Flexible Learning Itineraries in Digital Environments for Personalised Learning in Teacher Training

Itinerarios de aprendizaje flexibles en entornos digitales para un aprendizaje personalizado en la formación docente

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ABSTRACT

The pedagogical strategy of flexible learning itineraries in digital environments aligns with current practices that focus on students' agency to control their own learning. Flexible learning itineraries allow personalised learning while enhancing self-regulated learning skills such as setting aims and defining strategies. Paramount for successful strategies of flexible learning itineraries is the learning design which has to be defined with precision and responds to a detailed set of needs beyond access at anyplace or anytime. The main aim of flexible learning itineraries is to allow student choice so that they may construct their own pathway by selecting their options based on their own individual needs, motivations and prior knowledge. This research seeks to validate the prototype of a pedagogical strategy based on flexible learning design implemented in a subject of the Teacher Education programme at the University of the Balearic Islands. From a design-based research methodological approach, learning itineraries and sequences were created, and data was collected on student satisfaction via an online survey. Results show, on the one hand, the students' satisfaction with the experience and the pathways built, and on the other hand, in view of the diversity of choices made, that the pathways promoted the personalisation of learning, allowing the teaching-learning process to be adjusted to their personal characteristics. Conclusions suggest that the instructional design supports self-regulated learning strategies. In addition, conclusions reflect on the need to address digital current challenges from equitable and just approaches; and, also, on the value of the teacher's role as designer.

Keywords: educational technology; information and communication technologies; teacher education; individualised teaching; self-management.

RESUMEN

La estrategia didáctica basada en el diseño de itinerarios de aprendizaje flexibles en entornos digitales se alinea con las prácticas actuales centradas en la agencia de los estudiantes para tomar el control de su propio aprendizaje. Estos permiten un aprendizaje personalizado al tiempo que mejoran habilidades de aprendizaje autorregulado como establecer objetivos y definir estrategias. El objetivo principal de los itinerarios de aprendizaje flexibles es permitir a los estudiantes elegir para que puedan construir su itinerario seleccionando opciones en función de sus propias necesidades individuales, motivaciones y conocimientos previos. Esta investigación busca validar el prototipo de una estrategia didáctica basada en el diseño de aprendizaje flexible implementado en una asignatura del Grado de Maestro de Educación Primaria de la Universidad de las Islas Baleares. A partir del enfoque metodológico de investigación basada en diseño, se crearon itinerarios y secuencias de aprendizaje y se recopilaron datos sobre la satisfacción de los estudiantes mediante una encuesta en línea. Los resultados muestran, por una parte, la satisfacción del alumnado con la experiencia y los itinerarios construidos, y por otro, a la vista de la diversidad de elecciones que se hicieron, que los itinerarios promovieron la personalización del aprendizaje permitiendo ajustar el proceso de enseñanza-aprendizaje a sus características personales. Las conclusiones sugieren que el diseño didáctico apoya las estrategias de aprendizaje autorregulado. Además, reflejan la necesidad de abordar los desafíos actuales digitales desde enfoques equitativos y justos; y, también, sobre el valor del papel de los profesores como diseñadores.

Palabras clave: tecnología educativa; tecnologías de la información y la comunicación; formación del profesorado; enseñanza personalizada; autogestión.

INTRODUCTION

Today, there are cases where learning designs aimed at developing lifelong learning and promoting the integration of Information and Communication Technologies (ICT) in pedagogical processes are remain based on traditional education, which has been mainly characterised by content and teacher-centred approaches to learning. These characteristics have been observed as inefficient in addressing learning in a digital society characterised by their complex knowledge (Salinas, 2009; Agudelo & Salinas, 2015). Flexible learning responds to the need to promote pedagogical methodologies placing students at the centre of teaching and learning processes (Willems, 2011) and digital technologies can support these new ideas for teaching under learning designs forms (Laurillard et al., 2018). Likewise, the OECD Skills Outlook 2019 report posits that digital environments can support the development of skills and interdisciplinary knowledge by facilitating student construction of their own self-paced learning processes. Autonomous and lifelong learning can be enhanced by flexible itineraries or pathways across different contexts, which, in this regard, have been facilitated by the design of technology-enhanced learning activities (Marín et al., 2020). Virtual environments can extend learning beyond formal and institutional contexts for which it becomes paramount for learners to develop skills for lifelong learning whilst at the same time being able to plan and manage their own learning processes. Furthermore, digital environments are at the root of current educational trends which allow student-centred approaches for autonomous and personalised learning (de Benito et al., 2010; Agudelo & Salinas, 2015; Mengual-Andres et al., 2020) and which are paramount for the promotion of Open Educational Resources (OER), as recommended by the UNESCO (2019). In order to achieve these goals, learning design needs to be addressed rigorously by taking into account the diverse elements and their interactions (Salinas & Agudelo, 2016). In this article we present an initial prototype of the pedagogical strategy based on flexible learning itineraries or learning pathways in digital environments so as to face the challenges arisen by digital technologies in education and address the need for personalization of learning and digital skills along with a critical approach for equality based on OER.

