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Impact of Educational Stage in the Application of Flipped Learning: A Contrasting Analysis with Traditional Teaching

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Abstract: The effectiveness of flipped learning depends largely on student typology. This study analyzes the applicability of this approach, according to the characteristics inherent to students based on their educational stage. The objective of the research is to verify the effectiveness of flipped learning compared to a traditional methodology during the stages of preschool, primary, and secondary education. For this study, a descriptive and correlational experimental research design was followed, based on a quantitative methodology. Two types of analysis groups (control and experimental) were established in each of the mentioned educational stages. As a data collection instrument, a validated ad hoc questionnaire was applied to a sample of 168 students from the Autonomous City of Ceuta (Spain). The results show that the applicability of flipped learning is more positive in primary and secondary education when compared to a traditional teaching method. However, the results found in preschool education reflect the difficulties in adapting the model to the needs of the students of that stage, due to the difficulties in the autonomous management of digital teaching platforms and the requirement of a minimum level of abstraction to apply this approach.

Keywords: flipped learning; traditional teaching; educational stage; student's *t*-distribution

1. Introduction

Many of the educational practices that are carried out today are not applicable to the daily contexts in which students perform outside the school environment. A possible solution to this situation is implementing new pedagogies to reverse the actions and times that, in a traditional way, take place in the classroom [1]. In this way, flipped learning has recently acquired a leading role [2,3] as an alternative that was developed due to the inclusion of information and communication technologies (ICT) in the field of education, to give greater prominence to students during their learning processes [4,5].

The flipped learning concept was coined in 2012 by two experts in the area of education (Jonathan Bergmann and Aaron Sams). The experts, in their teaching exercise, made online audiovisual material so that students who did not regularly attend the classroom could maintain their learning [6]. Since then, its evolution has been constant, and it has a greater number of followers thanks to its effectiveness in transferring teaching and learning processes [7].

On a pedagogical level, flipped learning (called inverted learning in Spanish [8]) consists of "flipping" traditional learning situations [9]. In this way, when students are outside schools, they can learn theoretical content through information and communication technologies (ICT), either by viewing explanatory videos or working with didactic applications, among other actions [10–13].

Consequently, the teaching period is used to apply work dynamics or active practices related to the relevant theory [14–17], which promotes the interaction between all educational agents involved in the classroom [18,19].

This teaching method enhances the role of the student, who determines and guides his or her own training autonomously [20,21]. The student can access the didactic contents, provided that he or she has a mobile device with Internet access, from anywhere and at any time [22,23]. This allows student to adapt the content to his or her learning style or moments of greatest motivation during the training process [24–27]. In this way, mixed education is promoted, which allows one to combine the best of face-to-face teaching and online teaching [28,29].

Several studies show the benefits of this teaching method for students. Among these benefits, it has been found that it promotes high motivation rates [27], commitment [30,31], responsibility, and participation [32]. These levels are justified by the high degree of freedom available to students to restructure and adapt the acquisition of theoretical content [21,33] and self-regulate their own training processes [1,34,35].

This method also encourages collaborative and cooperative work among equals [36], which generates a higher level of interrelation and enhances socialization both inside and outside the classroom [12,24,37,38]. This climate within the classroom generates the search for solutions to the problems posed [12,39].

All this affects the degree of content acquisition [40] and, therefore, the grades obtained by students [41–43], which allows them to reach the curricular elements raised during the academic year [44–46].

The formative climate generated by flipped learning encourages students' attitudes toward learning to be more positive [47], which enhances their performance compared to traditional teaching methods [43,48–50].

These characteristics of active methodologies are different from those that correspond to a traditional teaching methodology. In the traditional classroom, the teacher has almost exclusive control over the instructional process [51]. This approach provides students with standardized objectives to achieve and offers instructions via a measurable key that is reinforced collectively [52] by resorting to memorization [53]. In this type of traditional methodology, students learn via specific assessments such as written content tests [54], all without crossing the spatial limits of the closed classroom [55].

Despite all the benefits mentioned above, the flipped learning method can also generate some difficulties for the student. These complexities have been found mainly when the student is in situations with a difficult resolution [39,56], especially in situations related to the access and management of teaching platforms [31] and when dealing with concepts that require a high level of abstraction [19].

The success of the implementation of flipped learning requires the involvement, training, and dedication of teachers [57], as well as an optimal level of digital competence to generate digital resources [58] and organize and adapt the virtual spaces where the content is located [59,60]. In addition, this approach requires teachers to sometimes dedicate their own time to generating resources to follow, guide, and adequately tutor the student [61,62].

Justification and Objectives

The effectiveness of the application of flipped learning depends largely on the student typology upon which it is put into practice [63]. Its application is very different depending on the educational stage in which the teacher performs his or her function [64]. This approach follows the investigative path of other research that measures the effectiveness of an inverted classroom when compared to traditional methodologies. This verifies its benefits based on an amalgam of academic and attitudinal indicators [65]. However, the studies shown in the literature review analyzed the results obtained after applying the approach but do not compare the results in the various educational stages (Preschool, Primary, and Secondary Education). Consequently, this study focuses on a little researched field within the area of education and the application of active methodologies.

The present study analyzes the applicability of the approach while taking into account the characteristics inherent to students according to their educational stage of preschool, primary, or secondary education. The results are an important starting point for determining if this approach is adapted effectively and is relevant to the needs of students [66].

The general objective of the research is to verify the effectiveness of the flipped learning approach compared to a traditional methodology in three different educational stages (preschool, primary, and secondary education). These statements, to conduct the investigation, are broken down into the following objectives with a higher level of concreteness.

