





# Flipped Learning in Higher Education for the Development of Intrinsic Motivation: A Systematic Review

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**Abstract:** Background: Flipped learning (FL) is being considered, in terms of new educational trends, a beneficial pedagogical model in the classroom. In particular, FL and intrinsic motivation (IM) are key components to the model since they can be crucial to a high-quality education. FL for the development of IM in higher education, as well as searches for potential interventions have, thus improved over the past ten years. However, no reviews that analyze the findings and conclusions reached have been published. Consequently, the objectives of this paper were to analyze the relationship between the use of FL and the IM of students in higher education, and to identify the aspects that should be present in FL models to develop the IM that contributes to high-quality education. Methods: in accordance with PRISMA guidelines, a systematic review of PubMed, Web of Science, Scopus, and ProQuest was carried out. Results: Of the 407 studies that were initially discovered, 17 underwent a full examination in which all findings and conclusions were analyzed. After implementation, the majority of the FL interventions improved IM results. Conclusion: many key aspects have been identified that must be followed in order to intrinsically motivate students using the FL methodology.

**Keywords:** flipped learning; innovation; teacher methodologies; intrinsic motivation; higher education; quality education



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## 1. Introduction

According to the fourth Sustainable Development Goal of the 2030 Agenda [1], high-quality education promotes sustainable development. In this regard, intrinsic motivation (IM) is crucial to promoting high-quality education because students thus find the work itself engaging and fulfilling [2–4]. This enables them to give their work meaning, investigate new subjects, meet learning challenges, and create their own objectives or study subjects that pique their curiosity. Furthermore, there is a significant correlation between IM and academic performance and wellbeing [5].

Specifically, IM is the desire to perform a particular task or action in the hopes of finding enjoyment or delight in doing so [6–9]. The primary focus of self-determination theory (SDT) is on intrinsic motivators that support the basic psychological needs for growth [10–14]: autonomy (the desire for autonomy and a sense of responsibility for one's actions), competence (where people feel effective and capable), and relatedness (where people feel significantly connected to or cared for by other people and groups). In addition, SDT-based research that particularly aims to promote IM through interventions has emerged recently [15–19]. The value of developing motivation in high-quality education has been examined by the scientific community [16,20–22]. As a result, multiple investigations have suggested particular strategies, pedagogical models, or programs to boost

motivation in various educational areas and stages, as with, for example, Flipped Learning (FL) [23–26].

In particular, FL can be defined as a pedagogical model that allows for the relating of aspects of face-to-face education with virtuality, and enables students to be directed to access data in real time without them needing to be present in the classroom, so that the student assumes a fundamental role during the training process, increasing their responsibility, involvement, commitment, and accomplishment [1,7]. In the FL model, homework is completed outside of class while instruction is conducted in class. It is a teaching model where students watch asynchronous instructional videos or read some texts, articles, or books as homework while discussions, projects, experiments, and personalized coaching is carried out during class [3]. Other research highlights that FL has at least three essential elements: students obtain the majority of their course material from outside of the classroom; students actively engage with the material, other students, and the teacher in the classroom to complete higher-order learning activities; and students are required to complete outside-of-class tasks in order to benefit from the in-class activities [8].

At present, there are several studies that have analyzed the positive impact of FL as a pedagogical model to promote an autonomy-supportive learning environment, self-regulation, interaction between students and between students and the teacher, and a deeper engagement with the material, so that it can provide more complete learning experiences [15,16,27]. Additionally, there is an increasing amount of research that emphasizes the importance of FL for optimal academic performance [17–19]. FL enables students to be prepared for higher-order academic activities such as problem-solving [27]; it leads to better final examination scores, performances, and overall success [16]; and it has advantages in terms of time optimization, active learning, and understanding [10]. Therefore, FL is a very helpful pedagogical model because the outcomes of its use are the development of the competencies required by different educational programs.

Finally, the importance of IM to achieve high-quality learning in higher education has also been the focus of numerous FL investigations based on SDT [10–13]. The scientific community attaches great importance to this topic, so it is useful to be able to compile the knowledge that is currently available on different FL pedagogical models that promote IM. As a consequence, it will be possible to compile up-to-date data on the many types of interventions being employed and draw illuminating conclusions for subsequent research. The demand for collection and analysis, with the aim of closely evaluating the importance of IM in FL, served as the initial impetus for the current study. Therefore, this systematic review had two research questions: (1) ‘What is the relationship between the use of FL and IM in higher education like?’ and (2) ‘What aspects should be present in the FL model to develop IM?’. Therefore, the objectives of the present review are the following: (1) ‘to analyze the relationship between the use of FL and the IM of students in higher education’ and (2) ‘to identify the aspects that should be present in FL models to develop IM that contribute to quality education’. As a result, it will be possible to gather up-to-date information on the many types of interventions being used and make insightful reflections for future research. To the best of the authors’ knowledge, although some studies have summarized FL for education [28–30], a systematic review that includes FL for the development of IM in higher education has not yet been published. This study will be especially useful for academics, researchers, and instructors looking for high-quality education that complies with the 4th SDG of the 2030 Agenda.

The following structure will be used for the article. Section 2 is provided first, followed by Section 3 and then Section 4. Section 5 describes the limitations and future research directions, and lastly, the conclusions are in Section 6.

## 2. Materials and Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed when conducting this systematic review [5,14] (Supplementary Material S1).

The PRISMA-supported standards guarantee that each of the listed articles has undergone a careful review process.

### 2.1. Design

To identify articles published before 23 July 2023, a systematic search was conducted of the Web of Science, PubMed, Scopus, and ProQuest databases. The search was conducted on titles, abstracts, and keywords, and the search strategy included words relating to (1) population, (2) interventions, (3) and outcomes. The three groups of keywords were combined using AND, and the terms in each group were linked using OR: population—“university”, “higher education”, “high education”; intervention—“flipped classroom”, “flipped learning”; and outcomes—“intrinsic motivation”, “self-determination theory”.

### 2.2. Screening Strategy and Selection of Scientific Articles

Duplicate records were deleted when the search was ended. The remaining records were then checked to see if they met the inclusion or exclusion criteria, which are shown in Table 1 below.

