APPLICATION OF THE FLIPPED CLASSROOM METHODOLOGY IN LEARNING THE DEVELOPMENT OF MOBILE INTERFACES

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Abstract

Nowadays it is increasingly a question of applying different learning techniques and strategies in the classroom to enhance student engagement and concept assimilation. This study presents flipped learning methodology applied to the development of mobile interfaces. Specifically, we explore the opportunity to apply this approach using Android Studio technology, under the JetPack Compose framework. The development will be carried out in Kotlin language, currently used in the creation of applications and interfaces for mobiles, among other specific uses. The methodology involves creating a series of videos to explain in detail each of the parts that must be developed and considered when creating an interface. Students are expected to have knowledge of the Kotlin language, and little by little, from basic to advanced, they will be immersed in the development of mobile interfaces. The working method involves video tutorials and exercises, with students documenting questions to be answered in the classroom sessions. The main contribution is the learning of a software programming environment, a complex subject, which presents a steep learning curve. By applying flipped classroom with previously recorded examples of software creation, students will be able to consult this material as many times as they need, and replicate the examples that the teacher proposes, until they achieve sufficient autonomy to be able to independently develop their software projects. This flipped learning approach aims to foster an active learning environment where students are motivated to engage deeply with the subject matter, ultimately enhancing their proficiency in mobile interface development.

Keywords: Technology, android studio, education, flipped classroom, Kotlin, JetPack compose.

1 INTRODUCTION

The constructivist theory of learning presents knowledge as a complex system in which various aspects of experience and prior understanding are actively used to construct meaning [1]. Based on these principles, different methodologies for knowledge transfer are increasingly being implemented in the classroom. Among the most well-known are gamification, project-based learning (PBL), and flipped learning.

In the flipped learning methodology, students engage in prior activities, such specific reading and tutorials, which allow them to independently explore the content before the in-person class. This approach allows in-person sessions to deepening understanding through interactive and collaborative activities [2]. By changing the relationship between students and teachers, with flipped learning students become active learners, and teachers transition from the role of sages to that of learning guides who facilitate the educational environment [3]. During the COVID-19 pandemic, this method was amply used due to mobility restrictions and showed positive results [4]. Supporting this, two meta-analysis indicate its pedagogical effectiveness when appropriately designed [5, 6].

Given these outcomes, flipped learning has potential applications in teaching complex subjects such as the development of mobile interface, where students face challenges that require a blend of technical and conceptual skills. At a macro level, it demands a high degree of abstraction and the ability to manage multiple and simultaneous tasks, including application design, logic implementation, user interface development, testing, among others. In terms of specific abilities, it requires previous knowledge of general programming concepts, proficiency in integrated development environments (IDEs), and familiarity with programming languages [2].

Given this, to facilitate the learning process of development of mobile interface, flipped learning method is an opportunity to simplify and engage students in development of mobile interface. This approach benefits both students and teachers. For students, flipped learning promotes autonomy and foster interaction and collaborative learning among peers [3]. For teachers, it provides an innovative way to share their knowledge, connect with diverse learning styles, and build effective interactions with students. Regard this, this study aims to explore how flipped learning can be applied in the development of mobile interfaces classrooms. [2].

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Although flipped learning is associated with improved student learning, the context of its application must be considered. Socioeconomical context plays a critical role, especially in developing countries, where unequal access to essential resources such as computers and the internet could hinder its effectiveness. Universities must address these disparities by ensuring equal access to infrastructure, such as computer labs and high-speed internet, to create an equitable learning environment for all students.

2 METHODOLOGY

The experiments in this study were conducted according to a series of steps as shown in Fig. 1. These steps include “introduction methodology”, “project proposal”, “upload videos”, “students watch videos”, exercises and doubts”, and finally “assessment”.