(1) To determine the effects of the attitudinal aspects of a traditional methodology and the flipped learning approach as they relate to the mental abilities of students including motivation, self-regulation and flexibility, autonomy and critical thinking, creative thinking and decision-making, and problem solving.

(2) To determine the effects of the traditional methodology and the flipped learning approach on the interactive and effective aspects of the teaching and learning process, the following factors are necessary: interactions with teachers or the peer group, access to and choice of materials and/or contents, the temporary use of the session, the individualization of learning, and the achievement of objectives.

(3) To comparatively analyze the application of the flipped learning approach in stages to determine which variables turn out to be more potentiated in each stage.

2. Materials and Methods

To carry out this study, a descriptive and correlational experimental design was established, based on quantitative methodology and the guidance of experts [67,68]. In this investigation, two types of analysis groups (control and experimental) were configured in each of the educational stages mentioned above. The control group followed a traditional teaching and learning process, while the experimental group developed a training praxis through flipped learning. As an independent variable, the use of a technopedagogical approach (flipped learning) is taken, and the degree of effectiveness achieved by the students during the learning process is set as the dependent variable.

2.1. Participants

The study sample is composed of 168 students who are enrolled in a teaching cooperative in the Autonomous City of Ceuta (Spain). These subjects were selected through a non-probabilistic sampling for convenience, given their ease of access, and are in the last level of preschool education (n = 48, M_{AGE} = 5 years, SD = 0.26), the sixth grade of primary education (n = 60, M_{AGE} = 12 years, SD = 1.03), and the fourth year of secondary education (n = 60, M_{AGE} = 16 years, SD = 1.36). In this way, the sample is distributed in two sample subgroups corresponding to the experimental group (n = 83, 49.4%) and the control group (n = 85, 50.6%).

The configuration of the study groups is shown in Table 1.

Table 1. Sample distribution by sex and educational stage.

Boys	**Preschool**	**Primary**	**Secondary**
	n (%)	**n (%)**	**n (%)**
Experimental group	10 (12.05)	17 (20.48)	14 (16.87)
Control group	11 (12.94)	19 (22.35)	13 (15.29)
Subtotal	21 (12.5)	36 (21.43)	27 (16.07)
Girls	**Preschool**	**Primary**	**Secondary**
Experimental group	13 (15.66)	13 (15.66)	16 (19.28)
Control group	14 (16.47)	11 (12.94)	17 (20)
Subtotal	27 (16.07)	24 (14.29)	33 (19.64)

Source: Own elaboration.

2.2. Instrument

The data collection phase was carried out through an ad hoc questionnaire, designed by researchers based on other tools and variables reported from the scientific literature. The educational stage was taken as an important sociodemographic factor during the application of flipped learning [58]. The following variables of the Thomas Discroll questionnaire were selected [69]: access to materials, self-regulation, and autonomy and increased interactions between students and the teacher. This questionnaire is important because it is a pioneer in analyzing the incidence of flipped learning among students. Santiago and Bergmann adapted this analysis to a Spanish context [64], by taking into account the context of primary and secondary education, like the present study. For this reason, the ad hoc questionnaire intends to update this past investigation of the flipped learning model to be able to inquire about its incidence at each educational stage, combining study perspectives that were already initiated but which had not been previously compared.

The instrument is composed of 42 items, classified in three dimensions (sociodemographic, attitude and mental ability, and interactive-effective). The response configuration follows a four-point Likert format, and the questionnaire has a format similar to an individualized evaluation rubric.

The validation of the questionnaire was carried out qualitatively and quantitatively. The first validation was performed through the Delphi method, with the purpose of achieving expert feedback (six doctors in educational technology) from an objective and anonymous perspective [70]. The assessment of the judges reached an adequate value (Me = 4.93, SD = 0.37, min = 1, max = 6). The feedback received focused on the modification of certain issues to improve their interpretation. Likewise, Kappa de Fleiss and W de Kendall statistics were used to obtain the index of relevance and concordance of the assessments issued by these specialists (K = 0.82, W = 0.86). These results show adequate consistency among the possible values [−1,1] (greater than 0.75 and close to 0.9).

Quantitative validation was carried out following an exploratory factor analysis with a principal component analysis (PCA) by varimax rotation. Dependency was found between the variables with Bartlett's test of sphericity (2784.43, $p < 0.001$) and by determining sample adequacy with the Kaiser-Meyer-Olkin test (KMO = 0.89).

Lastly, the reliability of the tool was calculated using various statistical procedures, which include: Cronbach's alpha = 0.86, compound reliability = 0.84, and mean variance extracted = 0.79.

Variables

The variables used in the present study within the attitudinal dimension and mental ability are shown below.

- Motivation: the level of interest and participation shown during learning activities.
- Self-regulation and flexibility: the ability to decide for yourself the organization of your learning.
- Autonomy and critical thinking: the ability to carry out learning tasks without teacher support and accepting mistakes and limitations.
- Creative thinking: the ability to imagine novel and different alternatives for the most frequent issues.
- Decision-making and problem solving: the ability to perform actions with initiative and determination.

On the other hand, the variables used within the interactive-effective dimension are:

- Interaction with teachers: answering open questions, query questions, and general communication with the teacher.
- Interaction with peers: communication and participation with other students.
- Access and choice of materials and/or content: the ease or difficulty for the student to use the facilitated learning tools and conceptual content.
- Temporary use of the session: the effective use of the time allocated to the teaching and learning processes.

- Individualization of learning: adaptation of the methodology to the particular needs of the student.
- Achievement of learning objectives: the degree of achievement of the planned objectives in relation to didactic contents.

2.3. Procedure

The study began in March 2019, when the researchers contacted the educational center in question. After a meeting with the management team at the location of the objectives of the investigation, consent was obtained to initiate the investigation.