**Table 1.** Inclusion/exclusion criteria.

Criterion	Inclusion Criteria	Exclusion Criteria
1. Population	University students.	Non-university students.
2. Intervention	Flipped learning (FL) to develop intrinsic motivation (IM).	FL that is not aimed at developing IM.
3. Comparison	Not applicable.	Not applicable.
4. Outcomes	Programs that have informed the development of IM.	Programs that have not informed the development of IM.
5. Study design	Only original full-text research written in either English or Spanish.	Written in a language other than English or Spanish. Examples of non-original article genres include reviews, letters to the editor, trial registrations, protocol proposals, editorials, book chapters, and conference abstracts.

### 2.3. Data Selection

The aspects of FL pedagogical models that could foster IM as well as data that can most correctly represent FL have been extracted. To achieve this, the information collected from the original publications is presented in three tables: The first presents the aim of the study, the country, sample, area, measurement methods, results, and conclusions. The second one details the year of studies, the duration of FL, whether it was gamified or not, and the detailed intervention. The third table shows the aspects that should be present in the FL model depending on the moment in time and the person responsible for its execution.

### 2.4. Methodological Assessment

By adapting the STROBE evaluation criteria, the methodological evaluation process was applied to find articles that were appropriate for inclusion [20]. Each item was scored using a numerical description (1 = finished, 0 = not finished). Following O’Reilly et al. [5], each study’s rating was qualitatively examined in accordance with the rules detailed in the Supplementary Material S2. Articles with scores below seven were considered to be at a high risk of bias, while those with scores over seven were considered to be at low risk.

### 3. Results

#### 3.1. Identification and Selection of Studies

A total of 407 documents, of which 3 were duplicates, were initially obtained from the Web of Science, PubMed, Scopus, and ProQuest databases. As a result, 404 articles in total were downloaded. Following a second review of the remaining publications' titles, abstracts, and complete texts, using the same criteria described in Table 1, 174 studies were disregarded in accordance with Criterion 5 (Study). Of the remaining 230 articles, 52 were removed for not meeting Criterion 1 (Population), 142 were removed based on Criterion 2 (Intervention), and 19 were removed for not meeting Criterion 4 (Outcomes). Finally, 17 articles were included in the qualitative analysis. The four PRISMA-recommended phases are depicted in a flow diagram in Figure 1, along with the inclusion and exclusion criteria for each article in each phase.

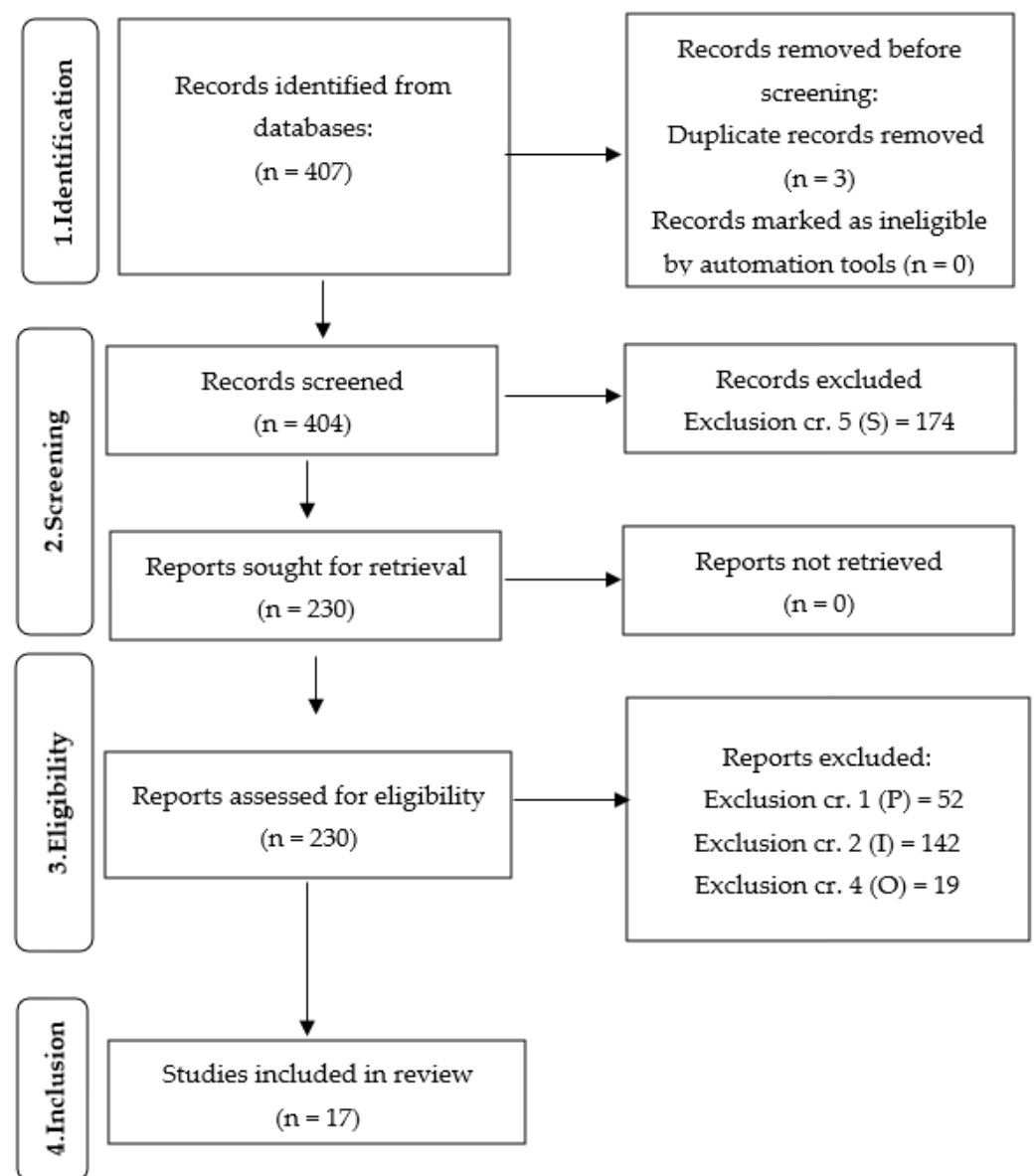


Figure 1. Flow diagram of the study.

### 3.2. Methodological Quality

Table 2 shows that the overall methodological quality of the articles is very high based on our assessment using each of the STROBE evaluation criteria [5], which have been described in Section 2.4.

