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Self-Regulation of Learning and the Co-Design of Personalized Learning Pathways in Higher Education: A Theoretical Model Approach

COLLECTION:
GUIDANCE AND SELF-REGULATED LEARNING

ARTICLE

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ABSTRACT

The way we learn is changing, and this requires seeking learner-centred pedagogical strategies. Based on this idea, this paper is about the process of construction and validation of a pedagogical model approach based on the perspectives of co-design, learning pathways and self-regulated learning. Through a process of Design Based Research, different techniques and instruments have been applied to collect information aimed at the creation and validation of a co-design model in the construction of personal learning pathways. Among them is the validation of the results through an expert judgment carried out in a future workshop. These results and the methodology of how they were validated is the part that is presented in this work.

The data show the dimensions of the model and its representation from two perspectives, teacher, and student. Both points of view have the objective that the students reach new knowledge and improve self-regulated learning, being the protagonists of the whole process. In addition, the work is a proposal for a strategy to be implemented in hybrid, online or mixed contexts where the students become the protagonists of their learning.

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INTRODUCTION AND BACKGROUND

The mechanisms and the way we learn are changing. As a result, experts are looking for new strategies to adapt and bring education closer to those who learn. These changes have had a direct impact on education, fostering the integration of information and communication technologies (ICT) (De los Santos et al. 2020; Moreno et al. 2021). These have enabled teachers to provide flexibility to learning processes and the introduction of new pedagogical approaches (Sargent & Casey 2020).

In this context, educational administrations and the university community have opted for the inclusion of ICT as a central axis of innovative training practices (Cabero, Arancibia & Del Prete 2019; Fernández & Alhama 2018). Technological innovation is increasingly understood as an educational process that requires the active involvement of students (Jovanović et al. 2017) and teaching staff, in accepting new roles (Zheng et al. 2020). In addition, the search for learning strategies, adapted to the context and with a projection towards the professional future (OECD 2019) is now an inevitable challenge within higher education.

The advances applied in educational technology have had an impact on the acquisition of knowledge and have allowed access to information in times of pandemic (Díaz, Ruiz & Egüez 2021). A key aspect of this application is the flexibility of design of objectives, learning sequences and the typology of assessments; generating student focused teaching strategies and promoting self-regulated learning (Gros & Noguera 2013; De-Benito, Salinas & Darder 2013; De-Benito, Moreno & Villatoro 2020). In these past months, when society has been challenged by a global health crisis that has directly affected education, students' autonomy and their capacity for self-regulated learning have been fundamental to continuing their learning. Technology-enriched environments have contributed to this, through actions such as sharing, collaborating, managing, organizing, and interacting between teachers and students. In addition, these help students take responsibility for tasks, taking control of their learning with the possibility of help from the instructor (Zimmerman 2001). The role of the teacher with the introduction of technology in higher education has taken on that of an educational facilitator, guiding the student through the content to be acquired (Salinas 2000).

As regards this perspective, it makes sense as we begin the search for new educational designs that are in balance with the needs of the educational community and, at the same time, student-centred. As indicated by De-Benito, Moreno and Villatoro (2020), one solution is the adaptation of learning pathways and learning sequences to the learners, with the aim of enhancing and/or acquiring new competences. Consequently, the creation of a model that brings together personalized learning pathways, participation, collaboration, self-regulation, and technology is a way to respond to the training demands of future professionals within higher education.

Taking these aspects into account, the need arises to create a learning model that integrates the perspectives of self-regulation, technology and co-design within the learning pathways. To do this, a series of phases were developed following Design-Based Research and concluding with the representation of the model. The objective of the work is the creation and validation of a design model of co-designed learning pathways in technological environments that help students to self-regulate.

This work has been developed within a broader project developed by the Educational Technology Group of the University of the Balearic Islands, under a learning pathways implementation project. Taking advantage of participation in the project and carrying out a series of research techniques, actions and analysis of results, a learning model was proposed and later validated. To understand the components of the model, the concepts of learning pathway, self-regulated learning and co-design together with their own interrelation, must be defined.