The last level of each educational stage was selected (5-year-old child, sixth year of primary education, and fourth year of secondary education). The establishment of the control and experimental groups was carried out randomly, because the educational center has two lines (A and B) for each level, which facilitated the process of group configuration. Line A was established as a control group and line B was established as the experimental group.

The experiment was produced with content related to the Spanish Language and Literature, so that the area of languages, communication, and representation in preschool education, as well as the subject of the Spanish language and literature, were used in the stages of primary education and secondary education. A didactic unit (treatment) was composed of 10 sessions taught by a member of the research group because he performs his teaching work in the educational center. The control group followed a traditional training action, without the use of ICT, and the experimental group used a flipped learning approach throughout the development of the unit.

The flipped learning modality inverted traditional learning situations [9]. Therefore, during the sessions in the classroom, the students visualized different explanatory videos, worked with didactic applications of digital and technological components, and reinforced the learning of theoretical content [10–13]. Consequently, the teaching period was used to apply work dynamics or active practices related to the theory being learned. In the preschool education stage, given the difficulty of producing a total investment in learning, an adaptation similar to that by Santiago and Bergmann [64] (flipped learning 3.0.) was carried out. Using this adaptation, it was not necessary to select a different time for the session to actuate inverted learning fully and effectively.

In the group that followed traditional learning, the applicator (teacher) held sessions in which he held control and prominence in the teaching and learning processes [51]. The teacher provided standardized instructions and objectives that students had to memorize [53] and reinforce collectively [52]. Subsequently, the students had to capture the assimilated learning in a specific assessment test materialized as a written content exam [54], without transcending the spatial limits of the closed classroom [55].

Once the implementation of the didactic unit was completed, the applicator completed the rubric questionnaire with the individualized results for each student. Subsequently, the data were analyzed in detail statistically. To ensure the integrity of the investigation, the evaluation rubric contained the achievement indicators for each value established in the questionnaire (1–4). It was clearly shown what the contribution of the methodology was to the students regarding the action in question (what do the students do?), the content (how do they concretize the action?), and the condition (how do they do it?). In this way, the applicator had the necessary information to determine which result was associated with each of the achievement indicators and, subsequently, with the study variables. In addition, a pilot test was conducted with participants of similar characteristics, in which the implementation of the questionnaire was subject to supervision.

2.4. Data Analysis

The statistical analysis was carried out using basic descriptions, such as the number of frequencies (n) and its equivalent percentage (%), the Mean (M), and the standard deviation (SD). Similarly, specific coefficients were applied to determine the trend of sampling distribution, such as Fisher's skewness (Skew) and Pearson's kurtosis (Kurt). A comparison of means between the established groups was

performed using a Student's t-test, to measure the size of the effect that originated via Cohen's d and biserial correlation (r) with $p < 0.05$ as a statistically significant difference. All statistical treatments were carried out using the Statistical Package for the Social Sciences (SPSS, v. 24).

3. Results

The results shown in Table 2 reflect the scores obtained by the control groups during the teaching and learning processes, which were differentiated by stages. In the three stages analyzed, it was observed that the use of a traditional methodology resulted in greater empowerment of the contents interacting and greater achievement of the learning objectives. The temporary use of the session is important in primary and secondary education. On the other hand, self-regulation and creativity were the least potentiated skills in preschool education, while interaction with the teacher and critical thinking were the variables with the lowest score in primary and secondary education. Likewise, it is relevant to highlight that, of the eleven variables analyzed, only six of them were in the infant stage, four were in primary education, and three were in secondary education, which exceed the central score (M ≥ 2.5).

Table 2. Results obtained for the study variables in the control group.