**Table 2.** The methodological quality of the articles.

Reference	1	2	3	4	5	6	7	8	9	10	Q
Bawaneh and Moumene (2020) [10]	1	1	1	1	1	1	1	1	1	0	9
Challob (2021) [21]	1	1	1	1	1	1	1	1	1	0	9
Diaz-Carrion and Franco-Leal (2021) [22]	1	1	1	1	1	1	1	1	1	0	9
Elzeky et al. (2022) [23]	1	1	1	1	1	1	1	1	1	1	10
Gómez-Carrasco (2019) [24]	1	1	1	1	1	1	1	1	1	1	10
Ha et al. (2019) [13]	1	1	1	1	1	1	1	1	1	1	10
Ishak et al. (2020) [25]	1	1	1	1	1	1	1	1	1	1	10
Lamsyah et al. (2022) [26]	1	1	1	1	1	1	1	1	1	0	9
Langdon and Sturges (2018) [31]	1	1	1	1	1	1	1	1	1	0	9
Mentzer et al. (2023) [32]	1	1	1	1	1	1	1	1	1	1	10
Moll-Khosrawi et al. (2021) [33]	1	1	1	1	1	1	1	1	1	1	10
Sailer and Sailer (2021) [34]	1	1	1	1	1	1	1	1	1	1	10
Schwarzenberg et al. (2018) [35]	1	1	1	1	1	1	1	1	1	1	10
Teng (2017) [36]	1	1	1	1	1	1	1	1	1	0	9
Velde et al. (2021) [12]	1	1	1	1	1	1	1	1	1	1	10
Zainuddin and Perera (2019) [11]	1	1	1	1	1	1	1	1	1	0	9
Zhao et al. (2021) [37]	1	1	1	1	1	1	1	1	1	1	10

### 3.3. Article Analysis

Below are the outcomes from the analysis of the studies, together with the most crucial information regarding the FL developed in each study. To achieve this, the information collected from the original publications is presented in three tables: Table 3 details the specific information on each FL intervention. Table 4 provides the aspects that should be present in the FL model depending on the moment in time and the person responsible for its execution. Table 5 presents the primary information on each study (aim, country, sample, area, measurement methods, results, and conclusions).

Table 3 shows that the academic year in which FL has been applied is very varied, thus, it is not necessary to have a higher or lower level of knowledge of a subject. As for the duration of the interventions, they are very varied, from a couple of weeks to a semester or two whole semesters. Likewise, it can be observed that the interventions were either gamified or not.

**Table 3.** Description of FL interventions.

Study	Year	Duration	Gamified	Intervention
Bawaneh and Moumene (2020) [10]	Not reported.	2 months.	Yes.	<p>Students were given in-depth explanations of the major ideas included in the department-approved textbook via audio or video content. Subsequently, the researchers posted them on Facebook, WhatsApp, and the university learning management system (Blackboard). At the same time, an assignment that included a worksheet was uploaded. Before coming to class, students were told to prepare themselves by watching or listening to the audio portions. Additionally, students were instructed to view related YouTube videos from the URLs they received through the same channels. Occasionally, the instructor would send case studies, publications about the subject, and contact information for experts. Students were split up into groups of four to six people in the classroom, and they were free to discuss the ideas in their handouts as a group. Following a class discussion led by the instructor, students were occasionally asked to participate in laboratory experiments. In the end, Kahoot was used as a method for formative evaluation in each class, and students were asked to respond to some questions. Afterwards, the teacher gave a brief talk to clarify any complicated ideas or theories that the pupils were having trouble understanding. In order to help the students gain thorough comprehension of the material, the instructor had the chance to assign group projects.</p>
Challob (2021) [21]	Third.	13 weeks.	No.	<ul style="list-style-type: none"> <li>- Pre-study phase: As a writing assignment, each student was required to write an essay on their own. The students participated in a training session where they learned about the various stages of the writing process and how to carry them out practically, as well as how to use Google Classroom for the writing process and peer review, and the fundamentals of writing an effective essay.</li> <li>- The study phase: The participants were assigned to groups and worked cooperatively on three writing assignments. When the students were engaged in the pre-writing, drafting, and post-writing stages of Hayes and Flower's model of the process approach to writing [38], the fundamentals of FL were implemented.</li> <li>- Post-study phase: as a writing assignment, pupils were required to write an essay on their own.</li> </ul>
Diaz-Carrion and Franco-Leal (2021) [22]	21-year-old students.	36 h.	No.	<p>Eight chapters make up the curriculum of the subject in which FL was used. In 75% of the classes, this approach was used. Prior to class, the students engaged in independent reading and/or watched videos that addressed the theoretical material. The videos were available for students to watch and read as many times as necessary. After entering the classroom, the work groups applied the theoretical justifications learnt to a hypothetical or actual business. At this point, the teacher's duties included clearing up pupils' questions and expanding on theoretical material. Lastly, the work groups gave an oral presentation on the real-world application they had created in class. In order to direct learning, the teacher interjected, moderating the discussion that had arisen in the classroom and posing questions.</p>

Table 3. Cont.

Study	Year	Duration	Gamified	Intervention
Elzeky et al. (2022) [23]	Different academic years.	8 weeks.	Yes.	One week prior to clinical lab training, both groups received routine FL instructions consisting of a skill video and one multiple-choice quiz on the pre-class materials uploaded to the Moodle page. Class activities included three case scenarios, an instructor demonstration, student re-demonstration of the skills on simulators, and a peer evaluation checklist. Following the collection of baseline data, Moodle was gamified for the students in the intervention group for the next six weeks. The game components included badges, leaderboards, ranks, levels/unlocks, and points, in addition to three gamified tests on each skill. With this online incentive, the students could compete and earn the most points and badges. The quiz included text and visuals in addition to videos. The course made use of multiple question categories, multiple quiz formats, and a total of eighteen game quizzes and stages.
Gómez-Carrasco (2019) [24]	Different academic years.	First semester, 4 h per week.	Yes.	Each week, the teaching team created a video that included the subject's theoretical information. The students were required to watch the FL video at home. In-class activities included case studies, role-playing, material analysis, cooperative learning, etc. Techniques for gamification were added to this. Using team competitions created with the Socrative platform, the students responded to questions regarding the theoretical videos at the start of each session. Team competitions based on the topics covered during the session were held once more at the end. As the proposal was being developed, the work groups had the opportunity to earn badges. Those who earned the most badges at the end of the course would receive prizes.
Ha et al. (2019) [13]	Not reported.	Two academic years.	No.	Out of a total of five courses, each instructor redesigned one, utilizing FL, and added items for students to complete outside of class (e.g., videos, books, e-resources, etc.). Each of the courses that were featured had up to half of its content flipped thanks to the use of ECHO360 software, PowerPoint, Blackboard, YouTube, and online video hosting.
Ishak et al. (2020) [25]	Not reported.	One semester.	No.	Out-of-class activities were as follows: Students were obliged to take notes while watching asynchronous internet video lectures that were created and sent to them. Prior to class, all video lectures were filmed and sent to the students for their study. In-class activities were as follows: To make sure that the students were prepared for class or had seen the video lectures at home, the instructor went over each student's notes and administered a brief quiz. In order to free up more class time for interactive activities, the instructor then incorporated experiential learning and hands-on learning activities that provided rapid feedback through conversation with classmates and/or instructors.
Lamsyah et al. (2022) [26]	Different academic years.	Two semesters.	No.	Online lectures, assignments, and discussions were conducted via digital classrooms on the HINPHT of Fez's G-Suite platform. In-person sessions were then added to the online sessions that included only practical activities and application exercises.