At this point, it should be underlined that in this paper we use the terms learning itineraries and learning pathways as synonyms, following Buitrago et al. (2021). These two terms come from different research backgrounds which do not seem to have been cross-referenced in previous scientific literature but which we observe as conceptually equivalent and we believe that an understanding of both views could have a positive impact on the two conceptual traditions. However, there seems to be a very relevant difference between these two conceptual traditions relating more to their implementation and practice rather than their underlying frameworks. Learning itineraries have always been implemented in contexts where diversity and opportunities for student choice are offered by the teacher's learning design (see, for

example, studies by de Benito et al. (2010) and Agudelo and Salinas (2015) which are all conducted in the emerging spaces between personal and institutional virtual environments and offer a set of options), whereas for learning pathways there also exists educational implementation in which diversity of student choice is based on adaptive digital environments in which the routes are mainly supported by data-driven decisions – as, for example, in Welch Bacon and Gaither (2020) – and may involve choice throughout the whole programme – see for example, research by Latrellis et al. (2020).

THEORETICAL FRAMEWORK

Flexible learning promises democratic access to education for everyone. However, flexible learning has also been criticised for its uncritical approaches, in which agentic skills are assumed while other circumstances related to power and privileges remain inadvertent (Houlden & Veletsianos, 2019). Thus, flexibility beyond "anytime anyplace" claims are needed, which requires greater questioning by practitioners (Houlden & Veletsianos, 2019) and designers and further work as required in learning itineraries or pathways.

In the context of formal education and as a general approach, learning pathways have been defined by Janssen et al. (2011, p. 2018) as "sets of one or more learning activities leading to a particular learning goal" and can take the form of simple tasks to be completed by students or involve an entire curriculum. According to Janssen et al. (2011), in order to make their choices, learners need some specifications such as learning objectives, study load or prerequisites. The decision process is carried out through two main processes: screening and choice, which means that students select a number of possible options by considering their attributes before making the final choice. This means that the number of options offered should avoid choice overload and a tool to select a limited set of options is recommended in order to help learners in their selection process. In line with this, learning itineraries have been said to allow flexibility, which has been described as the adaptation of the media, the organisation of content and learning objectives, time, participation conditions, and instructional design, among other elements (de Benito et al., 2010; Agudelo & Salinas, 2015; Buitrago et al., 2021). Also, Buitrago (2020) has observed that learning itineraries have been designed based on different underpinning concepts such as learning guides or content structures and more recently have been adapted to concept maps.

Salinas (1999) observed that flexible education demands a conceptual change in its learning and teaching processes, as well as in the teacher's roles together along with the educational practices and the organisation of content, and its access, control and infrastructure. The underlying educational principles for flexible itineraries require a balanced approach to collaborative and autonomous learning along with the key role of the learner who makes their own choices. Also, as one of the main elements,

the technological environment allows processes to be controlled (Salinas, 2013). Therefore, the option of flexible learning itineraries in digital environments allow for personalisation of learning while at the same time promoting the development of self-regulated skills and student agency (de Benito et al., 2020). Flexibility is promoted through digital environments since these support navigation through the diverse options that may configure learning itineraries (Lopes & Lima, 2019).

Personalised learning has been defined as the adaptation of "teaching decisions on a macro and micro level to follow an individual learner's needs" (Rajagopal et al., 2020, p. 155). Both flexible itineraries and pathways have been linked to personalised learning. From one perspective, personalised learning pathways have been defined as "an organised, progressive and adaptive architecture within which learning content is personalised to achieve improved comprehension and demonstrated competence by each individual learner" (Welch Bacon & Gaither, 2020, p. 91). In this definition, the data-driven environment is included in the term 'adaptive system' and it allows us to understand that personalisation comes from the data obtained and the solutions offered by the platform itself.

However, personalised learning can also be understood separately from the adaptive systems recently developed. According to this different approach, personalisation of learning is based on the adaptation of content and planning of the design by including students' prior knowledge, varied content levels, including the need for higher levels of performance, and diverse learning styles (Minguillón et al., 2005) allowing the co-design of their education plan that may result in increasing students' commitment and engagement (Buitrago et al., 2021). Thus, based on these authors, personalisation of learning is closely related to the construction of student learning paths based on their interests, needs, prior knowledge and peer influence. Following Coll (2016), the purpose of personalised learning is to enable students to make sense of what they are learning, which involves taking control of and making their own decisions about their learning. Learners have their own voice and the option to choose. In this way, they can adapt to their own learning pace, adjusting it to their own beliefs or eliminating barriers whilst simultaneously increasing student engagement (Coll, 2016). However, this flexibility for personalised learning needs to be guided by teachers who should offer increasing flexibility during the learning process, giving more guidance at the beginning and more freedom towards the end (Peña-López, 2009).