		Likert Scale n (%)				Parameters			
		None	Few	Enough	Completely	M	SD	Skew	Kurt
Preschool Education	Motivation	5 (20)	5 (20)	8 (32)	7 (32)	2.68	1.08	1.55	−1.21
	Self-regulation	11 (44)	10 (40)	4 (16)	0 (0)	1.72	0.72	0.99	−0.98
	Autonomy	10 (40)	9 (36)	4 (16)	2 (8)	1.92	0.93	9.98	−0.38
	Creativity	3 (12)	4 (16)	10 (40)	8 (32)	2.92	0.97	1.97	−0.6
	Resolution	6 (24)	8 (32)	9 (36)	2 (8)	2.28	0.92	1.4	−0.96
	Teacher	2 (8)	8 (32)	12 (46)	3 (12)	2.64	0.79	2.07	−0.36
	Classmates	5 (20)	9 (36)	7 (28)	4 (16)	2.4	0.98	1.43	−0.98
	Contents	2 (8)	3 (12)	14 (56)	6 (24)	2.96	0.82	2.38	0.4
	Time	3 (12)	6 (24)	9 (36)	7 (28)	2.8	0.98	1.84	0.89
	Individualization	1 (4)	16 (64)	7 (28)	1 (4)	2.32	0.61	2.15	0.56
	Objectives	0 (0)	7 (28)	10 (40)	8 (32)	3.04	0.77	2.64	−1.33
Primary Education	Motivation	6 (20)	10 (33.4)	7 (23.3)	7 (23.3)	2.5	1.06	1.42	−1.21
	Self-regulation	8 (26.7)	7 (23.3)	11 (36.7)	4 (13.3)	2.37	1.02	1.34	−1.77
	Autonomy	7 (23.3)	7 (23.3)	11 (36.7)	5 (16.7)	2.47	1.03	1.43	−1.14
	Creativity	10 (33.3)	8 (26.7)	7 (23.3)	5 (16.7)	2.23	1.18	1.14	−1.22
	Resolution	7 (23.3)	11 (36.7)	7 (23.3)	5 (16.7)	2.33	1.01	1.32	−1.02
	Teacher	8 (26.7)	13 (43.3)	6 (20)	3 (10)	2.13	0.92	1.23	−0.55
	Classmates	4 (13.3)	15 (50)	9 (30)	2 (6.7)	2.3	0.78	1.66	−0.27
	Contents	1 (3.3)	12 (40)	11 (36.7)	6 (20)	2.73	0.81	2.13	−0.87
	Time	3 (10)	8 (26.7)	12 (40)	7 (23.3)	2.77	0.92	1.92	−0.75
	Individualization	2 (6.7)	17 (56.7)	8 (26.7)	3 (10)	2.4	0.76	1.85	−0.08
	Objectives	1 (3.3)	7 (23.3)	14 (46.7)	8 (26.7)	2.97	0.79	2.47	−0.48
Secondary Education	Motivation	10 (33.3)	13 (43.3)	5 (16.7)	2 (6.7)	1.97	0.87	1.1	−0.23
	Self-regulation	9 (30)	9 (30)	8 (26.7)	4 (13.3)	2.23	1.02	1.21	−1.09
	Autonomy	10 (33.3)	11 (36.7)	5 (16.7)	4 (13.3)	2.1	1.02	1.08	−0.77
	Creativity	11 (36.7)	11 (36.7)	6 (20)	2 (6.7)	1.97	0.91	1.06	−0.56
	Resolution	6 (20)	10 (33.3)	9 (30)	5 (16.7)	2.43	0.98	1.45	−1.03
	Teacher	13 (43.3)	11 (36.7)	4 (13.3)	2 (6.7)	1.83	0.9	0.93	−0.03
	Classmates	10 (33.3)	14 (46.7)	6 (20)	0 (0)	1.87	0.72	1.21	−1.05
	Contents	1 (3.3)	12 (40)	12 (40)	5 (16.7)	2.7	0.78	2.18	−0.7
	Time	2 (6.7)	14 (46.7)	8 (26.7)	6 (20)	2.6	0.88	1.82	−0.87
	Individualization	2 (6.7)	21 (70)	5 (16.7)	2 (6.7)	2.23	0.67	1.85	1.35
	Objectives	2 (6.7)	9 (30)	12 (40)	7 (23.3)	2.8	0.87	2.06	−0.74

Source: Own elaboration.

Regarding the scores obtained by the experimental groups (Table 3), the access and choice of materials and content together with the achievement of the learning objectives are the most potent variables in preschool education. Interaction with the teacher remains one of the most outstanding variables in primary and secondary education, highlighting, in this last stage, the temporary use of

the session. Of the eleven variables analyzed, the use of flipped learning allowed them to exceed the central score (M ≥ 2.5) for eight of the variables in preschool education and all the variables analyzed in the primary and secondary stages.

Table 3. Results obtained for the study variables in the experimental group.

		Likert Scale n (%)				Parameters			
		None	**Few**	**Enough**	**Completely**	**M**	**SD**	**Skew**	**Kurt**
Preschool Education	Motivation	3 (13)	4 (17.4)	9 (39.1)	7 (30.5)	2.86	0.99	1.88	−0.73
	Self-regulation	9 (39.1)	9 (39.1)	5 (21.8)	0 (0)	1.83	0.76	1.09	−1.22
	Autonomy	8 (34.8)	8 (34.8)	5 (21.7)	2 (8.7)	2.04	0.95	1.09	−0.75
	Creativity	3 (13.1)	3 (13.1)	9 (39.1)	8 (34.7)	2.96	0.99	1.96	−0.56
	Resolution	5 (21.8)	9 (39.1)	7 (30.4)	2 (8.7)	2.26	0.89	1.41	−0.76
	Teacher	0 (0)	6 (26.1)	12 (52.2)	5 (21.7)	2.96	0.69	2.83	−0.9
	Classmates	4 (17.4	6 (26.1)	9 (39.1)	4 (17.4)	2.56	0.97	1.61	−0.94
	Contents	2 (8.7)	2(8.7)	11(47.8)	8 (34.8)	3.08	0.88	2.37	0.35
	Time	2 (8.7)	5 (21.8)	9 (39.1)	7 (30.4)	2.91	0.93	2.06	−0.66
	Individualization	1 (4.4)	7 (30.4)	13 (56.5)	2 (8.7)	2.7	0.69	2.47	0.08
	Objectives	0 (0)	4 (17.4)	10 (43.5)	9 (39.1)	3.22	0.72	3.08	−1.03
Primary Education	Motivation	3 (10)	5 (16.7)	12 (40)	10 (33.3)	2.97	0.95	2.07	−0.5
	Self-regulation	3 (10)	7 (23.3)	13 (43.3)	7 (23.3)	2.8	0.91	1.98	−0.61
	Autonomy	2 (6.7)	4 (13.3)	7 (23.3)	17 (56.7)	3.3	0.94	2.46	0.1
	Creativity	7 (23.3)	10 (33)	9 (30)	4 (13.3)	2.33	0.98	1.36	−0.99
	Resolution	3 (10)	8 (26.7)	12 (40)	7 (23.3)	2.77	0.92	1.92	−0.75
	Teacher	1 (3.33)	3 (10)	12 (40)	14 (46.7)	3.3	0.78	2.94	0.58
	Classmates	1 (3.33)	4 (13.3)	15 (50)	10 (33.3)	3.13	0.76	2.79	0.24
	Contents	3 (10)	4 (13.3)	13 (43.3)	10 (33.3)	3	0.93	2.15	−0.24
	Time	3 (10)	5 (16.7)	11 (36.7)	11 (36.7)	3	0.97	2.07	−0.55
	Individualization	1 (3.33)	5 (16.7)	17 (56.7)	7 (23.3)	3	0.73	2.74	0.28
	Objectives	1 (3.33)	3 (10)	16 (53.3)	10 (33.3)	3.17	0.73	2.95	0.72
Secondary Education	Motivation	2 (6.7)	4 (13.3)	14 (46.7)	10 (33.3)	3.07	0.85	2.42	0.09
	Self-regulation	2 (6.7)	6 (20)	16 (53.3)	6 (20)	2.87	0.8	2.32	−0.03
	Autonomy	2 (6.7)	3 (10)	5 (16.7)	20 (66.7)	3.43	0.92	2.65	0.96
	Creativity	5 (16.7)	10 (33)	9 (30)	6 (20)	2.53	0.99	1.55	−1.04
	Resolution	3 (10)	6 (20)	11 (36.7)	10 (33.3)	2.93	0.96	2.01	−0.7
	Teacher	0 (0)	2 (6.7)	11 (36.7)	17 (56.7)	3.5	0.62	4.04	−0.31
	Classmates	0 (0)	3 (10)	15 (50)	12 (40)	3.3	0.64	3.59	−0.71
	Contents	2 (6.7)	3 (10)	12 (40)	13 (43.3)	3.2	0.87	2.52	0.37
	Time	0 (0)	2 (6.7)	10 (33.3)	18 (60)	3.53	0.62	4.1	−0.99
	Individualization	0 (0)	2 (6.7)	23 (76.7)	5 (16.7)	3.1	0.47	4.44	1.15
	Objectives	0 (0)	2 (6.7)	13 (43.3)	15 (50)	3.43	0.61	3.95	−0.57