Table 3. Cont.

Study	Year	Duration	Gamified	Intervention
Langdon and Sturges (2018) [31]	Not reported.	Two semesters.	No.	Online lectures were recorded for the students. Each of the online lectures took 10 min. There were multiple lectures in every module. Answering questions and working on the instructor-created projects took up class time.
Mentzer et al. (2023) [32]	Minor students.	Two semesters.	No.	In groups, students worked on three design projects. Following the formation of teams, the curriculum guided students through the well-known design process, which included a problem description, observations, interviews, and literature research, as well as devising a solution and presenting findings in an engaging manner. As they gained more knowledge, the students benchmark rose in terms of seeing what already existed, iteratively rewriting their problem statement, and creating functioning prototypes that highlighted one or more of their concept's important aspects. A panel of knowledgeable judges evaluated the top five final presentations to decide which two would win prizes to help with their future development. Each small group of around 40 students received Tech 12000 instruction in a room equipped with Chromebooks, movable chairs and tables, and whiteboards. The educators received professional development from two coordinators.
Moll-Khosrawi et al. (2021) [33]	Third.	One semester.	No.	<p>In order to teach the instructors and standardize the intervention, eight pilot training sessions were held. Three medical lecturers were involved in the FL's preparatory phase six months before the study period began. Prior to discussing and actively participating in pre-learning opportunities, the learning objectives were first determined. There were specified learning methodologies.</p> <ul style="list-style-type: none"> <li>- Pre-training (class) content: instructional materials, individual learning spaces, and a brief (20 min) session on NTS was held following baseline training.</li> <li>- Classroom phase (group learning space): three simulated scenarios, a five-minute debriefing after each, and a second training session. The instructors' job was to facilitate learning by creating a conducive atmosphere and promoting involvement.</li> </ul>
Sailer and Sailer (2021) [34]	23-year-old students.	One semester.	Yes.	Regarding the out-of-class activities for the students, a link including a video lecture and details on the time and location of the next in-class event was issued to the students one week before the study. The lecturer discussed feedback and assessment in a medium close-up manner in the video. We asked the students to use this material to get ready for the next lecture. The instructor declared that the material would be covered in the upcoming in-class lecture. In terms of in-class activities, a brief pretest was given at the beginning of the face-to-face lecture to gauge students' level of preparedness, declarative prior knowledge, and demographic information. The next in-class activity featured training questions concerning feedback and assessment along with a debriefing on them. The lecturer led a plenary session, during which the students were required to work separately on the training questions. The effectiveness of their learning process was evaluated by monitoring students' responses to the training questions.



Table 3. Cont.

Study	Year	Duration	Gamified	Intervention
Schwarzenberg et al. (2018) [35]	Not reported.	Two semesters.	Yes.	<p>Ten themes that were revealed over the course of the semester formed the framework for the content. Videos containing theoretical content and practical examples were included in the course. Multiple-choice and short-answer quizzes were used in the pre-class exercises to gauge students' comprehension of the subject matter. In addition to an explanation of the right response, the students received comments on their responses. Program comprehension, program correction, and queries about expanding the existing examples shown in the films were among the subjects covered. Every week, students had to take part in the forum by either posting a question about the topic for that week or responding to one of their peers' questions. In order to monitor the caliber of the questions that were posed and the responses provided by the students, the lecturer and teaching assistant moderated the forum and responded to queries. A feature called programming milestones was included in the second semester. The idea of experience points, which are utilized in role-playing games, served as the foundation for the feature's design. Experience points, which indicate a player's advancement in the game, are obtained by finishing a certain task. The students experienced four programming milestones throughout the course of the semester. Concept reviews based on the most popular themes discussed on the forum and Q&amp;A sessions regarding the optional programming projects that the students completed in class and via the online platform were among the teacher's in-class activities. Throughout the second half of the semester, the students were required to work in groups to construct a program each week during group programming assignments. To put together the entire solution to the problem, each group had to construct a portion of it and collaborate with another group. After class, the completed solutions could be turned in.</p>
Teng (2017) [36]	First.	10 weeks.	No.	<p>The course coordinator and the flipped learning teachers produced online videos, or vodcasts, of their lectures. There were two FL modalities:</p> <ul style="list-style-type: none"> <li>- Structured FL: As a flip tool this used online videos and WebQuests. The QuestGarden framework was used to arrange both in-class and out-of-class learning materials, and all materials were given to the students prior to each lesson. Students used WebQuests to study materials and watch online videos before and after class. Students completed assignments focused on questions during class.</li> <li>- Semi-structured FL: Online videos were the flip tool. In terms of the delivery of materials, students received printed copies of the out-of-class learning materials prior to class. Students were given printed copies of the course materials. Students reviewed lesson materials outside of class and watched online videos before and after class. Students completed assignments and studied class materials during class.</li> </ul>

Table 3. Cont.