PERSONALIZED LEARNING PATHWAYS IN HIGHER EDUCATION

A learning pathway is a knowledge organizer that shows a generalized version of the subject matter and has flexible navigation (Darder et al. 2010). This approach allows the learner to adapt his or her own pathway to personal resources. From another perspective, a learning pathway is based on the adaptation of the concepts to be assumed by the group of students within a planned timeframe, considering previous knowledge, needs and learning styles (Minguillón et al. 2005). In the same sense, it offers alternatives for the learner to choose

how to proceed through the planned activities but does not describe the solutions and/or the problem (Coffey et al. 2003).

The activities and learning objects in the pathway should be varied and offer options on how to study them. Based on multiple intelligences, this can lead to a higher level of motivation and thus to more meaningful learning (De-Benito, Darder & Salinas 2012). This term appears from the point of view of instructional design. When learners participate, they do so from the point of view of co-design or in the configuration of a specific aspect (De-Benito, Moreno & Villatoro 2020). The learning pathway is composed of small learning units called sequences that learners are free to choose. The sequences are a proposal of small learning and assessment activities that seek the achievement of educational objectives, meaningful learning, and self-regulation (Villatoro & De-Benito 2021).

SELF-REGULATED LEARNING WITHIN PERSONALIZED PATHWAYS

Self-regulated learning has been informally addressed for two centuries (Daura 2013). This research began to be contextualized in the 1980s, with a focus on how students could control their learning (Zimmerman 2001). As a result, there are multiple meanings of the term. Academic self-regulation focuses on outcome-oriented learning processes, where students are strategic agents who stay motivated towards important goals (McCombs 1989). At the moment a task is started, students activate and maintain cognitions, behaviours and emotions systematically oriented towards the achievement of their goals (Schunk & Zimmerman 1994).

During the last 30-years, numerous authors have developed models of learning from this perspective. Among them, we highlight the Cyclical Model created by Zimmerman and Moylan (2009), which organizes self-regulatory processes in three phases (Panadero & Alonso-Tapia 2014):

- *Planning*. The learner analyses the previous content of the task; assesses their ability to succeed, considering their personal skills, and establishes their personal strategy to proceed with its resolution.
- *Execution of the task*. In this phase the task is carried out, using self-control to solve the task and self-observation to achieve cognitive monitoring.
- *Self-reflection*. The phases conclude with the task completed. Causal attributions appear that determine the success or failure of the process.

These phases of the Cyclical Model fit with the proposal presented in this article, since they contribute to structuring the itinerary and the students' own reflection. Co-design procedures are closely related to self-regulation, in terms of flexibility and the pace of learning (Villatoro & De-Benito 2021). The cyclical model includes student decision-making, incorporating the student's point of view into the teaching process (Bain & 2009). Along the same lines, the model proposed by Zimmerman and Moylan (2009) is the one that appears most frequently in research carried out in technological environments and which helps to promote self-regulation (De-Benito, Moreno & Villatoro 2020; Villatoro & De-Benito 2021). These points are in line with the objective of the model, being the perspective that best suits the research.

Learning pathways are made up of small sequences that are activities of different types, such as projects, conferences, or others. The sequences follow the structure of the cyclic pattern as they unfold. According to the perspective of the cyclical model, therefore, the cyclical structure shapes the phases of the methodological proposal, achieving the self-regulation of the participants.

PARTICIPATORY AND COLLABORATIVE DESIGN TO DEVELOP PERSONALIZED PATHWAYS AND ENCOURAGE SELF-REGULATED LEARNING

Experiences developed under this perspective have increased in recent decades, as they show the importance of the relationship between teachers and students as a key to improve educational practices (Bovill 2020; Kinzie & Kuh 2017; Magolda & Astin 1993). Conceptually, participatory and collaborative design refers to educational strategies that are initiated through collective reflection and lead to increased knowledge in the participants and in the artefacts produced (Robertson & Al-Zahrani 2012). Participatory design has been the way to involve educational agents, making them partners (Sanders & Stappers 2008). The results of creative processes emerge from discussion and agreement, leading to co-creation (Bovill 2020). From this point of view, co-design can be applied in different areas such as content, subject matter, methodologies, or others (Bovill 2017). Within co-design, different levels are established as

there are different interactions between participants (between teachers, between students, between students and teachers or between experts) and different degrees of participation (Villatoro & De-Benito 2021). When a co-design process is initiated, it progresses through a series of stages, to achieve the final product. These moments are (Gros 2019):