Source: Own elaboration.

On the other hand, in Figure 1, a comparison between the study groups is observed by means of an area graph based on the average scores obtained in the attitudinal dimension and for mental ability. The means obtained by students who experienced a flipped learning methodology are higher than those for students who experienced a traditional methodology in the elementary and secondary stages. Although this trend is maintained in preschool education, the difference in means is much smaller at this stage.

Similarly, Figure 2 shows a comparison of the average scores obtained by the control groups and the experimental groups regarding the interactive-effective dimension. In the same way, as in the previous dimension, the means obtained by the experimental groups are higher than those of the control groups, with their difference being higher in primary and secondary education when compared to preschool education.

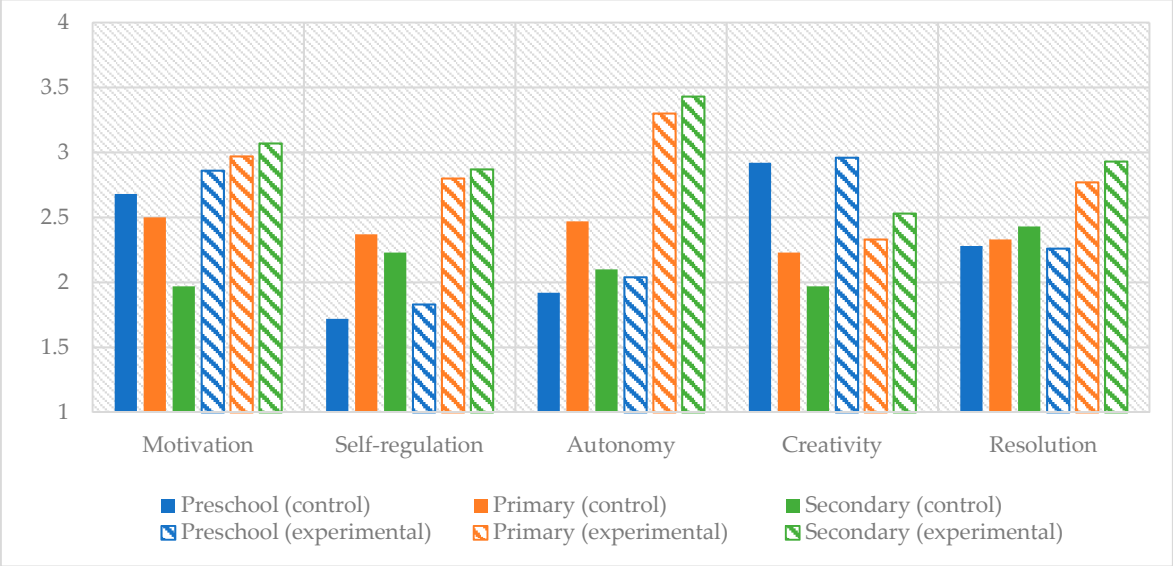

Figure 1. Intergroup comparative in the "attitude and mental ability" dimension.

