered active learning approach. The classroom activities included reviewing pre-class materials, teacher-led classroom discussions, small group activities, student presentations, individual tasks and in-class assessments.

**Purpose of the research**
As distance learning becomes increasingly important in our modern era, this research aims to explore the use of active learning methods, including discussion, writing, animation, drawing, association, analysis, knowledge measurement and games, in virtual learning environments, such as online flipped learning.

The study seeks to enhance the existing literature on the impact of face-to-face and online flipped learning models on student success. Additionally, it aims to address a significant gap in the literature by determining the effect of these models on students’ epistemological and pedagogical beliefs, which can impact their motivation, learning outcomes, academic achievements and decision-making processes.

The ultimate objective of this study is to compare the impact of face-to-face and online flipped learning on students’ academic achievements and their perspectives on learning and teaching, offering valuable insights to the field. The following research problems were formulated in this direction:

1. Is there a significant difference in students’ academic achievement between face-to-face and online flipped learning?
2. Is there a significant difference in students’ epistemological belief systems between face-to-face and online flipped learning?
3. Is there a significant difference in students’ pedagogical belief systems between face-to-face and online flipped learning?

**Method**
**Research model**
The study used a quasi-experimental design with pre- and post-measurements and a control group. Table 1 illustrates the symbolic view of the design.

Both the experimental and control groups took pretests and posttests as indicated in Table 1. The experimental group used an online flipped learning model, while the control group used a face-to-face flipped learning model.
Working group
The research study focused on teacher candidates who attended the “Educational Psychology” course in the Spring 2021–2022 term of the Pedagogical Formation Program at Düzce University’s Education Faculty. The study included 39 students, 22 females and 17 males, in the experimental group and 37 students, 22 females and 15 males, in the control group. The experimental group included students from various disciplines, such as Physics, Chemistry, Biology, Information Technologies, Health Services, Machinery Technology, Installation Technology and Air Conditioning. The control group comprised students from Mathematics, Electrical and Electronics Technology, Accounting and Finance and Metal Technology fields.

Implementation process
The researchers conducted an experiment in the Educational Psychology course, which lasted 14 weeks. In the first week, an introduction was given, and a pre-test was conducted. For the next 13 weeks, the researchers applied two different models to two separate groups. The experimental group received online flipped learning, while the control group received face-to-face flipped learning. Both groups had no interaction and were unaware of the procedures applied to the other group.

Both groups used group work, comprising six students who self-selected themselves. Google Classroom was the platform used for group registration, assignment distribution and progress tracking. Every week, a different group member was elected as the group leader. The group leader was responsible for executing, reporting and uploading the group’s collective work to Classroom. The implementation process was carried out in pre-lesson and classroom studies.

Pre-Lesson Studies: Both groups were instructed to study the subject matter before class. The teacher provided video lessons, each lasting 15–20 min, and supplementary PDF documents for specific topics. These materials were distributed to the students before the start of the class.

Before the class, every student independently reviewed the course material, responded to the video-based questions, completed the tasks related to the PDF documents and researched and presented the application steps for each method and technique that would be covered in the coming week. Each group had a designated student leader who compiled all individual work into a single file and uploaded it to Google Classroom. The students then received feedback on their assignments and made necessary corrections before submitting the final version to the system.

Classroom studies
In the experimental group, the coursework was completed online through the University’s online platform every Wednesday for 13 weeks, from 8:30 p.m. to 10:50 p.m. On the other hand, in the control group, the coursework was conducted face-to-face in a classroom environment every Friday from 6:00 p.m. to 8:20 p.m. However, due to various reasons such as holidays, snow and earthquake, the University decided to provide distance education for some weeks (six weeks) during the implementation process for the control group.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-response</th>
<th>Treatment</th>
<th>Post-response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>O₁</td>
<td>X</td>
<td>O₂</td>
</tr>
<tr>
<td>Control group</td>
<td>O₃</td>
<td></td>
<td>O₄</td>
</tr>
</tbody>
</table>

Source(s): Table by authors
The students were able to achieve high-level learning by practicing what they learned at home through classroom activities, both online and face-to-face. Those who completed their homework could actively participate in the activities during the lesson. However, those who did not complete their homework could still participate but were not given a score for that week’s assessment. The techniques, methods and activities used each week in this process are detailed in Table 2.