Martínez (2009) suggested that personalised learning is a key pedagogical element for building a learning itinerary as it supports meaningful information management by organising learning. Benítez (2010) also added that a learning design directly connects learning theories and their implementation as they work together to turn theory into practice. ICT can enhance the learning design of personalised learning when based on the constructivist approach whilst at the same time improving the discussion between educational stakeholders (Coll & Monereo, 2008). Likewise, ICT

can facilitate personalization by promoting the creation and access to OER, which have been claimed to support equity and inclusion for all learners (UNESCO, 2019).

Therefore, flexible itineraries require a high level of learning design, involving greater organisation of elements such as aims, content, organisational structure (Cabero, 2004) and the pedagogical sequence which is related to meaningful learning (Díaz Barriga, 2013). Díaz Barriga (2013) defines the pedagogical sequence as activities with an internal order aimed at achieving a new outcome based on previous learning and which are related to a problem-based situation in a real context. The design of pedagogical sequences is dynamic since all activities are highly interrelated – including assessment. They are designed in three phases: initial activities, where there is a connection with students' prior knowledge; development activities in which new learning scenarios are established; and closing activities, which require summarising and the conclusion of the whole learning process.

The learning design of this conceptual pedagogical sequence approach, with its three different stages of preparing, performing and concluding learning, has a close relationship with the self-regulated learning process framework. Zimmerman's work (1989; 2002) was pioneering and first described self-regulated learners as those learners who control their processes based on motivational, cognitive and behavioural variables and who are able to transform their mental abilities into cognitive academic skills. In parallel, McCombs (1989) emphasised the active role of learners, who choose their learning aims and thus plan, select strategies and assess their performance during learning. Further research in this field has provided a definition of diverse models, and of all of these, Zimmerman's (1989), which was subsequently revised by Zimmermann and Moylan (2009), is that which is most closely related to the concept of flexible learning itineraries.

Student academic agency involves moving forward in the context of self-regulated learning research and is receiving greater attention in the educational context. Based on Castañeda et al. (2014), agency includes cognitive, motivational and self-regulatory elements that allow students to develop learning skills in an active way. In particular, it is related to the ability to choose between options, which implies the use of resources and strategies for the development of agency in the individual, relational and contextual dimensions defined by Jääskelä et al. (2016).

This article aims to present a pedagogical strategy prototype based on flexible learning itineraries allowing for personalisation of learning, and in which students have the opportunity to build their learning process, and thus, develop self-regulated learning skills and enact agency. Our research aims to design and assess a pedagogical strategy based on learning itineraries which are organised in pedagogical sequences in order to enhance students' self-regulated learning. Thus, our work seeks to answer the following research questions: Do students perceive that personalised learning itineraries support self-regulated and autonomous learning?

METHODOLOGY

In order to answer the research questions, the following aim is defined: design and analysis of pedagogical sequences to the construction of personalised learning itineraries supporting student autonomy and responsibility in the teaching and learning process. Thus, a design-based research methodology is adopted as the research approach (de Benito & Salinas, 2016; Plomp, 2013; Reeves, 2006), offering a framework to study the design and implementation of educational improvement with participative processes and iterative cycles. Thus, each new cycle, which is based on the results of the implementation of the previous one, improves the design and contributes to the expansion of what is known by offering design principles.

This paper presents the methodological design of the research carried out and describes the implementation of the first cycle. The complete design is presented in another article published by Salinas and de Benito (2020).

The study has followed the phases described by Reeves (2006) and de Benito and Salinas (2016): a) analysis of the situation and definition of the problem; b) development of solutions; c) implementation and evaluation; and d) production of documentation and generation of design principles.