- *Discovery*. The stages start with the first contact. The students become familiar with the team's ways of working, including the technologies used, workflow, procedures, and routines, among others.
- *Ideation*. This is the start of the process, where the objectives, the values of the group of participants and the expected results are clarified.
- *Prototyping*. Completion comes with the form of the product created by the co-design team and its dissemination.

From a practical point of view, there is no single way to apply co-design. There are different methods and tools, although they all have commonalities (Mor, Ferguson & Wasson 2015; Pastor, Lozano & Gros 2017). Participatory design is a perspective that fits the co-creation of learning pathways, as they are closely related to self-regulation, in terms of learning pace and flexibility (Villatoro & De-Benito 2021).

THE ROLE OF TECHNOLOGY IN THE CO-DESIGN OF LEARNING PATHWAYS

Technology helps teachers and students in planning, execution, reflection, communication, and follow-up actions improving educational processes (De-Benito, Moreno & Villatoro 2020). In addition, it reinforces performance and prepares students to transfer acquired knowledge to other contexts (Hernández 2017). There is very little experience and information, on research related to co-design and technology, (Gros 2019). The technological environments which support co-design-based projects do not refer to concrete specifications on which model to follow. They rely on technology as a support in graphic and visual representations, planning, development of individual and/or collaborative tasks and as a means of group communication (Villatoro & De-Benito 2021). When we relate learning pathways to co-design and self-regulated learning, we can identify the use of different tools depending on the stage of the designer, teacher, or expert (Figure 1).