The control group performed group work in the classroom and then presented their work to the entire class. The experimental group, on the other hand, collaborated in designated break out rooms within the distance education platform. The lecturer visited these rooms, checked on the progress and provided guidance. Finally, the groups presented their activities to the whole class in the main hall of the platform. In both models, every activity in the course was reported as a group, and the chief of the group for the week was responsible for these reports. The chief uploaded the reports to Google Classroom.

**Evaluation of the Course:** The students were assessed through a final exam, portfolio evaluation, peer assessment and self-assessment. The final exam was held after the completion of the process, and the student portfolios, along with self and peer assessments, were evaluated.

**Data collection tools**
“Epistemological Belief Scale towards Learning,” “Pedagogical Belief Systems Scale,” and “Achievement Test” were utilized in the study. Information about each tool is provided below.

<table>
<thead>
<tr>
<th>Week</th>
<th>Methods, techniques and activities</th>
<th>Week</th>
<th>Methods, techniques and activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>➢ Preparing Crossword</td>
<td>8</td>
<td>➢ Drama Technique</td>
</tr>
<tr>
<td></td>
<td>➢ Opinion Development Technique</td>
<td></td>
<td>➢ Opinion Development Technique</td>
</tr>
<tr>
<td>2</td>
<td>➢ Branched Tree Technique</td>
<td>9</td>
<td>➢ Six Thinking Hats Technique</td>
</tr>
<tr>
<td></td>
<td>➢ Writing Slogans</td>
<td></td>
<td>➢ “Finding the Wrong One” Game</td>
</tr>
<tr>
<td></td>
<td>➢ “What Does It Have?” Game</td>
<td></td>
<td>➢ STory Completion</td>
</tr>
<tr>
<td></td>
<td>➢ Writing Slogans</td>
<td></td>
<td>➢ Problem Solving</td>
</tr>
<tr>
<td></td>
<td>➢ Writing Diary</td>
<td>10</td>
<td>➢ Poster Preparation (Sandwich Technique)</td>
</tr>
<tr>
<td>3</td>
<td>➢ Mind Map Technique</td>
<td></td>
<td>➢ Writing Letters</td>
</tr>
<tr>
<td></td>
<td>➢ Conversation Circle Technique</td>
<td></td>
<td>➢ Argumentation Technique</td>
</tr>
<tr>
<td></td>
<td>➢ Finding Similarity and Difference</td>
<td>11</td>
<td>➢ Station Technique (Writing an Examples)</td>
</tr>
<tr>
<td>4</td>
<td>➢ Writing Riddles</td>
<td></td>
<td>➢ Argumentation Technique</td>
</tr>
<tr>
<td></td>
<td>➢ 5WH Technique</td>
<td></td>
<td>➢ Writing Story</td>
</tr>
<tr>
<td></td>
<td>➢ Socratic Inquiry Technique</td>
<td></td>
<td>➢ Station Technique (Writing an Examples)</td>
</tr>
<tr>
<td></td>
<td>➢ Writing Review</td>
<td></td>
<td>➢ Argumentation Technique</td>
</tr>
<tr>
<td>5</td>
<td>➢ Question and Answer</td>
<td>12</td>
<td>➢ Card Matching Game</td>
</tr>
<tr>
<td></td>
<td>➢ Drama Technique</td>
<td></td>
<td>➢ STory Completion</td>
</tr>
<tr>
<td></td>
<td>➢ Roundtable Discussion Technique</td>
<td></td>
<td>➢ Aquarium Technique</td>
</tr>
<tr>
<td></td>
<td>➢ Writing Letters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>➢ Educational Game</td>
<td>13</td>
<td>➢ Concept Map</td>
</tr>
<tr>
<td></td>
<td>➢ Writing “Mani”</td>
<td></td>
<td>➢ Structural Grid</td>
</tr>
<tr>
<td></td>
<td>➢ Script Writing</td>
<td></td>
<td>➢ Finding Similarity and Difference</td>
</tr>
<tr>
<td></td>
<td>➢ Snowball Technique</td>
<td></td>
<td>➢ Case Study (Butter-Bread Technique)</td>
</tr>
<tr>
<td>7</td>
<td>➢ Finding Similarity and Difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Station Technique (Acrostic, STory, Slogan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>➢ Panel Discussion</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source(s):** Table by authors

---

Table 2. The methods, techniques and activities used each week.
**Epistemological Belief Scale Towards Learning:** Kutluca *et al.* (2018) developed a 23-item scale with four dimensions: Access to Information, Against Genetic Nature, Absolute and Single Reality and Epistemic Contradiction. The scale’s Cronbach’s alpha coefficient is 0.79.