Figure 1

Cycle diagram following the phases described by Reeves (2006) and de Benito and Salinas (2016)
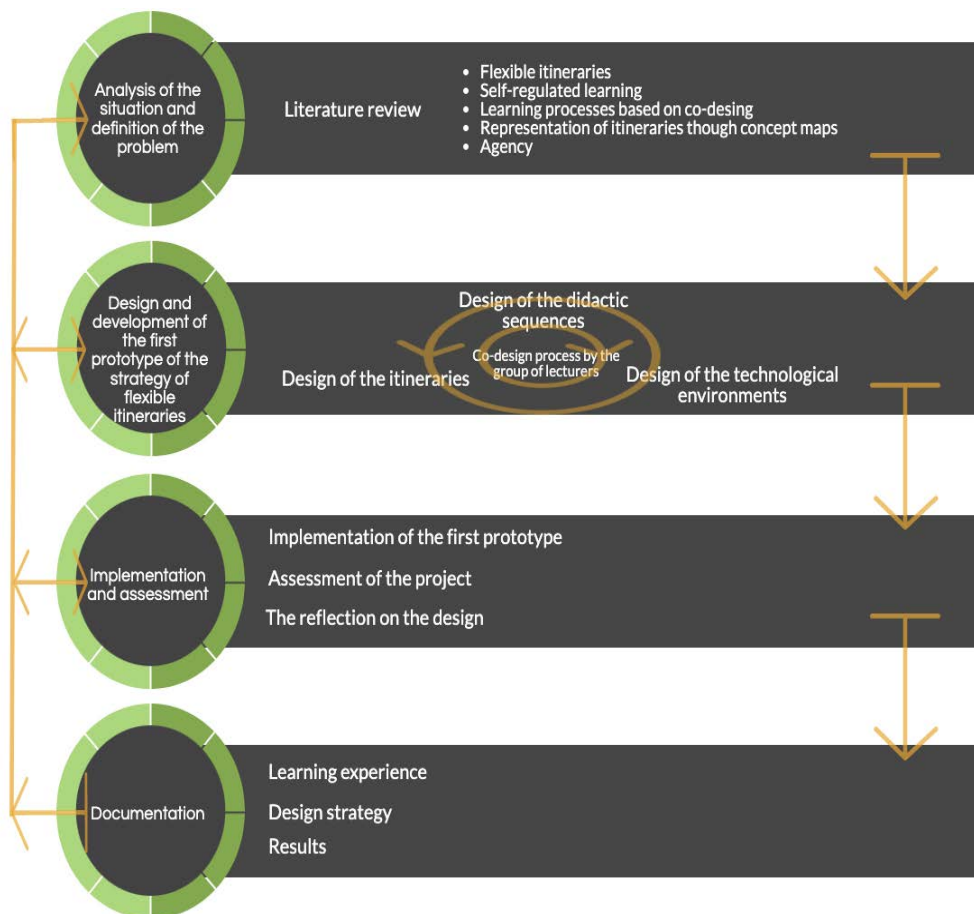
Analysis. The analysis of the situation allows us to formulate the research questions and variables of the study by addressing both the literature review and context analysis. In this phase, we carried out a systematic review of flexible itineraries (de Benito et al., 2010; Salinas & Agudelo, 2016), self-regulated learning (Zimmermann & Moylan, 2009), learning processes based on co-design (Dollinger et al., 2018), representation of itineraries through mind maps (de Benito et al., 2012) and agency (Jääskelä et al., 2016). All these reviews considered the characteristics

of higher education and the organisational requirements along with those of virtual environments and participants.

Design and Development. In this phase, the design and development of the first prototype of the flexible itineraries strategy was carried out in different iterative cycles. Each cycle included a process of situation analysis, design and development, implementation and assessment, and closing. The cycles that were developed are the following:

a. Design of the pedagogical sequences that would make up the itineraries. In a co-design process by the group of lecturers the following structure was agreed: a) information on the topic; b) development and construction of learning by designing learning activities; c) closing, reflection and assessment (Díaz Barriga, 2013). A template for the presentation of the pedagogical sequence was agreed upon (students file/document) and understood as an OER since all were free to use and reuse in order to create their itineraries. This document includes two closing instruments: an assessment questionnaire so that students can assess their satisfaction level according to their own motivation and awareness of their own learning; and, an assessment survey to evaluate student satisfaction with the learning design suggested and documents provided. All documents were open to students in a local repository, which was fed by the team of lecturers-researchers and available to all participants of the different groups of the subject and islands.

b. Design of the itineraries. Based on a co-design approach, the group of lecturers-researchers established the criteria for the design to support face-to-face and distance itineraries with a wide range of formats. In developing the process, many ways to collect data on the learning itineraries chosen by students were used: analysis of mind maps with visual representation of their personal itinerary, analysis of their personal weekly reflective tweets on their learning and the final satisfaction survey. In this paper, we present the results of the final survey.

c. Design of the technological environment. In this phase, the design of the virtual platform to support learning itineraries was undertaken. This design was based on the institutional virtual environment and other technical support services for the selection of the learning path. In order to assess the usability of the digital environment, we collected both messages sent by students and lecturers' assessments from their follow-up meetings.

Implementation and assessment. This cycle included the implementation of the first prototype, the assessment of the project and the reflection on the design of flexible learning itineraries. During strategy implementation, information was collected through the above-mentioned techniques: final survey, closing survey in each pedagogical sequence, monitoring of the co-design process, student outcomes and performance analysis and communication throughout the digital environment.