Study	Year	Duration	Gamified	Intervention
Velde et al. (2021) [12]	First.	4 weeks.	No.	All students were to have the chance to actively engage with (non-)academic experts in a dynamic environment with student-centered activities through expert labs. The majority of the student-centered activities were group projects. For instance, students were required to work with an expert to produce a brief presentation for their group on a certain topic or to take part in a group discussion. Prior to engaging in expert lab activities (e.g., asking questions, participating in conversations), students had access to online resources, including films, which followed each lab. The students participated in ten two-hour work groups where they completed assignments pertaining to the lectures' subject matter, expert labs, and a group poster for a poster presentation to their peers. Tutors supervised them while they worked in groups. Along with conducting an experiment, students also kept a diary in which they recorded their reflections on the course learning process and their personal development (collaborating, planning, providing and receiving feedback). The course material and an introductory lecture at the start of the course provided information to the students about the FL model. "How to prepare for an expert lab" was the main topic of discussion in the work group prior to the first expert lab.
Zainuddin and Perera (2019) [11]	Different academic years.	12 weeks.	No.	After watching instructional video lectures at home, students met in person to engage in group projects, student presentations, and face-to-face classroom activities. Both in-class and out-of-class activities were intended to be a part of the FL instruction. Short video clips, that were posted to the institutional learning management system so that students could view them before class, were shared as part of the after-class activities. The main in-person class activities were a conversational activity lasting 45 min, an interactive feedback session lasting 15 min, and a listening exercise lasting 40 min.
Zhao et al. (2021) [37]	Third.	Not reported.	Yes.	The learning objectives and syllabus were presented by the instructor. Subsequently, the pupils began their educational pursuits, incorporating various integrated learning methodologies. They used the interactive, gamified e-book as a teaching tool for the FL of mathematics. Following that, pupils had to view a fifteen-minute pre-class video on fractions. They were required to read the interactive e-book's fractions content and engage in peer discussions with their classmates in order to complete the problem-based learning stage that took place in class.

**Table 4.** FL model depending on the moment in time and the person responsible.

Role	Before Class	During Class	After Class
<b>Instructor</b>	<ul style="list-style-type: none"> <li>- coordinator educates teachers on the principles of FL.</li> <li>- plan the intervention, define the learning objectives and learning methodologies.</li> <li>- prepare the material.</li> <li>- explain advantages of FL to students.</li> <li>- provide pre-class materials and tasks with enough time.</li> <li>- declare that the material would be covered in the upcoming in-class lecture.</li> <li>- provide incentives (marks awarded).</li> <li>- prepare projects and assignments to be carried out in class.</li> </ul>	<ul style="list-style-type: none"> <li>- brief recap of pre-class materials.</li> <li>- design activities.</li> <li>- provide connection between pre-class materials and in class activities.</li> <li>- design discussions.</li> <li>- allow students to ask about new information.</li> <li>- answer students' questions and expand on theoretical material.</li> <li>- handle tools such as different software; PowerPoint, Blackboard, YouTube, online video hosting, etc.</li> <li>- facilitate learning by creating a conducive atmosphere and promoting involvement.</li> <li>- go over each student's notes and administer a brief quiz.</li> <li>- experts labs (invite professionals working outside of the university).</li> </ul>	<ul style="list-style-type: none"> <li>- evaluate students' achievement.</li> <li>- get feedback from students regarding how they feel about their education</li> <li>- discuss with colleagues that also use FL and participate in seminars.</li> <li>- assess the aspects personalized learning offers.</li> <li>- evaluate the effectiveness of FL.</li> </ul>
<b>Students</b>	<ul style="list-style-type: none"> <li>- read received FL instructions.</li> <li>- prepare using the material (watching or listening to the audio portions, reading the documents, etc.).</li> <li>- take notes while preparing using the material.</li> <li>- answer multiple-choice and short-answer quizzes to prepare for class.</li> <li>- discuss the ideas in groups or in an online platform.</li> </ul>	<ul style="list-style-type: none"> <li>- work cooperatively.</li> <li>- discuss.</li> <li>- activities: case studies, role-playing, material analysis, cooperative learning, oral presentations, etc.</li> <li>- interactive activities.</li> <li>- applied exercises.</li> <li>- practice simulated scenarios, including a debriefing after each.</li> <li>- interactive and gamified activity.</li> </ul>	<ul style="list-style-type: none"> <li>- participate in Kahoot, quizzes, or other methods for formative evaluation and respond to some questions.</li> <li>- use badges in games for evaluation.</li> <li>- kept a diary in which to record reflections on the course learning process and personal development.</li> <li>- interactive online feedback session.</li> </ul>

Additionally, as shown in Table 4, instructors provide different types of materials to students to prepare the subject matter prior to face-to-face classes: lectures, textbooks, gamified e-books, audios, videos, case studies, publications about the subject, contact information for experts, and other e-resources. The materials must be accessible; attractive, so that they arouse the curiosity of the students; well organized; and include the most relevant and up-to-date information, and all this in accordance with the objectives of the subject and the course. In order to make the material available to the students, the instructors use different systems: printed documents, email, WhatsApp, Facebook, Youtube, Moodle, Google Classroom, Blackboard, ECHO360 software, and the Socrative platform. In relation to the research results, it can be seen in Table 5 that the majority of the studies found that IM had been developed following the FL pedagogical model and relied on the SDT, which supports the basic psychological needs required for the growth of autonomy, competence, and relatedness [10–13,21,22,24–26,31,32,35,36]. In addition, some studies that have compared traditional FL and gamified FL have found better results with the later, since it encouraged students to participate in the learning process [23,37], while another study that did so perceived improvements only in IM and social relatedness [34]. Finally, one study found no significant differences in IM between students who followed FL and those who received traditional instruction [33]. However, the authors of this study believe that although their intervention had the potential to increase IM, it may have been too short to have had an effect.