**Pedagogical Belief Systems Scale:** Soysal *et al.* (2018) created a 26-item scale to measure teacher-centered (14 items) and student-centered (12 items) pedagogical beliefs. The scale has a Cronbach’s Alpha coefficient of 0.77.

**Achievement Test:** After conducting a study, the academic achievement levels of the students were determined using an achievement test comprising of 60 questions. 19 questions were related to “Developmental Psychology” while 41 questions were related to “Learning Psychology”. The “Learning Psychology Course Achievement Test” (Sahin *et al.*, 2020) consisting of 50 questions was used to select the “Learning Psychology” questions. The average difficulty level of these questions was 0.50. Four questions with a discrimination coefficient of less than 0.3 were corrected accordingly. The researchers also created a pilot application test consisting of 40 questions for “Developmental Psychology” and administered it to 210 undergraduate students specializing in Turkish Language Teaching, PDR and English Language Teaching. After analysis, 19 questions were selected from the test. Corrections were made in seven items with a discrimination coefficient of 0.21–0.26. The average difficulty level of the selected questions was 0.42.

**Data analysis**

The data analysis was done with the assistance of the SPSS software. The Kolmogorov–Smirnov test was utilized to determine normality. The pre-test scores for the “Achievement Test” were not normally distributed (0.002), while the post-test scores were distributed normally (0.200). Conversely, the pre-test scores for the “Epistemological Beliefs Scale towards Learning” were distributed normally (0.200), but the post-test scores were not distributed normally (0.032). Both pre-test and post-test scores for the “Pedagogical Belief Systems Scale” were normally distributed (0.200).

We used the Wilcoxon Signed Rank and Mann–Whitney U tests for data that did not exhibit normal distribution and had less than 30 individuals in the groups. In other cases, we used the independent samples t-test. We found a significant difference in pre-test scores for the “Pedagogical Belief Systems Scale,” the ANCOVA test was utilized to control for pre-test scores and determine if there was a significant difference in post-test scores between the groups. Before conducting ANCOVA, all prerequisites were checked to ensure they were met.

1. **Independence of the Groups:** A student was not included in more than one group in the study. In this case, the assumption of independence of the groups from each other is met.

2. **Normal Distribution and Homogeneity of Variances:** To begin with, we analyzed the normality of the pre-test and post-test scores. It was seen that both were normally distributed ($\phi = 0.200$). We used Levene’s test to check the homogeneity of variances assumption, and the results showed that they were insignificant ($F = 0.138, p = 0.712$).

3. **Linearity:** We conducted a correlation analysis to examine whether a linear relationship exists between post-test and pre-test data. The results showed a correlation coefficient ($R$) of 0.509 and a significance level ($p$) of less than 0.05. It is important to note that a correlation coefficient of at least 0.3 between the dependent variable and the covariate is required for linearity.
Equality of Intra-Group Regression Coefficients: Within-group regression slopes were examined for this purpose. According to the results obtained, it was found that the combined effect of the pre-test scores and the two different applications in the groups on the post-test scores were insignificant ($P_{\text{group}} \times \text{pre-test} = 1.227 > 0.05$).

Validity and reliability
The KR-20 reliability was utilized to determine the internal consistency, while Cronbach’s Alpha reliability was employed to determine the internal consistency of the scales. Table 3 displays the reliability coefficients obtained for the pre-test and post-tests of the measurement tools.

As seen in Table 3, the reliability coefficients vary between 0.641 and 0.888. For the reliability coefficient, values between 0.60 and 0.70 are acceptable, between 0.70 and 0.80 is good and between 0.80 and 0.95 indicates a high level (Boateng et al., 2018; Coaley, 2010; Kline, 1986). In this case, it can be said that the pre-test and post-test results of all scales are reliable.