Documentation. Presentation and dissemination of the learning experience, design strategy and results obtained.

Context

In this section there is a description of the context of the itinerary prototype implemented during school year 2019-20 in a third-year subject of the Primary Teacher Education programme at the University of the Balearic Islands with the intervention of six teachers and 206 students organised into 5 groups. Furthermore, we report the results obtained on student satisfaction with the itinerary. All students were informed of the research project and its aims and were asked for their voluntary participation for which they did not receive any compensation and could withdraw without negative consequences. All data have been treated anonymously following the mandates of current European and Spanish laws on data privacy.

Design, development and implementation of a strategy based on flexible learning itineraries

Based on the agreements reached by the lecturer-researcher teams on the pedagogical sequences, organisation of itineraries and the technological environment, a prototype was designed and developed with the following characteristics.

For the creation of the itineraries, we followed the model agreed upon in the design phase and thus, the pedagogical sequence followed the structure suggested by Díaz Barriga (2013): introductory activity, development and closing activity. Assessment was decided according to workload and the pedagogical sequences were structured into blocks of 6 hours (6, 12, 18, and 24) which accounted for 5%, 10%, 15% and 20% of the final assessment, respectively. Each pedagogical sequence included a student fact sheet that presented information on elements such as, learning aims, places available, requirements, teamwork, dedication in hours, schedule, sequence description and task (or activities), assessment criteria and a satisfaction rating, and learning resources. These elements emerge both as part of the pedagogical design and as attributes for students' choices, as suggested by Janssen et al. (2011).

The itinerary of this subject was organised into two blocks: a common one that would make up 30% of the final assessment and which included a face-to-face continuous assessment route, and a non-presential route; a wide variety of activities of up to 15 pedagogical sequences split into four groups according to their typology, from which students had to choose one for each group and whose assessment composed 70% of their final mark. The group of sequences aimed to diversify the learning activities offered and thus better adapt to students' needs and motivations. To this end, pedagogical sequences included the following options: distance and in person activities, experiential and contextualised ones requiring continuous attendance; individual and teamwork activities with different groupings of students;

and, finally, pedagogical sequences for a variety of topics and based on different approaches.

The pedagogical proposal was implemented in the institutional virtual environment and with the support of other external services – such as survey tools – for the selection and management of itineraries and group formation depending on selection; as well as for data collection on satisfaction with the learning itinerary compound and the pedagogical sequence outcomes (see Figure 2).

Figure 2

Learning itineraries: blocks and pedagogical sequences
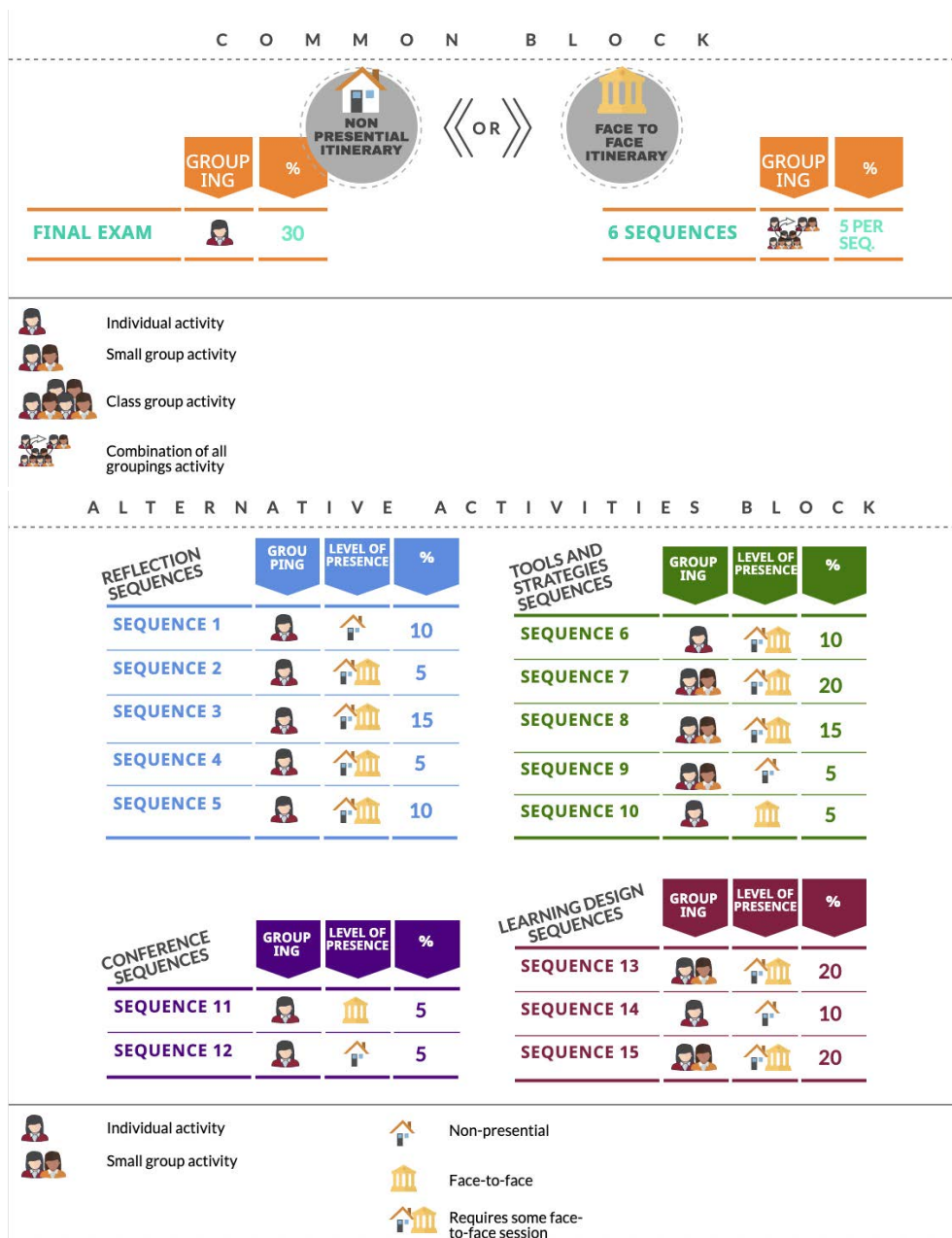
RESULTS