**Table 5.** The studies' country, sample, area, measurement methods, results, and conclusions.

Study	Aim	Country	Sample Size	Area	Measurement Methods	Results	Conclusions
Bawaneh and Moumene (2020) [10]	Examine how FL affects students' motivation and comprehension of medical physics concepts.	Saudi Arabia.	123 (58 FL and 65 in conventional learning).	Medical physics.	Survey with Likert-type responses divided into six scales: self-efficiency, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation.	FL increases students' intrinsic motivation (IM) and comprehension of medical physics subjects.	Students were more engaged and had greater autonomy in their research due to the use of technology to obtain educational resources.
Challob (2021) [21]	Examine how employing FL affects students' autonomy, motivation, and performance in writing in English. Additionally, investigate the key elements present in the FL English writing environment that support these effects.	Iraq.	15.	English.	Qualitative observation.	The students' English writing performance, autonomy, and IM were influenced by the FL environment.	The interactive nature of the learning environment, flexibility of time and place, feedback from teachers and peers, and a variety of learning sources were the primary variables that assisted students in improving their English writing performance, autonomy, and IM.
Diaz-Carrion and Franco-Leal (2021) [22]	Examine how students' academic performance in management courses is affected by self-pacing, cognitive load, extrinsic motivation, and IM.	Spain.	87.	Business management.	Five-point Likert scale measuring competence, autonomy, and relatedness.	Findings suggest that reinforcing several self-determination theory (SDT) factors—the sense of competence, relatedness, and extrinsic motivation—improves tertiary students' performance in the context of FL.	The findings suggest that programs focused on using FL in management studies need to be supported. Being autonomous has an indirect impact on students' academic achievement by enhancing their sense of competence and relatedness.
Elzaky et al. (2022) [23]	Examine the effects of gamified FL on the skills, competency, and motivation of students studying the fundamentals of nursing.	Egypt.	128.	Nursing.	Instructional Materials Motivation Survey (IMMS).	When compared to the traditional FL, gamified FL increased nursing students' IM, preparation level, skills knowledge, and sense of self-confidence throughout laboratory clinical practice.	Gamification can be used in conjunction with the FL model to encourage students to participate in the learning process.
Gómez-Carrasco (2019) [24]	Examine how the gamification-based and non-gamified FL programs affect learning and motivation.	Spain.	210.	Primary Education degree.	Questionnaire with a Likert scale.	The data demonstrate a highly favorable effect on IM, the learning achieved, due to the FL techniques used.	Generally, the deployment of a gamified FL training program had a favorable impact on the students' IM and perceptions of learning.

Table 5. Cont.

Study	Aim	Country	Sample Size	Area	Measurement Methods	Results	Conclusions
Ha et al. (2019) [13]	Analyze the effects of the FL approach on instructors' and students' teaching and learning experiences in Asian higher education.	China.	13.	Faculty of Education.	Student interviews.	In the area of education, the FL method offers significant potential to meet the three basic cognitive needs of IM.	Most students had positive views regarding the FL method, and the SDT's main components can be used to explain both students' and instructors' positive feelings.
Ishak et al. (2020) [25]	Develop and understand the factors that influence university students' decision to use asynchronous pre-class online video lectures (AOVL) for FL.	Indonesia.	31 respondents for questionnaires and 10 for interview.	Information Management and E-Administration.	Likert-type scale.	Students' opinions of IM and self-efficacy were favorable. The results show that pupils have satisfied the three fundamental psychological demands identified by SDT.	Three major themes emerged from the thematic analysis of the data: (a) the students' outside-the-classroom content mastery; (b) students' interactions with peers and instructors; and (c) students' learning autonomy.
Lamsyah et al. (2022) [26]	Analyze FL's effect on the undergraduate students' motivation to learn at the Higher Institute of Nursing Professions and Healthcare Techniques in Fez.	Morocco.	372.	Nursing.	Viau's motivation scale.	Data analysis showed a statistically significant relationship between FL and students' IM; their motivational profiles increased after FL from 18.54% to 89.25%.	FL can greatly enhance pedagogy, so it is crucial to expand its scope and incorporate it as a brand-new method of instruction inside institutions of higher learning for the health sciences.
Langdon and Sturges (2018) [31]	Analyze the impact of FL on undergraduate students' academic performance, motivation, basic need satisfaction, and course experience.	United States.	145.	Exercise Science.	The adapted Academic Motivation Scale (AMS). Basic Need Satisfaction in Relationships Scale (BNS-RS).	"IM to know" is high in FL but with similar results in traditional learning. "IM to accomplish" and "IM to experience simulation" were moderate in FL.	FL was considered to be a feasible alternative to traditional learning because both formats had high IM and general course experiences; nevertheless, instructors must be conscious of the need to reinforce preparation for in-class work.

Table 5. Cont.

Study	Aim	Country	Sample Size	Area	Measurement Methods	Results	Conclusions
Mentzer et al. (2023) [32]	Analyze how, in comparison to a conventional face-to-face setting, the Interactive Synchronous HyFlex approach to learning satisfies students' basic psychological needs.	United States.	584.	Design and Innovation.	Basic Psychological Needs Scale (BPNS).	The Interactive Synchronous HyFlex approach significantly improved the basic psychological needs for IM. When compared to students in the traditional design thinking class, students in this FL intervention reported very similar levels of autonomy satisfaction, competence satisfaction, and relatedness to peers and the instructor.	Because FL encourages students to learn by doing, it is the perfect setting for the design thinking course that served as the context for this study. Students who engaged in active learning courses participated in pre- and post-class preparation activities such as watching video lectures or talks, reading text-based materials, and taking online quizzes.
Moll-Khosrawi et al. (2021) [33]	Examine whether flipped learning enhanced students' non-technical skills (NTS) performance in comparison to lecture-based learning (LBL), in simulation-based medical education (SBME) emergency training.	Germany.	102.	Medicine.	Situational Motivation Scale (SIMS).	No significant differences were found in IM between students who followed FL and those who followed traditional instruction.	Medical educators should think about using FL to teach complex human factors and skills because its incorporation into SBME (simulation-based medical education) results in a considerable improvement of students' NTS (non-technical skills) performance.
Sailer and Sailer (2021) [34]	Examine the effects of a gamified FL intervention on the learning process performance, application-oriented knowledge, intrinsic motivation, and psychological need for satisfaction, using a point-based quiz and team leaderboard.	Germany.	205.	Educational science.	Likert-type scales.	Favorable impacts of gamified in-class activities were found on IM and social relatedness, but no appreciable effects on competence satisfaction, according to SDT. Gamification has a beneficial indirect effect on application-oriented knowledge that is moderated by the learning process performance.	The study casts light on a specific casual construct in which game design elements (points and team leaderboards) set off particular mechanisms (immediate task-level feedback and team competition).
Schwarzenberg et al. (2018) [35]	Analyze which aspects of FL's implementation have an impact on their grades and which aspects of student learning and motivation are improved.	Chile.	377.	Programming.	Intrinsic Motivation Inventory (IMI).	FL increases the enjoyment and satisfies the need for autonomy for IM.	The outcomes of in-class activities, online involvement, and extracurricular activities like programming milestones all contribute to the student experience in FL.

Table 5. Cont.