Results
The research results align with research problems: 1) Academic Achievement, 2) Epistemological Belief in Learning and 3) Pedagogical Belief Systems.

Academic achievement
Table 4 shows the Mann–Whitney U test results to find differences in pre-test scores for groups “Learning Psychology Course Achievement Test.”

After analyzing Table 5, we can conclude that there is no significant difference in the pre-test scores of the groups for the “Learning Psychology Course Achievement Test” ($z = -0.547$, $p = 0.584$). This means that the groups are equally matched in terms of academic success prior to the applications.

The Wilcoxon Signed Ranks test results for the “Learning Psychology Course Achievement Test” pre-test and post-test scores are presented in Table 5.

After analyzing Table 5, it is clear that there is a significant difference between the grades of the “Learning Psychology Course Achievement Test” for the experimental and control groups. The test results show that the experimental group had a Z-score of $-4.202$ with a $p$-value of 0.00002, while the control group had a Z-score of $-3.834$ and a $p$-value of 0.0010.

<table>
<thead>
<tr>
<th>Measurement tools</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement test</td>
<td>0.825</td>
<td>0.853</td>
</tr>
<tr>
<td>Epistemological belief scale towards learning</td>
<td>0.737</td>
<td>0.641</td>
</tr>
<tr>
<td>Pedagogical belief systems scale</td>
<td>0.888</td>
<td>0.865</td>
</tr>
</tbody>
</table>

Source(s): Table by authors

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>35</td>
<td>35.24</td>
<td>1233.50</td>
<td>-0.547</td>
<td>0.584</td>
</tr>
<tr>
<td>Control group</td>
<td>32</td>
<td>32.64</td>
<td>1044.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source(s): Table by authors

Table 3. Reliability coefficients of measurement tools
Table 4. Pre-test Mann–Whitney U test results
Both groups had better post-test scores, suggesting that the procedures carried out in both groups had a positive impact on learning.

Table 6 displays \( t \)-test results to determine significant differences between groups’ “Learning Psychology Course Achievement Test” scores after applications.

After analyzing Table 6, it is clear that there was no significant difference observed in the “Learning Psychology Course Achievement Test” scores between the groups (\( t = 0.695, p = 0.489 \)). It indicates that both groups gained equal benefits from the applications used, and there was no significant difference in their academic achievements.

**Epistemological Belief in Learning**

Table 7 displays the Mann–Whitney \( U \) test results, which compares the “Epistemological Belief Scale towards Learning” scores of the groups before and after the applications.

After analyzing Table 7, it is clear that there is no significant difference in the pre-test (\( z = -0.214, p = 0.831 \)) and post-test (\( z = -1.027, p = 0.304 \)) scores of the “Epistemological Belief Scale for Learning” between the groups. As a result, it can be concluded that the groups were comparable to each other prior to the intervention, and no change in the students’ epistemological beliefs occurred at the end of the interventions.

The results of the Wilcoxon Signed Ranks test to determine if there was a difference between the groups’ pre-test and post-test scores on the “Epistemological Belief Scale towards Learning Scale” are presented in Table 8.

---

**Table 5.**
Wilcoxon signed ranks test pre-test and post-test results

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>6</td>
<td>8.67</td>
<td>52.00</td>
<td>-4.202</td>
<td>0.00002</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>28</td>
<td>19.39</td>
<td>543.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative Ranks</td>
<td>4</td>
<td>13.13</td>
<td>52.50</td>
<td>-3.834</td>
<td>0.0001</td>
</tr>
<tr>
<td>Positive Ranks</td>
<td>27</td>
<td>16.43</td>
<td>443.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ties</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source(s):** Table by authors

---

**Table 6.**
Post-test \( t \)-test results between groups

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>35</td>
<td>34.29</td>
<td>9.25</td>
<td>0.695</td>
<td>0.489</td>
</tr>
<tr>
<td>Control</td>
<td>32</td>
<td>32.78</td>
<td>8.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source(s):** Table by authors