Results on student satisfaction with the itinerary and sequence

At the end of the term, a final survey to assess student satisfaction was conducted. The instrument included questions about the strategy based on flexible itineraries, the descriptive files of the pedagogical sequences, time and organisation management and the virtual environment. It was developed ad hoc and included 18 items to be answered on a Likert scale with 5 levels and 2 open response items. Out of the 206 students enrolled, 196 responses were collected from students who stated that they had attended more than 80% of the lessons on campus.

In parallel, at the end of each alternative sequence, along with task submission, students were asked to score their satisfaction with the pedagogical sequence on three items whose answers included a five-level scale.

Following Carifio and Perla (2008), the data obtained on the Likert scale were associated with a numerical variable, 1 for the minimum rating of the scale and 5 for the maximum, and a descriptive statistical analysis was performed.

From the average scores obtained in the final questionnaire, it appears that (see Table 1):

- Students valued positively the option of selecting their own itinerary (4.12) and were satisfied with their selection (3.76). The experience of working through itineraries was equally positive (3.81), motivating (3.36), and students reported learning that could be transferred to other situations (4.09).
- The sequence descriptions were consulted (4.24), the information contained was sufficient to construct the itinerary (3.49). They were useful (3.37), provided sufficient information (3.26) and helped to organise learning (3.36), although they were not clear (2.98).
- Time dedicated was sufficient to master the subject (3.95) and the pace of work was appropriate (3.05).
- In the organisation of content by itineraries, the option of exercising control over the learning process (3.57), of learning more (3.44) and of focusing on lesser-known content (3.38) were valued positively.
- The assessment of access to resources (3.84) and communication tools (3.82) in the virtual classroom was also positive.

Table 1

Mean scores and standard deviation of student satisfaction with the route, sequences and environment

	X	σ
I appreciate the option of selecting my own itinerary	4.12	.997
I am satisfied with the selected itinerary	3.76	1.10
In general, I value the working experience of this subject as positive	3.81	.99
The way of working in the subject (by itineraries) was motivating for me	3.26	.996
From the way I worked in this subject, I learned skills that I will be able to use in other subjects or professional experiences	4.09	.806
I consulted the sequence descriptions to construct my itinerary	4.24	1.12
The information presented in the sequence sheets was sufficient to choose my itinerary	3.49	.965
The sheets for each sequence were useful for me	3.37	1.34
The sheets for each sequence gave me enough information	3.26	1.12
The information presented in the sequence sheets helped me to organize	3.36	1.21
The descriptive sheets of each sequence were clear and easy to understand	2.98	1.15
The time I spent preparing the subject was enough to master it	3.95	.999
The pace of work of activities, submitting assignments etc., was suitable	3.05	1.15
This way of working on the content gave me more control over the learning process, as it allowed me to work on it according to my preferences (timetable, pace, learning style etc.)	3.57	1.09
I think this way of working and organizing content helps me learn more	3.44	1.19
This way of organizing the content gave me more control over the learning process, as it allowed me to focus on the content, I did not know	3.38	1.07
The structure of the subject in the virtual environment made it easier for me to access the resources	3.85	1.06
The communication tools in the virtual environment were sufficient and suitable	3.82	1.03

Additionally, the results (average scores) of satisfaction with the 15 alternative sequences indicate a high level of satisfaction with the learning process (4.56). The approach to the pedagogical sequences was motivating (4.14) and students are aware of the new knowledge that the activity has brought in regard to their future teaching practice (4.36) with a low level of dispersion in scores (see Table 2).