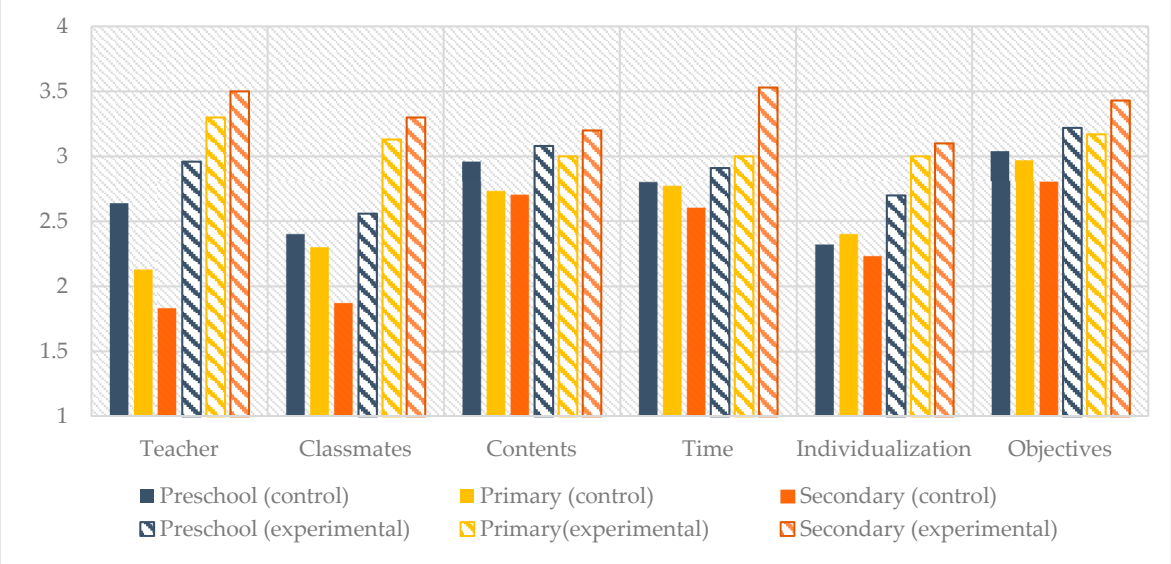

Figure 2. Intergroup comparative in the "interactive-effective" dimension.

In order to determine the value of independence between the results obtained when applying the traditional approach and during the implementation of the flipped learning approach (Table 4), Student's t-test was carried out with a standardized value of $p < 0.05$ as a statistically significant difference. Due to the comparative nature of this study, a small ($d = -0.2$), medium ($d = -0.5$), and large ($d = -0.8$) correlation force was differentiated. As a corrective element, for biserial correlation ($r = [0,1]$), a distinction was made between small ($r = -0.1$), medium ($r = -0.3$), and large ($r = -0.5$) effect sizes.

In preschool education, the only significance was found in the variable related to the individualization of student learning, which is a significance that has a small effect size based on the results obtained for the Cohen d statistics (d = −0.583) and biserial correlation (r = −0.28). In the primary education stage, the most potentiated variables in flipped learning compared to the traditional methodology are those related to autonomy, critical thinking, individualization, and interactions with teachers and classmates. Despite this, the strength of this aspect's association is reduced, with the exception of the interaction with the teacher, whose effect size was greater (r < −0.5). Lastly, the secondary education stage was the most decisive for applying flipped learning, since statistically significant differences were obtained in

all variables analyzed. This highlights the high strength of association in variables related to student interactions with the teaching staff and the peer group (r < −0.7).

Table 4. Study of the independence value between the control groups and experimental groups.

		Group, M (SD)		M_1–M_2	Student's *t*		*d*	*r*
					t (df)	*p*-Value		
Preschool Education	Motivation	2.68 (1.08)	2.86 (0.99)	0.2	2.68 (46)	0.541	–	–
	Self-regulation	1.72 (0.72)	1.83 (0.76)	0.11	0.48 (46)	0.633	–	–
	Autonomy	1.92 (0.93)	2.04 (0.95)	0.12	0.44 (46)	0.662	–	–
	Creativity	2.92 (0.97)	2.96 (0.99)	0.04	0.13 (46)	0.901	–	–
	Resolution	2.28 (0.92)	2.26 (0.89)	0.02	0.07 (46)	0.94	–	–
	Teacher	2.64 (0.79)	2.96 (0.69)	0.32	0.92 (46)	0.364	–	–
	Classmates	2.4 (0.98)	2.56 (0.97)	0.16	0.57 (46)	0.568	–	–
	Contents	2.96 (0.82)	3.08 (0.88)	0.12	0.5 (46)	0.617	–	–
	Time	2.8 (0.98)	2.91 (0.93)	0.11	0.4 (46)	0.689	–	–
	Individualization	2.32 (0.61)	2.7 (0.69)	0.38	2.01 (46)	0.048	0.583	0.28
	Objectives	3.04 (0.77)	3.22 (0.72)	0.18	0.81 (46)	0.424	–	–
Primary Education	Motivation	2.5 (1.06)	2.97 (0.95)	0.47	1.77 (58)	0.082	–	–
	Self-regulation	2.37 (1.02)	2.8 (0.91)	0.43	1.71 (58)	0.092	–	–
	Autonomy	2.47 (1.03)	3.3 (0.94)	0.83	3.23 (58)	0.002	0.841	0.388
	Creativity	2.23 (1.18)	2.33 (0.98)	0.1	0.37 (58)	0.712	–	–
	Resolution	2.33 (1.01)	2.77 (0.92)	0.44	1.71 (58)	0.093	–	–
	Teacher	2.13 (0.92)	3.3 (0.78)	1.17	5.2 (58)	<0.001	1.372	0.565
	Classmates	2.3 (0.78)	3.13 (0.76)	0.83	4.11 (58)	0.001	1.078	0.474
	Contents	2.73 (0.81)	3 (0.93)	0.27	1.16 (58)	0.25	–	–
	Time	2.77 (0.92)	3 (0.97)	0.23	0.94 (58)	0.35	–	–
	Individualization	2.4 (0.76)	3 (0.73)	0.6	3.07 (58)	0.003	0.805	0.373
	Objectives	2.97 (0.79)	3.17 (0.73)	0.2	1.01 (58)	0.324	–	–
Secondary Education	Motivation	1.97 (0.87)	3.07 (0.85)	1.1	4.85 (58)	<0.001	1.278	0.537
	Self-regulation	2.23 (1.02)	2.87 (0.8)	0.64	2.18 (58)	0.033	0.698	0.329
	Autonomy	2.1 (1.02)	3.43 (0.92)	1.33	5.25 (58)	<0.001	1.369	0.564
	Creativity	1.97 (0.91)	2.53 (0.99)	0.56	2.27 (58)	0.027	0.588	0.282
	Resolution	2.43 (0.98)	2.93 (0.96)	0.5	1.95 (58)	0.056	0.515	0.249
	Teacher	1.83 (0.9)	3.5 (0.62)	1.67	8.23 (58)	<0.001	2.161	0.733
	Classmates	1.87 (0.72)	3.3 (0.64)	1.43	8.02 (58)	<0.001	2.099	0.724
	Contents	2.7 (0.78)	3.2 (0.87)	0.5	2.3 (58)	0.025	0.605	0.289
	Time	2.6 (0.88)	3.53 (0.62)	0.93	4.68 (58)	<0.001	1.221	0.521
	Individualization	2.23 (0.67)	3.1 (0.47)	0.87	5.71 (58)	<0.001	1.503	0.601
	Objectives	2.8 (0.87)	3.43 (0.61)	0.63	3.2 (58)	0.002	0.838	0.386