Study	Aim	Country	Sample Size	Area	Measurement Methods	Results	Conclusions
Teng (2017) [36]	Examine whether FL instruction has improved students' academic performance and level of satisfaction in a cross-cultural communication course.	China.	90.	English.	Interviews.	FL is probably going to meet students' demands for autonomy, competency, and relatedness, which will improve the environment for IM and help students build the skills they need to learn independently or at their own speed.	FL was the most effective instructional intervention to improve students' academic achievement, followed by semi-structured FL and traditional learning.
Velde et al. (2021) [12]	Determine whether experimental large-scale FL is appropriate and gain knowledge of how the context (i.e., tasks, activities, instructions) of such FL affects student motivation.	Netherlands.	219.	Health Sciences.	The Basic Personal Needs Satisfaction and Frustration Scale (BPNSFS).	A large-scale flipped environment offers the chance to improve the student relatedness aspect of IM through more engagement and in-class group projects.	The difficulty of customizing a blended course to promote students' IM while developing large-scale FL persists; for instance, combining teacher support, scaffolding, and an environment that supports autonomy is difficult.
Zainuddin and Perera (2019) [11]	Distinguish between FL and non-FL instructional models using Self-Determination Theory as a guide.	Indonesia.	61.	English.	Survey questionnaires and qualitative interviews.	FL had a favorable impact on students' IM. Additionally, the students' peer interactions and ability to learn autonomously improved.	The use of recorded lectures on video, self-regulated learning environments, participation in class activities, and peer interaction all motivated students. FL had established the fundamental psychological requirements of SDT (competency, autonomy, and relatedness) successfully.
Zhao et al. (2021) [37]	Integrate a technologically gamified interactive e-book and pre-class self-study math content into classroom activities to improve student engagement with FL and boost motivation for learning.	China.	130.	Mathematics.	Questionnaire and qualitative interviews.	According to learning motivation, students who used GIEBFL (gamified interactive e-book FL) had better IM than the CFL (conventional FL) and TI (traditional instruction) students.	GIEBFL students performed better than CFL and TI students.

As can be seen in Table 5, the studies analyzed are student-driven, because the articles focus on the impact of FL on student motivation, and its other benefits for students, to achieve quality education. Additionally, the study topic is interesting independently of cultural or educational approaches since most of the sampled studies are numerous, representative, and geographically spread across a wide range of regions. A variety of tools are used for measuring, such as standardized scales, interviews, ad hoc surveys, and observation. Because of this, extensive findings from many perspectives can be obtained.

With regard to the conclusions of these studies, it can be observed in Table 5 that FL is a pedagogical model that assists in the development of IM, and specifically of the three basic psychological needs for it [9,10,28–30,35,37–41]. The discussion in this article analyzes the causes of the development of IM. Research has highlighted five different aspects that have been taken into account, such as the redesign of the course content [10], as the teacher must be conscious of the need to reinforce preparation for in-class work [31]; instructor support [12], since it favors students' relatedness (see Table 4); the interactive nature of the learning environment that allows flexibility in time and place, and interaction with a variety of learning sources such teachers and peers [11,12,21]; the importance of varied materials like watching video lectures or talks, reading text-based material, and taking online quizzes [25,32,35–37]; and, finally, it is worth mentioning the importance of well-designed gamification used in conjunction with the FL model to encourage students to participate in the learning process and improve their learning perception [23,24,34,37].

#### 4. Discussion

This study has answered the following research questions: (1) 'What is the relationship between the use of FL and IM in higher education like?' and (2) 'What aspects should be present in the FL model to develop IM?'

Regarding the first research question, this systematic review has shown that the published interventions employing FL as a pedagogical model have helped to increase IM. In relation to autonomy, the participants of the analyzed articles were motivated to study and practice the tasks, were able to learn on their own, took responsibility for their education, made decisions, and had the necessary confidence in their ability to learn. In addition, students had plenty of opportunity for self-learning in a welcoming and non-threatening learning environment due to the FL intervention [21]. Furthermore, the students had the freedom to choose the time and location of their own education as well as to start studying assignments on their own. In relation to competence, the SDT states that meeting students' desire for competence explains why pre-class materials are successful. Pupils thought that there was no difficulty in learning from the resources (need for competence). Students had a sense of control over their learning outcomes and competence with tasks and activities. Pupils admitted that they felt comfortable speaking up during class discussions and that they arrived to class prepared. In relation to relatedness, some studies concluded that the FL classroom layout was incredibly inspiring and stimulating for group discussions, ensuring a cordial and cooperative exchange of ideas, which is consistent with other research [39,40]. Additionally, students can gain quick scaffolding from other students through this cooperation and group interaction, which helps them overcome numerous learning obstacles and complete the assignments to the required standards. The students thought that their experience in FL had taught them something new, they could share knowledge with their teacher and peers on an equal platform, helping them grow as critical thinkers and problem solvers, which was consistent with other research [41,42].

Regarding the second research question, this review has identified several aspects that help to promote IM in FL interventions. It is important to have a good knowledge of the FL guidelines before designing the objectives and methodologies of a subject, taking into account the coordinators of the FL implementation. For this purpose, it is strongly advised that teachers take advantage of training seminars in order to understand how to use FL to organize their course instructional activities. A symbiosis is therefore required



between in-depth knowledge of the FL and technical competency of the subject. This is congruent with other studies [43,44]. It is also advisable that the instructor has support to prepare their videos or material, for example, or for any questions that may arise during the FL teaching.

Another aspect to FL is to convey the significance of this pedagogical method to the students so that they are aware of what FL is before they begin the course. It is also necessary for students to become acquainted with this method in order to take an active and accountable role in their education. When the program educational goals were determined, the students were informed about the working technique from the very beginning [45], and their acceptance of it could be depended upon. Employing the FL methodology improved the educational experience for pupils and promoted favorable learning results and behavioral adjustments. By using a graded method, cognitive overload was avoided and students were given control over their learning process. In this respect, to feel in control in such a novel environment, students who have not previously utilized FL may require more than an introductory lecture and a course description in the curriculum.

It is also important to assess the difficulties that students have in implementing FL [12]. Some students find this approach too harsh at first, and they require support and inspiration to adjust to a new, more engaging approach to learning [46]. Given the difficulty of designing a FL course to support first-year student motivation, it may not be advisable to use FL for an introductory course [12,47]. As the novelty of this instructional strategy wore off, students' favorable attitudes toward the flipped approach waned throughout the course [48]. In this regard, some students believe that the increased demand for independent study outside of class time and the absence of lectures are unfair or excessive [49]. It is crucial for learners and trainers to communicate continuously throughout the process in order to overcome these challenges. One strategy suggested for students is to write their thoughts about the use of FL in a journal. After that, teachers talk with students about their reflections to find out what challenges they are facing and how to overcome them [12].