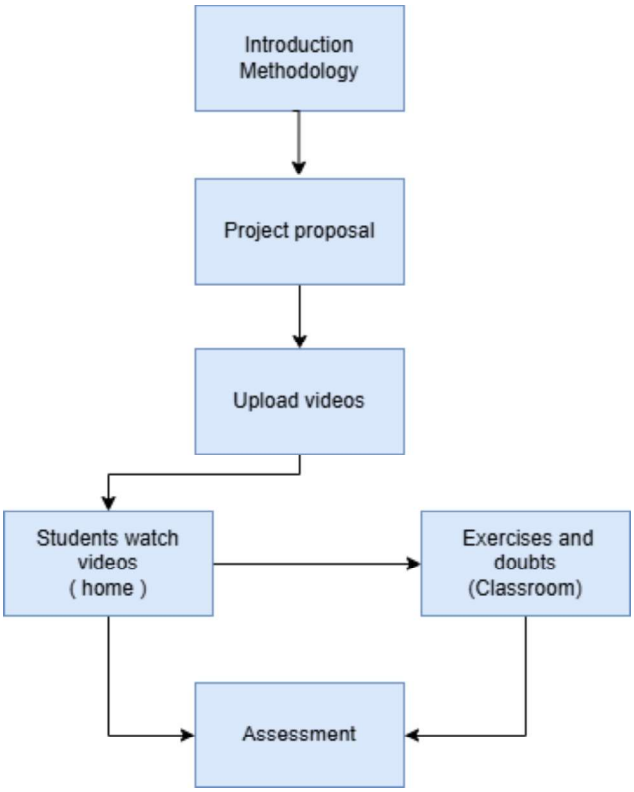

Figure 1.The diagram illustrates the methodological framework employed in this study. The process starts with an introduction to the methodology to be utilized, followed by the objective or purpose of the project. Subsequently, videos are uploaded containing theoretical and practical explanations of the topic. Students will then view the explanations at home and pose questions that will be addressed in class, along with a series of recommended exercises. Ultimately, the evaluation is conducted.

2.1 Introduction methodology

The experiment commenced with an informal presentation to the students, elucidating the concept of the flipped classroom methodology. Students were informed of the nature of their work to be conducted remotely, and that their homework would consist of watching videos that included theoretical and practical explanations, followed by transcription of any queries that emerged during this process. At the same time, they were informed that in the classroom sessions, their exercises and queries would be addressed in face-to-face sessions. We used email and group instant messaging web application, Slack [7], to ensure the perpetual accessibility of study materials (videos and exercises) for students. These materials were uploaded to a virtual classroom, accessible to all students at all times.

2.2 Project proposal

Following the establishment of this novel methodology, which entailed a departure from the conventional teaching approach, the students were informed of the rationale behind its implementation. Specifically

for the purpose of acquiring proficiency in the development of interfaces with JetPack Compose. The objectives delineated were as follows:

1 The formulation of theoretical-practical content that is accessible to the students when required, independent of their physical presence in the classroom, incorporating the instructor's elucidations.

2 Establish a learning paradigm that prioritizes experiential learning over theoretical frameworks.

3 Foster dynamic learning environments and facilitate effective communication between teachers and students.

2.3 Upload videos

An integral component of this methodology pertains to the instructional materials provided to students, namely audiovisual resources that help students to comprehend the instructor's explanations without the possibility of immediate clarification. To this, it is imperative to develop videos that are unambiguous, elucidating, and succinct. Additionally, these videos should be concise, with a maximum duration of 10 minutes, and should prioritize practical application over theoretical exposition. In this instance, the videos focused on the development of mobile interfaces, with students able to replicate the examples demonstrated in the live video from their own computers. As previously noted, the videos were stored in a cloud, which facilitated their integration with the virtual classroom utilized throughout the course. An example of these videos (in Spanish) can be found in [8].

2.4 Students watch videos (home)

The flipped classroom methodology reverses the traditional approach to learning. As mentioned before, instead of the teacher explaining the content in the classroom and students doing exercises at home independently, with this methodology, students watch videos at home. The idea was that students could rewatch videos as many times as they needed. They could pause, rewind, and fast-forward, which is helpful with multimedia content like this. While they watched, students could write down any questions they had.

2.5 Exercises and doubts (classroom)

Following the viewing of the instructional videos, the students were prompted to take notes on any ambiguities or uncertainties. Subsequently, the classroom environment was meticulously designed to address each student's individual inquiries. The instructor provided supplementary guidelines and addressed all pertinent questions raised by the students. Thereafter, exercises and projects were proposed to be conducted in the classroom, with a focus on the videos viewed in the students' homes.