Table 2

Mean scores (mean and standard deviation) of student satisfaction with the options offered

	X	σ
I am satisfied with the learning process	4.26	.756
I found the approach to the activity motivating	4.14	.811
This activity provided me with new knowledge that I will be able to take into account in my professional practice	4.36	.726

In light of the average scores, and also considering the dispersion in many items, we can affirm that organisation by itineraries was welcomed by a large number of students who reported benefits in their learning. As for the components, we observed that the model and content of the descriptive sheets of the sequences were appropriate and useful, although it would definitely be worthwhile making them clearer for further iterations of the pilot strategy.

Data obtained suggest that itineraries were well planned in terms of pace and workload. This is a key element since this methodology increased the number and diversity of activities to be carried out by students, which might well have resulted in a heavier workload and a greater need for organisation. This planning facilitates the process of screening and final choice as suggested by Janssen et al. (2011). In fact, students' comments about the advantages and disadvantages of this project and organisational methodology – 155 answers on the former and 183 on the latter – show that the most significant limiting factor was workload. Likewise, we might also infer that it helped a large number of students improve their level of self-management in the process (or it benefited those students who had these skills), management of resources and relationships with others. The comments collected on affordances reinforce this last statement, as the main advantage (according to 38.1% of respondents) was being able to choose the sequences to be carried out according to interests or motivations, followed by different aspects encompassing self-regulation (37.4%), which in turn was the second disadvantage (10.9% of respondents).

It can be observed that the rating of each one of the sequences is higher than the overall evaluation of the itineraries, the descriptive sheets, and so on. An explanation for this fact is that the satisfaction survey for each sequence followed by students was filled out upon completion of each one during term time, whereas the overall assessment of the proposal took place at the end of the academic year, when students might have been showing signs of fatigue in their answers.

DISCUSSION AND CONCLUSION

It seems that flexible itineraries have encountered difficulties in educational uptake, as claimed some time ago by Gunn (2011), although they are one of the most relevant pedagogical strategies for student-centred approaches to learning, and thus, in alignment with current innovation trends in which students are asked to develop autonomously (Willems, 2011; Salinas et al., 2022). It is interesting to point out that in contrast to traditional designs where the same set of content and strategies are offered (Salinas et al., 2022), itineraries support continuous change and innovation that affects not only learners but also teachers and the whole institution. The innovative design documented in this article based on flexible itineraries in virtual platforms also changes the way teachers play their role and involve new organisational and technological environments that might affect and prepare institutions for the future requirements of our complex and diverse current society. Indeed, the fact that the diverse options are open through a local repository is a step forward towards open education, which has been argued to be transformational (Elias, 2021). Nonetheless, each pedagogical sequence becomes an OER, and users are free to use and reuse all materials available to them. In the experience reported, these OER have been available to students of the diverse groups involved, but with the new iteration cycles they will be improved and accessible for a wider audience. In this way, currently participants across different programmes have been involved through a common VLE (Virtual Learning Environment) and a tool to build flexible learning itineraries, and for the last step, as the resulting outcome of the third cycle of iteration, it is planned that both pedagogical sequences and virtual environments will be totally open to be used, mixed and reused by lecturers from other universities and contexts.

As has been argued, flexible itineraries have been linked to personalisation of learning along with the development of skills for self-regulated learning and student agency. The results obtained allow us to support these relationships by reflecting on the strengths and weaknesses observed, which in turn will be considered for further iterative cycles to re-design the strategy.

The diversity of final choices and thus, of personal itineraries, is evidence of having successfully handed over control to students and of connecting with their individual needs, motivations and preferences, organisation and availability, and prior knowledge (Minguillón et al., 2005; de Benito et al., 2010; Agudelo & Salinas, 2015). The connection of current learning with further lifelong and professional scenarios aligns this educational practice of learning itineraries with the development of student-centred designs, for the development of learners' skills and interdisciplinary knowledge, something which is essential to face the challenges of the 21st century, as claimed by the OECD Skills Outlook 2019 (2019). Furthermore, the learning design has also allowed students to enact their agency (Jääskelä et al., 2016), which is promoted mainly by offering the opportunity to choose, enhanced

by the contextual dimension. Our data support the fact that this process has been successfully developed.