Source: Own elaboration.

Lastly, the results obtained by the different experimental groups have been analyzed to determine the independence value of the application of flipped learning, according to the educational stage in which it is put into practice (Table 5). In this way, from the results obtained in the comparative analysis between preschool and primary education, it was found that the application of this approach during preschool enhances critical thinking more profusely, while self-regulation, autonomy of the student, and interactions with classmates are the variables that stand out in their application in the elementary stage over the preschool stage. In this case, critical thinking and self-regulation are the only variables with a medium effect size (r > −0.5).

Regarding the results of the comparison between the preschool and secondary stages, this last stage obtains superior results in variables related to self-regulation, autonomy, interaction with teachers and peers, the use of session time, and the individualization of learning. Likewise, regarding the application of the flipped learning approach in the primary and secondary education stages, the effects are similar in both cases, with the only significance being a greater use of time in the secondary stage. Despite this significance, the analysis of the effect size ($r = -0.309$) determined that this association in the final reflections should be carried out with caution (r < −0.5).

Table 5. A study of the independence value between the experimental groups.

		Group, M (SD)		M_1–M_2	Student's *t*		*d*	*r*
					t (df)	*p*-Value		
Preschool–Primary	Motivation	2.86 (0.99)	2.97 (0.95)	0.11	0.35 (51)	0.725	–	–
	Self-regulation	1.83 (0.76)	2.8 (0.91)	0.97	4.16 (51)	<0.001	1.157	0.501
	Autonomy	2.04 (0.95)	3.3 (0.94)	1.26	4.69 (51)	<0.001	1.333	0.554
	Creativity	2.96 (0.99)	2.33 (0.98)	0.63	2.23 (51)	0.03	0.64	0.31
	Resolution	2.26 (0.89)	2.77 (0.92)	0.51	1.97 (51)	0.054	0.563	0.271
	Teacher	2.96 (0.69)	3.3 (0.78)	0.34	1.66 (51)	0.103	–	–
	Classmates	2.56 (0.97)	3.13 (0.76)	0.57	2.27 (51)	0.027	0.654	0.311
	Contents	3.08 (0.88)	3 (0.93)	0.08	0.34 (51)	0.735	–	–
	Time	2.91 (0.93)	3 (0.97)	0.09	0.33 (51)	0.746	–	–
	Individualization	2.7 (0.69)	3 (0.73)	0.3	1.52 (51)	0.134	–	–
	Objectives	3.22 (0.72)	3.17 (0.73)	0.05	0.25 (51)	0.806	–	–
Preschool–Secondary	Motivation	2.86 (0.99)	3.07 (0.85)	0.21	0.75 (51)	0.459	–	–
	Self-regulation	1.83 (0.76)	2.87 (0.8)	1.04	4.72 (51)	<0.001	1.334	0.554
	Autonomy	2.04 (0.95)	3.43 (0.92)	1.39	5.23 (51)	<0.001	1.486	0.596
	Creativity	2.96 (0.99)	2.53 (0.99)	0.43	1.5 (51)	0.139	–	–
	Resolution	2.26 (0.89)	2.93 (0.96)	0.67	2.57 (51)	0.013	0.723	0.34
	Teacher	2.96 (0.69)	3.5 (0.62)	0.54	2.44 (51)	0.018	0.823	0.38
	Classmates	2.56 (0.97)	3.3 (0.64)	0.74	3.08 (51)	0.003	0.901	0.41
	Contents	3.08 (0.88)	3.2 (0.87)	0.12	0.46 (51)	0.65	–	–
	Time	2.91 (0.93)	3.53 (0.62)	0.62	2.71 (51)	0.009	0.784	0.365
	Individualization	2.7 (0.69)	3.1 (0.47)	0.4	2.37 (51)	0.022	0.677	0.321
	Objectives	3.22 (0.72)	3.43 (0.61)	0.21	1.13 (51)	0.264	–	–
Primary–Secondary	Motivation	2.97 (0.95)	3.07 (0.85)	0.1	0.42 (58)	0.674	–	–
	Self-regulation	2.8 (0.91)	2.87 (0.8)	0.07	0.3 (58)	0.767	–	–
	Autonomy	3.3 (0.94)	3.43 (0.92)	0.13	0.55 (58)	0.586	–	–
	Creativity	2.33 (0.98)	2.53 (0.99)	0.2	0.77 (58)	0.442	–	–
	Resolution	2.77 (0.92)	2.93 (0.96)	0.16	0.67 (58)	0.503	–	–
	Teacher	3.3 (0.78)	3.5 (0.62)	0.2	0.9 (58)	0.374	–	–
	Classmates	3.13 (0.76)	3.3 (0.64)	0.17	0.9 (58)	0.371	–	–
	Contents	3 (0.93)	3.2 (0.87)	0.2	0.84 (58)	0.402	–	–
	Time	3 (0.97)	3.53 (0.62)	0.53	2.5 (58)	0.015	0.651	0.309
	Individualization	3 (0.73)	3.1 (0.47)	0.1	0.62 (58)	0.538	–	–
	Objectives	3.17 (0.73)	3.43 (0.61)	0.26	1.5 (58)	0.139	–	–

Source: Own elaboration.