2.6 Assessment

As is customary in academic settings, a systematic evaluation of the exercises and the pedagogical approach was conducted following the completion and submission of the proposed exercises and projects. The evaluation by the instructor was conducted using rubrics, which were provided to the students prior to their initiation. Conversely, students were tasked with evaluating and assessing the methodology employed throughout the teaching-learning process in the development of interfaces with JetPack Compose. This evaluation was conducted through a digital questionnaire that students completed upon the culmination of the learning process.

3 RESULTS

In order to ascertain the viability of the proposed methodology for learning interface development by applying the flipped classroom methodology, it was validated according to a questionnaire that the students who participated in the learning completed at the conclusion of the course [9]. The experimental environment and the results obtained are described and discussed below.

3.1 Experimental environment

The experiment was conducted at a vocational training institute in Cádiz, Andalusia, Spain. The subject population comprised students enrolled in the second year of the Higher Education Cycle in "Multiplatform Application Development." The sample group consisted of 26 students, 25 male students, and one female student.

All students have some kind of Internet connection device at home. In the classroom, each student has a personal computer (PC) with the necessary features to carry out the exercises in the work framework. The framework used was Android Studio version Koala | 2024.1.2, developing the interfaces using the framework's toolkit, called JetPack Compose. The programming language used was Kotlin. The students had previously acquired proficiency in this programming language during their introductory course in the first year of the Higher Grade Vocational Training Cycle.

A form was developed for the purpose of collecting student evaluations of the learning process. This form was created using Google Forms, a free web application. Following the conclusion of the learning, the form was completed by all participants.

3.2 Discussion and results

As illustrated in Figure. 2, the age of the students who participated in the study ranges from 18 to 23 years old, with a majority of more than 80% falling within this age range. The data indicates a diversity of ages among the participants, which could mean that the level of knowledge on the subject was uneven, due to personal experiences.

Given the age data, it was considered essential to determine the student's initial knowledge level on the subject to be taught prior to the commencement of the study. The objective of the study was to ascertain whether students had previously encountered the JetPack Compose toolkit. Figure. 3 provides a comprehensive summary of the collected data. Majority of the students, exceeding 75%, had no prior exposure to the toolkit prior to the commencement of the learning process. Only a minority, constituting 25% of the participants, had received rudimentary or intermediate training. It is noteworthy that none of the students had prior professional experience with the toolkit before the experimental phase of the study. This provides a more comprehensive understanding of the experiment, as it acknowledges that the students begin with a similar level of knowledge, indicating that most of them are starting from scratch.

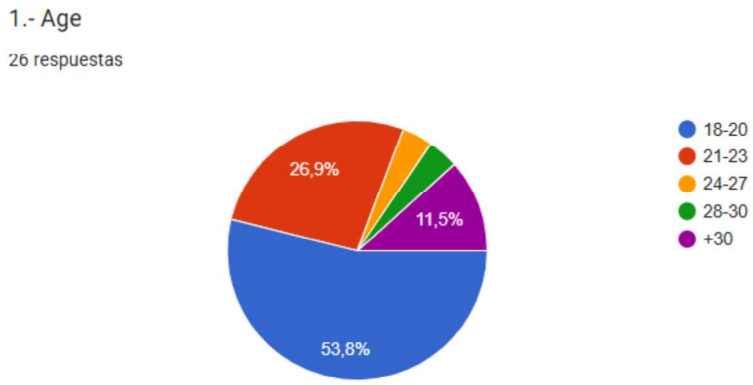

Figure. 2. Age of the surveyed students who participated in the experiment.

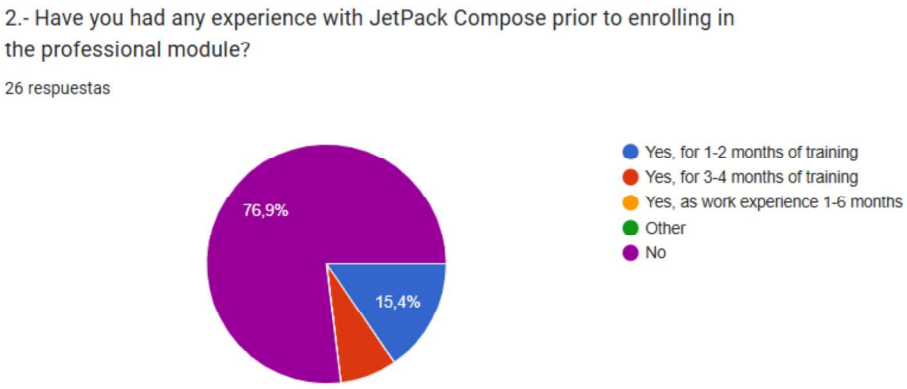

Figure. 3. Evidence of prior engagement with the JetPack Compose toolkit, whether in a professional or academic context.