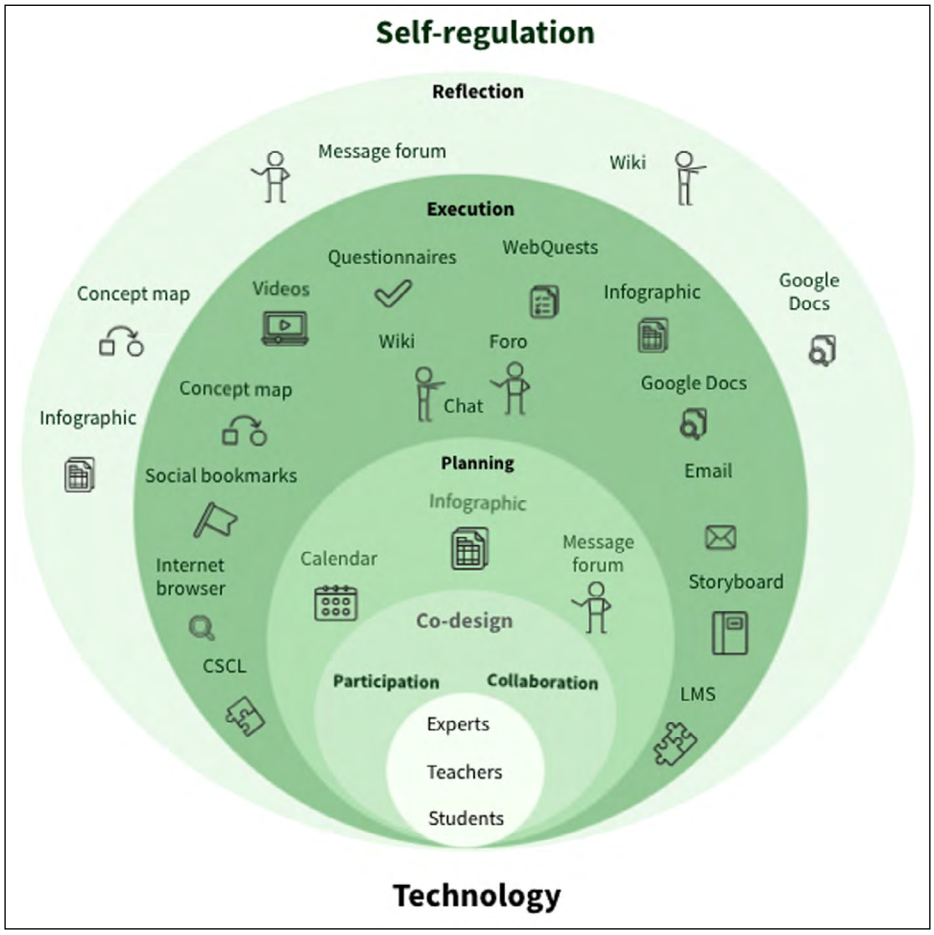

Figure 1 Tools related to learning self-regulation processes in co-design processes (Villatoro & De-Benito 2021).

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Technology fulfils the function of enriching and improving educational co-design processes within virtual environments. Considering Zimmerman's cyclical model (Zimmerman & Moylan 2009) and participatory co-design (Bovill 2020; Gros 2019), De-Benito, Moreno and Villatoro (2020) have taken an initial step towards technological configuration oriented to the co-design processes of personal learning pathways, contemplating three components.

- Institutional platform as a tool that integrates content organization, communication tools, management and monitoring of student activity.
- External tools for collaborative work tasks.
- Application for management of the sequences and configuration.

Pedagogical models must answer the questions of why, what for, how and when; including purposes, contents, sequences, and provide the instruments to put them into practice (Viveros & Sánchez 2018).

The starting point is learner-centred strategies to enhance self-regulated learning, the ability to learn to learn and prepare future professionals in new formal, non-formal and informal scenarios. This proposal is based on the design of learning pathways based on co-design, participation, and decision-making. The main points of this proposal include the following functions:

- *Pedagogical*. They refer to the elements to be allowed for within the teaching-learning process for the construction of the itinerary.
- *Technical*. The technical aspects used to implement the pathways include the tools used to represent/plan them, monitoring and tutoring.
- *Organizational*. Guidelines to be considered for the use of a methodology for co-designing learning pathways to encourage self-regulation.

On the one hand, the phases of the model coincide with those proposed by Zimmerman and Moylan (2009) in the cyclical model. The self-regulation process begins with the analysis of the pathway, broken down into smaller sequences. Subsequently, based on prior knowledge, the objectives and personal strategy for executing the pathway are established. Finally, students reflect on the process, achieving self-regulation of learning. On the other hand, our proposal is also based on co-design processes, understood as a joint creation between students and teachers to achieve an environment of collaboration and negotiation and address the teaching-learning process (Bovill, Felten & Cook-Sather 2014; Bovill 2020; Gros 2019). The aim of this work is to discover the dimensions of a model for the co-design of learning pathways in technology-enriched environments that promote self-regulated learning.

METHOD

CONTEXT

The model for the co-design of flexible learning pathways in technology-enriched environments that favour self-regulated learning, was generated and validated through a participatory co-design process among 13 teachers who acted as experts.

This study is part of a broader project, *Methodological strategies for the personalization of learning pathways in environments enriched with technology (EDU2017-84223-R)*, whose main objective is to generate a methodological model for initial teacher training that promotes self-regulation, autonomy, collaborative construction of knowledge and co-responsibility by incorporating personalized pathways in learning environments enriched by technology. Different tasks have been carried out related to experimenting with different types of tools, exploring the possibilities of mobile devices and the construction of technology-enriched learning environments; the design and implementation of didactic strategies that promote flexibility, autonomy and responsibility and ubiquitous learning. All this, from a learner-centred and co-designed (teacher-student) learning perspective.

The model was generated during three academic courses corresponding to the pre-pandemic period, during and after the pandemic in an online and blended learning mode.