4. Discussion

The literature review carried out in this study allows us to confirm that applying flipped learning is a booming research field [2,3]. Its benefits within the educational field have been verified by several authors [1,21,27,30–33,35], even though the effects of its application depend largely on the student typology in which they are put into practice [63].

The results obtained in the descriptive analysis allow us to verify that the results of its application vary, according to the educational stage in which the teacher performs their function [64], with a directly proportional trend observed between the effectiveness of the approach and the stage of student education.

In this way, a general analysis of the study variables shows positive results in the application of flipped learning in primary education and secondary education compared to traditional teaching methods. This is a trend seen in other similar studies [43,48–50].

The results obtained are similar to those found in the scientific literature, such as high motivation rates when participating in the teaching and learning process [27,32] as well as during high levels of self-regulation and flexibility of the training process [1,21,33–35] and notable improvements in interaction and collaboration with colleagues [12,24,36–38]. The results also show greater capacity for decision-making and resolution of the problems raised [12,39], and achievement of the curricular objectives [44–46].

However, the results obtained in the analysis of applying the flipped learning approach in preschool education reflect the difficulties in adapting this model to the needs of the students of said stage. This is a fundamental requirement when considering the relevance of the methodology in question [66]. The poor results obtained in the application of the flipped learning model originate from the absence of significant differences with respect to the results obtained with the traditional pedagogical model. This is a paradoxical fact that increases if we consider that the flipped model represents a genuine alternative and is optimized for pedagogical traditionalism [1,4].

Based on the literature analyzed, these results can be assigned to the characteristics inherent in preschool students. This typology of students may be considered an obstacle for the application of the flipped learning approach when faced with situations with a difficult resolution [39,56]. For students of these age ranges, the requirement for certain levels of abstraction during the application of the approach [19] and the limited manageability of digital teaching platforms could be a significant impediment [31].

Based on the analysis of the effectiveness of a traditional approach, in the three stages analyzed, this approach enhances one's interaction with the contents and achievements of the learning objectives. The temporary use of a session is especially important in primary and secondary education. Self-regulation and creativity are the least empowered skills in preschool education, while interaction with the teacher and critical thinking are the least empowered in primary and secondary education. Of the eleven variables analyzed, only six of them in the preschool stage, four in the primary education stage, and three in the secondary education stage exceed the central score.

Regarding the analysis of the effectiveness of flipped learning, the access and choice of materials and content together with achieving learning objectives are the most potent variables in preschool education. High interaction with the teacher in primary and secondary education is encouraged, which highlights the temporary use of the session during this last stage. Of the eleven variables analyzed, eight in primary education and all in the elementary and secondary stages passed the central score. The results for students who followed a flipped learning methodology are higher than those for students who experienced traditional pedagogy in the elementary and secondary stages. Although this trend is maintained in preschool education, the difference between the results of both methodologies is much smaller.

When comparing the effects of flipped learning and a traditional methodology, flipped learning is only more effective in preschool education for the individualization of learning. In the primary education stage, the effectiveness of flipped learning materializes in the students' autonomy, critical thinking, individualization, and interactions with teachers and classmates. In the secondary education stage, all skills (attitudinal, mental, interactive, and effective) are enhanced to a greater extent with the flipped learning approach, which highlights all the interactions between the students, peers, and teachers.

Regarding the comparison of the effects of flipped learning according to the educational stage in which it is put into practice, in preschool education, critical thinking is boosted more profusely, while self-regulation, autonomy, and interactions with peers stand out in their application more strongly during the primary stage than during the preschool stage. Secondary education achieves (compared to preschool education) superior results in self-regulation, autonomy, interaction with teachers and peers, the use of session time, and the individualization of learning. The effects in the primary and secondary stages are similar, with only a greater use of time during the secondary stage.

5. Conclusions

This study analyzed the applicability of a flipped learning approach while taking into account the characteristics inherent in students according to their educational stage: infant education, primary education, or secondary education. For this study, a distributional analysis was carried out to contrast these results with those achieved via a traditional teaching methodology.

The present study found that the applicability of the flipped learning model varies according to the educational stage in which it is put into practice. The flipped learning model obtains positive results in primary education and secondary education when compared to traditional teaching methods. However, the results found in preschool education reflect the difficulties in adapting this model to the needs of the students of said stage, possibly due to the obstacles posed by young students for the autonomous management of digital teaching platforms and the requirement for a minimum level of abstraction necessary to apply such an approach.

One of the limitations that arose during the study was the need to reschedule the research multiple times. The application of the instrument had to be postponed several times because it was affecting the normal development of the teaching and learning processes of the students. On the other hand, although the total sample size is acceptable, the size of each subgroup is small due to the normal size of the classrooms at each educational stage. Comparing the results of this study with those of other studies on the subject has been complicated due to the lack of studies that specifically analyze the educational stage when applying flipped learning.

For future research, we propose to develop an internal (strengths and weaknesses) and external (opportunities and threats) analysis so that the flipped learning approach in preschool education can be applied effectively. In this way, an approach optimization plan could be developed, and the new results could be evaluated in a sample of characteristics similar to those of the present study.

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