In order to ascertain the suitability of the materials provided for the students' learning and to determine whether revisions should be made for future editions of the course, the students were directly asked for

their opinion on the quality of the videos and exercises. As illustrated in Figure. 4, most of the students rated the materials as "excellent" or "very good," with only one student rating it as "good." The materials were designed with two objectives in mind: adherence to a proposed methodology and promotion of student learning. The latter objective entailed implicit encouragement of each student's personal development, ensuring that the materials were not entirely directed towards responses but incorporated an additional research component.

The prevailing paradigm of education, characterized by classroom lectures and homework exercises, has long been a staple of pedagogical practice. However, the advent of the flipped classroom model, has prompted a shift in the established tradition and the objective of this study was to ascertain the students' perceptions of this novel pedagogical approach. Figure. 5 presents the students' impressions regarding the learning experience facilitated by the flipped classroom model, juxtaposed with their perspectives on the efficacy of the traditional methodology. The results indicated that the vast majority of respondents, with the exception of a single participant, perceived a significant improvement in their learning experience if the traditional methodology had been employed. This finding suggests that the implementation of the flipped classroom methodology has been effective in enhancing the learning process, particularly in the context of developing interfaces.

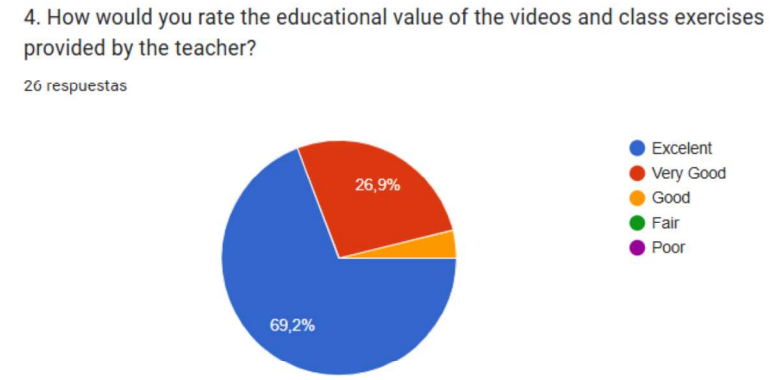

Figure. 4. A review of the teaching material (videos and exercises) used in the experiment by the students who participated is requested.

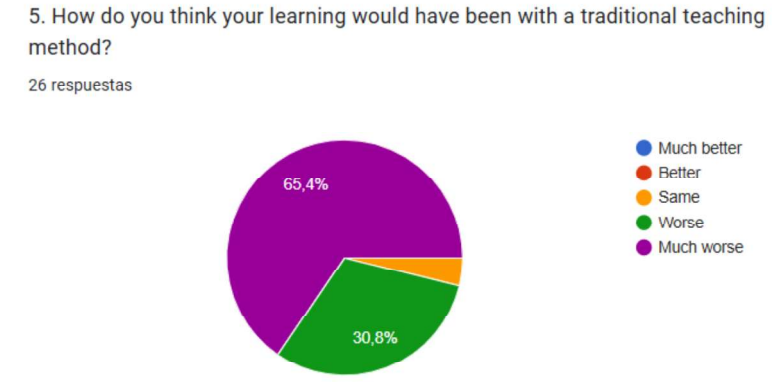

Figure. 5. A comparison has been made of the learning received in relation to the possible learning of the same subject using a traditional methodology.

Finally, it was deemed imperative to ascertain the aspects that students deemed most significant in the learning process, with the objective of ascertaining which of the components they had prepared prior to the commencement of the experiment were most pertinent to them. Figure. 6 presents the results of the inquiry incorporated into the questionnaire pertaining to this matter. Students were presented with five options, from which they could select a maximum of three. As depicted in Figure. 6, the majority placed the greatest value on the teaching materials, which is not unexpected, given their previously high ratings in another questionnaire item. In second and third place, the students prioritized the teacher's availability throughout the process and the time spent in the classroom, including the tasks carried out in it. This observation suggests that these factors should be prioritized in educational settings, as evidenced by

the findings of this study, without disregarding other crucial elements, as illustrated by the data presented in the graph that collects the data for this question.