---

**Table 7.**
Mann–Whitney \( U \) test results between groups

<table>
<thead>
<tr>
<th>Tests</th>
<th>Groups</th>
<th>N</th>
<th>Mean rank</th>
<th>Sum of ranks</th>
<th>Z</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>Experimental</td>
<td>26</td>
<td>27.46</td>
<td>714.00</td>
<td>-0.214</td>
<td>0.831</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>27</td>
<td>26.56</td>
<td>717.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test</td>
<td>Experimental</td>
<td>26</td>
<td>24.79</td>
<td>644.50</td>
<td>-1.027</td>
<td>0.304</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>27</td>
<td>29.13</td>
<td>786.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source(s):** Table by authors
Table 8 indicates that the difference between pre-test and post-test scores of the “Epistemological Belief in Learning” scale in the experimental group was not significant ($z = -0.351, p = 0.726$). However, in the control group, there was a significant difference in favor of the post-test ($z = -2.898, p = 0.004$). It was observed that the application used in the control group had a positive impact on students’ epistemological beliefs towards learning.

**Pedagogical belief systems**

Table 9 displays the Mann–Whitney $U$ test results to compare the “Pedagogical Belief Systems Scale” scores of the groups before and after the applications.

After examining Table 9, it is clear that there is a significant difference between the pre-test ($z = -2.051, p = 0.040$) and post-test ($z = -2.130, p = 0.033$) scores of the “Pedagogical Belief Systems Scale” for the different groups. This indicates that the groups were not equal before the application. Additionally, there has been a change in the students’ pedagogical belief systems after the applications.

To determine if the difference between the groups’ post-test scores is due to pre-test variance, it is important to conduct an ANCOVA test. This test helps to control for pre-test scores and establish if there is a significant difference in the post-test scores of the groups. The descriptive statistics from the analysis are presented in Table 10.

After the ANCOVA analysis, the mean of the experimental group increased from 96.04 to 97.42, while the control group’s mean decreased from 103 to 101.43, as shown in Table 10.

---

**Table 8.** Wilcoxon signed ranks test pre-test and post-test results

**Table 9.** Mann–Whitney $U$ test results between groups

**Table 10.** Descriptive statistics of groups after ANCOVA analysis
Table 11 shows the results of the post-test scores of the groups after the ANCOVA analysis.

Upon analyzing Table 11, it was found that the difference between the groups' post-test scores was not statistically significant ($F = 1.787, p = 0.188$) when controlling for pre-test scores. The effect size value ($\eta^2 = 0.041$) indicates that the experimental process applied to the groups had a low effect on altering the students' pedagogical belief systems. This means that only 4% of the change in pedagogical belief, which is the dependent variable, is a result of the procedures applied to the groups. Additionally, it was observed that 21% of the difference in post-test scores between the groups is attributed to the pre-test difference.

The results of the Wilcoxon Signed Ranks test are presented in Table 12 to determine if the practices had an impact on the “Pedagogical Belief Systems Scale” pretest-posttest scores.

Upon analyzing the data from Table 12, it was discovered that there was no significant difference in the pre-test and post-test scores of the experimental group for the “Pedagogical Belief Systems” scale ($z = -1.188, p = 0.235$). However, the post-test scores of the control group showed a significant improvement ($z = -2.057, p = 0.040$). This indicates that the procedures implemented in the control group had a positive impact on the students' pedagogical belief systems.

**Discussion**

This study aimed to compare the impact of face-to-face and online flipped learning on students’ academic achievements and their perspectives on learning and teaching, offering valuable insights to the field.

This research has shown that both face-to-face and online flipped learning have a positive impact on learning outcomes (see Table 5). In support of this result, several recent studies conducted by Donovan and Lee (2015), Green (2015), McCallum et al. (2015), Şahin et al. (2020), Whitman Cobb (2016), and Williams, Aguilar-Roca and O’Dowd (2015) have found that adopting a face-to-face flipped learning model enhances student achievement. Meanwhile, online flipped learning has also been found to contribute to students’ knowledge development.
in various studies (Kian et al., 2022; Musa et al., 2021). Moreover, several meta-analyses conducted by Aydin et al. (2021), Chen et al. (2018), Cho and Lee (2018) and Orhan (2019) have found that flipped learning has a moderate impact on students’ academic achievement when compared to traditional learning methods.