Another important aspect of FL is to make sure that the material has been prepared before going to class. In order to achieve this, it is crucial to let students know ahead of time about the information they need to prepare on their own. It is obvious that students who prepare the necessary materials ahead of time will grasp the information more readily than those who arrive at traditional classrooms with no prior knowledge of the subject matter [10]. Using tools such as quizzes offers teachers a chance to verify the work that the students have completed on their own [23,34].

Another aspect of FL is knowing how to combine student autonomy with interactions between students and expert teachers throughout the intervention [21]. These two facets stem from Vygotsky's social constructivism theory of learning [50], which holds that students' autonomous efforts in creating new information and meaning through social interaction and teamwork constitute learning. Programming milestones offer intentional practice opportunities spaced throughout the semester that impact learning and promote autonomy. Rather than assigning students a set of tasks to complete in a predetermined order, this feature lets them design their own plan to meet the course requirements and choose the next challenge to solve [35]. Regarding interaction, learning occurs when someone tries to explain to others what he or she knows about the task. Students might gain a deeper understanding of their viewpoints through the discussion [37]. They can gain greater confidence to complete the tasks in this way. When faced with challenges, people can return to the learning content in the material to find the information required to do the activity, and, because of the material's useful feedback, they feel more capable. Teachers should also give pupils the right resources and feedback to help them feel successful and self-sufficient. For instance, rather than evaluating pupils based on norms, more pertinent information may be provided to help them grasp how to complete the learning tasks [37].

Another significant aspect of FL is that using gamification in a FL intervention gives students a lot of chances for engagement and fun [24,35,37]. It is now simpler for pupils

to take pre-class material seriously due to the gamification of quizzes. This is why the questions chosen and the gamified quiz design are so important, as the level of difficulty of the test might affect students' motivation. The team leaderboard-based intervention, the use of badges, and the instant task-level feedback that games offer in the form of points can enhance the effectiveness of the learning process [23,34]. In addition to the feedback mechanisms that are employed, social interaction formats must also be taken into account. Implementing team competition is another crucial step in ensuring a positive culture of competition. Students' social relatedness was effectively fostered by this kind of contact. This could be the case because, among other things, it facilitates enriching discussions and exchanges and aids in encouraging student feedback and involvement. Similarly, the use of technology to access educational resources increased students' autonomy and engaged them in the process of finding and analyzing knowledge [10].

Other aspects that should be taken into account, but that are not specific to FL and are applicable to almost any learning process, are that the content should be well-designed, teacher support should be promoted, or a variety of rich materials should be offered.

In general, this systematic review has identified that IM can be promoted by FL as autonomy, competence, and relatedness are promoted in the participants of the analyzed articles through the encouragement of different aspects of FL intervention. In this regard, it is crucial to keep in mind that FL pedagogical models used to support IM must achieve the following strategies:

- have a good knowledge of the FL guidelines before designing the intervention.
- explain adequately to the students what FL is all about.
- monitor the students' difficulties with regard to the FL intervention.
- make sure that students have prepared the material before class.
- know how to combine self-study with interaction.
- use badges and leaderboards in the gamification used in the FL intervention.

## 5. Limitations and Future Directions

Despite the inclusion of the most pertinent databases, it is conceivable that some additional publications might be located in other databases, which could be a limitation of the current study. In addition, it is also possible that some articles could be discovered in other languages, because articles that have not been published in English or Spanish have been excluded from this study. Additionally, it should be mentioned that there are several limitations to the research that was analyzed. Because the surveys relied on retrospective and self-assessment comments, certain studies may have had a limited sample size, and a dataset that was only collected once, at a particular school or institution; consequently, some results may potentially be biased due to the subjectivity of the students. Finally, the present review has identified 17 articles; as more articles are published in the future, the results can be further generalized with the addition of new systematic reviews.

This article can act as the starting point for further research, because the scientific community has shown that the development of IM through FL is a very relevant topic that is still developing and has a long way to go. In this regard, as previously discussed, the technology applied in FL is very important for the development of students' IM. Therefore, new technological advances that can be applied in education, such as artificial intelligence, should be investigated in the future. Finally, due to the diversity of the work being carried out to foster IM through FL, this is an ideal field for innovation in line with the suggestions made in this review.

## 6. Conclusions

In this systematic review, the two research objectives have been fulfilled: (1) 'to analyze the relationship between the use of FL and the IM of students in higher education' and (2) 'to identify the aspects that should be present in the FL model to develop IM that contribute to quality education'. Given that past reviews on FL had different purposes, to the best of the authors' knowledge, no systematic review has examined the two research

objectives of this paper. As a result, this review's most pertinent theoretical contributions address the objectives that are outlined below.

Regarding the first research objective, it may be said that the results of the analyzed articles suggest that applying the FL methodology increases students' IM. Following the SDT, this approach promotes the three elements of students' basic psychological needs (autonomy, competence, and relatedness). Due to the benefits of implementing a FL methodology, this approach is becoming more common in universities across a range of academic and geographic areas.

Regarding the second research objective, it should be noted that all studies concurred on the need to recommend specific aspects of FL, based on the development of IM through FL, because doing so motivates students to be more interested in their studies and provides them with a sense of accomplishment. In this review, in the discussion, six key aspects have been identified that must be followed in order to intrinsically motivate students using the FL methodology.

This study also supplies practical implications for lecturers, teachers, or instructors that they can use as a guide in their classes. Therefore, practical aspects are provided on how to motivate learners intrinsically in an FL intervention. While there is not a single script that works for all FL interventions, students find that being prepared before class helps them concentrate on solving issues and participating actively. While a FL intervention might not be appropriate in every educational setting, it might be when it best meets the needs of the teacher, the students, and aligns with the subject matter.

The implementation of FL that supports IM is required to guarantee high-quality education. As a result of the aforementioned initiatives, the fourth Sustainable Development Goal of the 2030 Agenda can be supported. This goal emphasizes the need to give all students access to high-quality education and encourage possibilities for lifelong learning [1].

**Supplementary Materials:** The following supporting information can be downloaded at <https://www.mdpi.com/article/10.3390/educsci13121226/s1>, Table S1: PRISMA 2020 Checklist. Supplementary S2: Standards for Assessing the Quality of Articles. Reference [51] is cited in the Supplementary Materials.

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