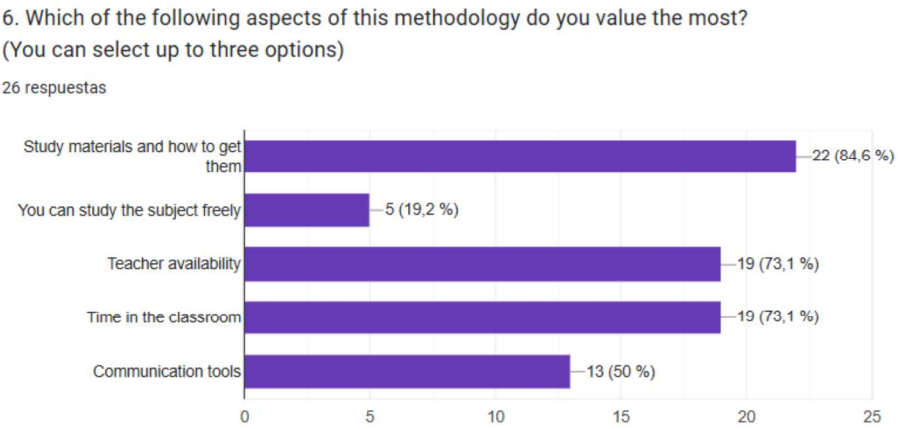

Figure. 6. A review of the most valuable aspects of the flipped classroom methodology from the perspective of students who have completed their learning process using this method.

4 CONCLUSIONS

After the presentation of the results and their discussion, the conclusions of the study will be grouped into different sections throughout this section to facilitate their reading.

4.1 Introductory data

This paper analyses the implementation of the flipped classroom methodology in an instructional context focused on acquiring proficiency in the development of interfaces for mobile devices employing the Kotlin programming language within the framework of Jetpack Compose. This methodology was employed in a second-year Vocational Training classroom, where the students had already acquired programming skills, though not all of them were familiar with the technology that would be utilized, and even fewer were acquainted with the methodology that would be employed during the instructional session.

4.2 Survey analysis

A preliminary investigation of the students' responses reveals that the sample is evenly distributed across age groups. Notably, the youngest participants in the study have no prior experience with Jetpack Compose, while those with experience, whether educational or professional, are the oldest. While the sample size is modest, it is sufficient to ensure that the study participants have virtually identical levels of prior knowledge on the subject.

The survey results pertaining to the evaluation of the study material indicate that the majority of students regard the exercises and teaching material to be "very good" or "excellent". This outcome underscores the importance of providing students with quality study material and exercises that are appropriately focused on the learning process.

The findings of the present study indicate a clear preference among students for the implementation of the flipped classroom methodology in lieu of the traditional learning methodology that was previously studied. Indeed, students have posited that their learning experience would have been significantly more arduous or even wholly unfavourable under the traditional methodology.

The most valued factors by students are the materials, which is consistent with the direct question and positive answers. Teacher availability and classroom time are the second and third most valued factors, respectively. These results indicate that for a correct and complete application of this methodology, it is very important that the teacher offers the highest possible availability to the students. In addition to providing quality material, as previously mentioned, it is crucial for teachers to meticulously plan their classroom sessions. This entails leveraging class time effectively, addressing student inquiries, allocating time for individual student work, and demonstrating attentiveness to any additional demands from students, among other responsibilities.

4.3 Limitations of the study

The present study acknowledges the inherent limitations of the scientific method, which may be influenced by extraneous factors. For instance, the outcomes of inquiries concerning prior experience with Jetpack Compose are contingent on the individual student's experience, which may be characterized by diversity and variability. Additionally, the results of other inquiries may be influenced by the students' maturity, as evidenced by their perception of the material presented and the most valued aspects. It is recommended that this study be conducted over the course of multiple academic years to allow for longitudinal analysis and comparison of results.

4.4 Future work

In subsequent studies, we propose the implementation of this methodology in the domain of other areas of Computer Science, such as the study of a programming language, to assess the impact of the comprehensive teaching-learning process delineated in this work on a different area. A more extensive study could be proposed, incorporating additional inquiries into the survey, to enhance the comprehension of students' perceptions.

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