Since students seemed to have constructed their own personalised learning itineraries, it was to be expected that these itineraries would have an impact on student engagement and motivation. Our results seem to confirm these facts and show evidence of engagement and satisfaction – despite the fact that some difficulties were also reported. This is also particularly interesting as motivation is one of the key processes described when preparing learning and following the self-regulated model referred to in this study, which seems to have been supported by the pedagogical sequences provided.

The model of pedagogical sequences seems to have supported student self-regulated learning processes (Zimmerman, 2002; Zimmerman & Moylan, 2009). In summary, students planned the processes – they chose their options in relation to their needs, motivations and other attributes, such as time and workload. They performed learning – while monitoring the three phases of the learning sequence. And finally, they self-reflected after each submission – which was scaffolded by a survey to undertake self-assessment on learning and satisfaction.

Along these same lines, and considering the dispersion in the responses, we can infer that, on the one hand, this methodology helped improve students' self-management, and, on the other hand, it benefited those students who already possessing these skills. This is certainly an interesting line to explore and for which to create scaffolding aids, if needed.

As for the construction of learning itineraries, based on data collected on the usefulness of the factsheets, we can infer that they did not overburden students in terms of decision making, as suggested by Janssen et al. (2011). Therefore, we believe that the clustering of four types of pedagogical sequences, the number of options in each group and the information included in the sheets of the sequence were manageable. Furthermore, there were no comments or queries by students on an excessive number of attributes when it came to making the choices. All in all, it could be concluded that the enactment of agency while choosing (the contextual dimension of agency) has not been particularly troublesome and that the design and the resources provided have been helpful. However, further research should explore these aspects and the manner in which students could prioritise some attributes over others, as well as the way of balancing support with more guidance at the beginning and more freedom at the end of the learning process, following recommendations by Peña-López (2009).

The design-based research methodology also supported a collaborative and participatory design of learning itineraries, which can be compared to the co-design processes at different levels by involving both teachers and students. As for the lecturers-researchers, the diverse iterative stages of design and development allowed for permanent discussion and communication which resulted in different revisions from the first design to that which was finally implemented and assessed as the first

pilot. Additionally, there was also co-teaching and sharing of sequences among the learners. Currently, the research team is working on the creation of an infrastructure to share sequences and teaching, which is enhanced by extending the availability of the repository beyond the single subject to the total number of participants, including teachers and students of diverse programs and courses. In order to do so, during the second iteration, a new platform was developed and validated. The prototype called FLIC (Flexible Learning Itinerary Configurator) was used to support the process of selection and validation of the pedagogical sequences that formed the learning path. Also it was used to share this information through the common VLE, called PLI-TELE, which also was home to all pedagogical sequences offered to students. Following the design-based research approach, it is hoped that new steps will make each pedagogical sequence an Open Educational Resource available in FLIC as a totally open repository for all.

The learning design of the current strategy based on flexible itineraries or pathways has also brought to light some limitations. First of all, students mainly agreed with the submission schedule, but the high data deviation may suggest that some students might have struggled to keep up with the rate of submission deadlines for the diverse pedagogical sequences. Moreover, factsheet questions achieve a high level of acceptance rates but, when it comes to the question of clarity, these sheets did not achieve such a high level of satisfaction among students, who reported difficulties in understanding them. In the new iterations of this pilot strategy, these materials should be improved according to student observations, as should the submission schedule. As for lecturers, one main issue was reported relating to the need for a more automated decision-making process. Firstly, it is necessary to improve the institutional learning environment so as to facilitate and automate registration of students into pedagogical sequences. Secondly, it would be very helpful to develop a more automated system with which to assign students to different groups with specific requirements such as a limited number of members, organisational characteristics or topics as preferred.

Finally, it is noteworthy to highlight two more paramount claims. This study is aligned with the critical approach to flexible learning in which the design based on personalised itineraries seeks to promote equality by a detailed organisation beyond the open access at anyplace or anytime. Furthermore, this study is based on a learning design that has been conceived and developed by lecturers-researchers. The option of personalised learning is offered as a prior stage to learners who can choose based on their needs, motivations, likes or other attributes. This approach has been called by Buitrago et al. (2021) as adaptable learning itineraries and has nothing to do with the latest developments in adaptive systems where personalisation is data-driven. The latest reviews of these platforms suggest issues in terms of non-transparent usage of data and unethical practices (Cobo, 2019; Perrotta & Williamson, 2018). Some voices have also pointed out the rather limited effects on student learning and agency (Bali, 2020). With this current approach to personalised flexible learning

with itineraries, we are focusing on the role of teachers as designers for technology-enhanced learning (Laurillard, 2012; McKenney et al., 2015; Persico et al., 2018), who should be the real leaders of educational innovation in digital environments, and who are essential to answer to challenges raised by online learning from social justice and equal approaches.

Acknowledgments

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