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PARTICIPANTS

The participants in the project consist of a group of 13 teachers, from six subjects of the initial teacher training studies (infant and primary) 'Pedagogy and Social Education' of the Faculty of Education of the University of the Balearic Islands. The subjects included in the study are characterized by having Educational Technology as the central axis of their contents and the teaching team is part of the research group, in which the EDU2017-84223-R project is being developed. From the results obtained, the first model proposal was built and presented in a future workshop of thirteen experts.

METHODOLOGICAL APPROACH

The co-design model was generated by applying the main postulates of Design-Based Research (DBR) (Figure 2). This methodological approach seeks to improve educational design processes, their development and evaluation, aiming to solve specific and generalised research problems (De-Benito & Salinas 2016; Richey & Klein 2014). DBR is characterised by being situated in a real context, providing validity, and offering solutions for improvement (Anderson & Shattuck 2012). Following the steps of this methodology, the co-design model has been created based on a theoretical framework of reference and the experience of the participants. The construction has been carried out within the phases of the project EDU2017-84223-R, following the phases of analysis, development of solutions, iterative cycles of testing and refinement of solutions, reflection, production of design principles and enhanced solution implementation (Reeves 2006).

In this way, the model design process integrates two phases or iterative cycles (Figure 2).

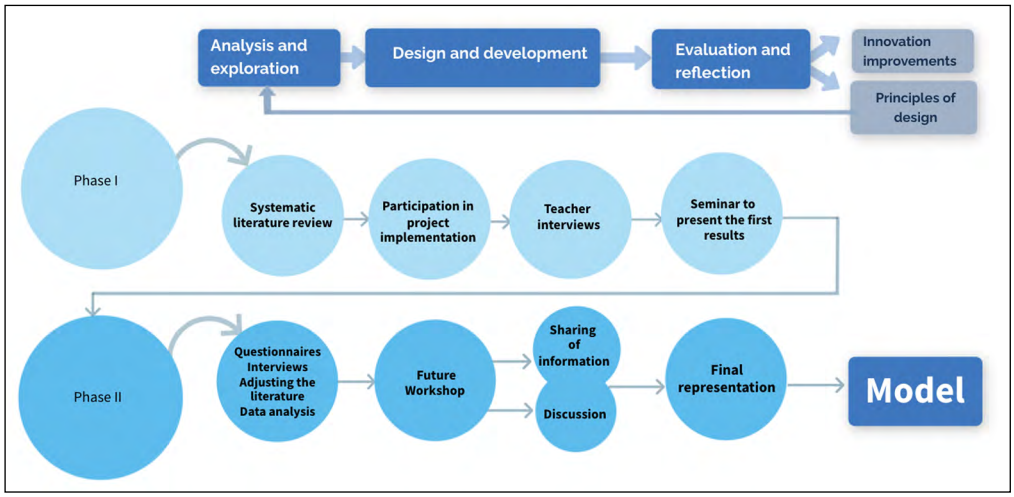

Figure 2 Model construction phases.

The first phase, corresponds to the identification of the problem and the conceptual definition of each of the central elements or variables within the model to be developed. This involved a systematic review of the literature, carried out to describe the models and dimensions of self-regulated learning in technology-enriched environments and elements of learning co-design to find commonalities; an analysis of the strategies for the construction of personalized learning pathways implemented by teachers, to identify the levels of co-design and the configuration of the technological environment; and, a focal group to analyse the results obtained and determine the key elements of the model in relation to: co-design, the construction of flexible learning itineraries and self-regulated learning.

The second phase focused on model development and validation. Based on the results obtained in the previous phase, a questionnaire was used and the results presented at a future workshop, allowing identification and ordering of the different elements involved in the co-design process. The 'future workshop' is a technique used in education and social work. The aim of this technique is to look for future solutions to current problems through intensive preparation and development phases (Vidal 2006).

After the workshop, a first draft of the model was generated and each participant was asked to validate the model individually through the mapping technique. This consisted of sending participants a summary report on the contributions and ideas presented in the workshop and the representation of the model in a final map. The experts made their contributions to the

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collaborative map by sending a comment document or through annotations on the map. Finally, the validated model presented in this work was represented (Figure 3).