This research has found that both face-to-face and online flipped learning have an equal impact on students’ academic achievement (see Table 6). There have been few studies that have assessed the effectiveness of both face-to-face and online flipped learning. Two research studies conducted by Hew et al. in 2020 and Jia et al. in 2023 yielded similar results, indicating no significant difference in academic achievement between the two methods. These findings suggest that online flipped learning has the potential to be equally effective as the traditional face-to-face approach.

Online flipped learning did not have an impact on students’ epistemological beliefs; however, face-to-face flipped learning had a significant positive effect on it (see Table 8). There has been no research in the literature on how flipped learning affects students’ epistemological beliefs. However, studies have shown that the pedagogical activities that students encounter can have an impact on their epistemological beliefs. The study conducted by Jehng et al. (1993) suggests that students’ beliefs about learning are shaped by their activities, cultures and contexts. Recent research has revealed that interactive teaching materials and activities can have a positive effect on students’ epistemological beliefs (Sheehey et al., 2023). For example, Atasoy and Küçük (2020) found that “writing for learning” activities can improve students’ epistemological beliefs. In this regard, it can be thought that interactive activities in face-to-face flip learning have the potential to influence and shape students’ epistemological beliefs.

Online flipped learning did not have an impact on students’ pedagogical beliefs; however, face-to-face flipped learning had a significant positive effect on it (see Table 12). The pedagogical activities that students encounter not only affect their epistemological beliefs, but also their pedagogical beliefs. For example, Kaşkaya’s (2023) study showed that the “critical reflection” approach, implemented after watching educational movies, can affect aspiring teachers’ pedagogical beliefs. It can be said that interaction in a face-to-face flipped learning environment changes an individual’s pedagogical beliefs, but interaction in an online environment might not be enough to alter an individual’s pedagogical beliefs.

Conclusion
The flipped learning approach is a modern teaching method that presents unique student challenges. This approach involves students learning course material at home through videos or interactive activities and then using classroom time to discuss and apply the material rather than traditional lectures. However, this approach’s online aspect poses additional challenges, such as potential difficulties with technology, the need for self-discipline and time management and the lack of face-to-face interaction between students and teachers. These challenges can negatively impact students’ socialization and interaction with their peers and teachers.

It is important to understand that simply providing interactive activities and resources online may not be enough to satisfy students and change their perceptions. Although online learning makes learning and engagement possible, the student-centered and constructivist approaches may not be fully realized in non-face-to-face environments. To enhance the effectiveness of flipped learning, real-time communication with instructors and friends may be necessary. While online platforms provide a way to communicate and exchange ideas, digital interactions may not easily influence deep-rooted beliefs and worldviews. Therefore, it is important to recognize that online interactions may not always result in transformative learning experiences, and other strategies may be necessary to effect meaningful change.
The more significant impact of face-to-face flipped learning on students’ epistemological and pedagogical beliefs may be due to the “protection of personal interests” bias that students have. Preservice teachers may have viewed the online flipped classroom as a game-changer in education. This study shows that students still value the face-to-face and interactive presence of a facilitator and a guide. On the other hand, many students may consider an online flipped classroom environment unconventional and too far beyond the limits.

The virtual learning environment is different from traditional classrooms, and students may require time to adapt. Despite some challenges, the online flipped learning approach offers a flexible and creative way to improve students’ learning experiences. It has the potential to revolutionize the way students learn and engage with course material. However, implementing flipped learning in an online setting may necessitate some innovative modifications.

References


Bergmann, J. and Sams, A. (2012), Flip Your Classroom: Reach Every Student in Every Class Every Day, Internal Society for Technology in Education, Washington, DC.


Coaley, K. (2010), An Introduction to Psychological Assessment and Psychometrics, SAGE Publications, USA.


**Corresponding author**

Şeyma Şahin can be contacted at: seymasahin@gmail.com

---

For instructions on how to order reprints of this article, please visit our website: [www.emeraldgrouppublishing.com/licensing/reprints.htm](http://www.emeraldgrouppublishing.com/licensing/reprints.htm)

Or contact us for further details: permissions@emeraldinsight.com