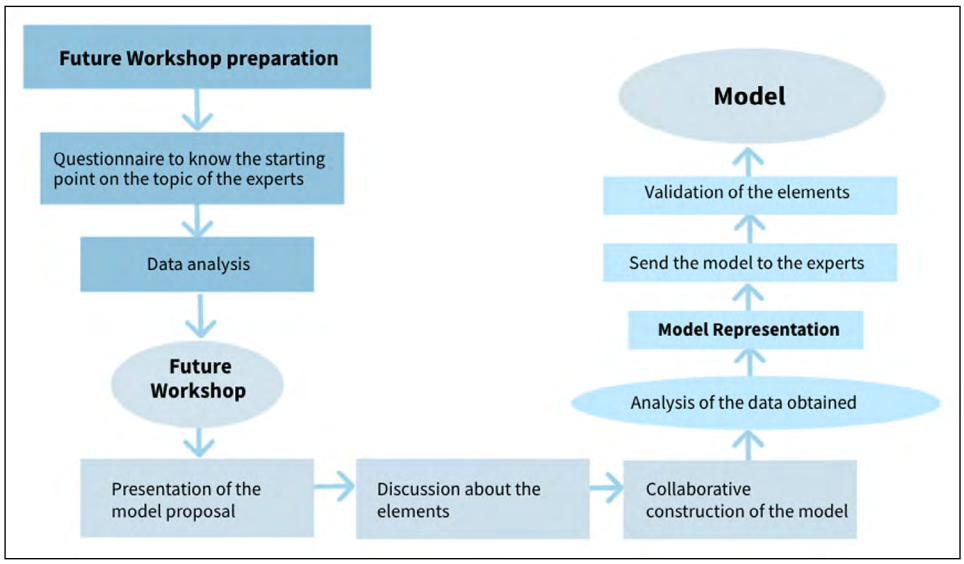

Figure 3 Development of the expert seminar (phase II).

PROCEDURE VALIDATION BY EXPERT JUDGMENT

Expert judgement validation consists of asking a few people to make a judgement about an object, an instrument, teaching material, or providing their opinion about a specific aspect of these (Cabero & Llorente 2013; Cabero et al. 2020). The reasons for the selection of this technique are determined by the advantages it brings. Among them are in-depth assessment, and the opportunity to address any lack of technical and human requirements and provide strategies for collecting information (Barroso, Cabero-Almenara & Vázquez 2012; Lannoy & Procaccia 2001). The objective in this specific case was to hear the experts' opinions on the proposal made and to improve it collaboratively until a final product was achieved. Specifically, the aim was to go deeper into the dimensions of the model and the elements that constitute it. We used the nominal group technique, organized in different phases that combined individual and group sessions. This method requires the experts to contribute information individually and in discussion groups until a joint consensus is reached (Cabero & Llorente 2013). In addition, the technique was adapted to the iterative phases of the research.

The selection of the experts was based on the suitability of their profiles to the analysis of the proposed model, based on their participation in some phases of the project, EDU2017-84223-R, their involvement as ICT experts and/or creators of theoretical models on ICT. In this case, there were 13 experts with the following characteristics (Table 1):

EXPERTS	PARTICIPATION IN THE PROJECT PHASES	THEORETICAL MODELLING OF ICTS
1	X	X
2	X	X
3	X	X
4	X	X
5		
6	X	X
7	X	X
8		X
9	X	X
10		X
11	X	X
12		X
13	X	X

Table 1 Characteristics of the participants in the expert judgement.

DATA COLLECTION TECHNIQUES

To design and validate the learning pathway co-design model, different information collection sources were used, some of which are part of the EDU2017-84223-R project in which this work is framed. In accordance with the characteristics of the DBR, mixed methods of data collection and analysis were used (Salinas & De-Benito 2020). Table 2 shows the different data collection techniques as well as the tools used.

Table 2 Techniques and instruments used to collect the data in each phase.

ITERATIVE CYCLES	TECHNIQUES AND INSTRUMENTS	TOOLS
Phase I	Systematic review	Rayyan. QCRI Airtable Atlas. TI statistical analysis software
	Teacher interviews	Atlas. TI statistical analysis software Videoconference tools
	Student interviews	Atlas. TI statistical analysis software Videoconference tools
	Student questionnaires	GoogleForms
Phase II	Expert Questionnaires	GoogleForms Atlas. TI statistical analysis
	Future workshop-focal group	GoogleForms Atlas. TI statistical analysis Cmaptools Paddlet Videoconference tools
	Mapping technique	CmapTools

Each of these techniques and instruments for gathering information were used in the different phases of the iterative cycles, to complete the process until the final version of the model was reached.

RESULTS AND DISCUSSION OBTAINED IN THE FUTURE WORKSHOP

In this section, the results obtained from phase two are presented and are structured based on (1) Results of the preliminary questionnaire to the participants in the future workshop; (2) Identification of the elements of the model; (3) Results from the future workshop; (4) Validation and final improvements.

RESULTS OF THE PRELIMINARY QUESTIONNAIRE TO THE PARTICIPANTS IN THE FUTURE WORKSHOP

Prior to the session and with the aim of contextualizing it, a preliminary questionnaire was carried out which revolved around 4 blocks. In addition, the purpose was to situate the experts in the themes and analyse their perspectives on co-design and self-regulation.

- *Levels of co-design carried out during the 2020–2021 academic year*. This block referred to the co-design actions that the experts had carried out during the last course, to identify whether they had applied the strategy. Most participants had carried out co-design processes between teachers (85.7%) and between teachers and students (71.4%). To a lesser extent they had been carried out among students (42.9%). Co-design processes had not been carried out among experts.

Based on the cyclical model of Zimmerman and Moylan (2009) and its phases, the study aimed to explore the opinions and experience of experts with the following blocks of questions. Each question had the objective of analysing the most important elements according to the participants in each phase.

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- *Highlights of the planning process*. The participants pointed out the following most important aspects of the planning process (Figure 4). In this phase, the students' goals and objectives regarding the pathway and learning cards stand out as a fundamental guide for selecting the didactic sequences (SDs).

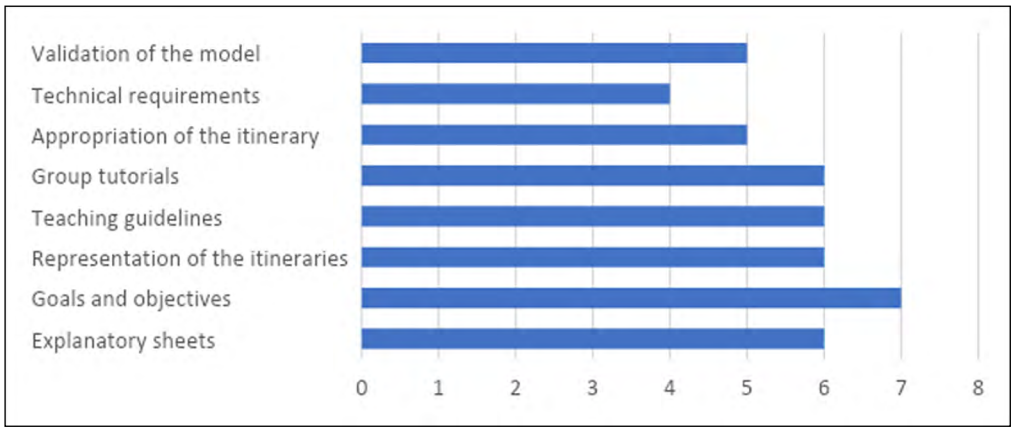

Figure 4 Important points highlighted by experts to be considered in the itinerary planning process.

It is worth noting that in Figures 4, 5 and 6 experts could respond to more than one answer. Each expert selected the variables they considered most important in each process.

- *Highlights in implementation*. The participants pointed out as remarkable elements previous beliefs about the development of the pathway and previous knowledge; these were seen as elements that could help to achieve the pathway. In addition, the experts added as a fundamental aspect the feedback between teacher and student (Figure 5).

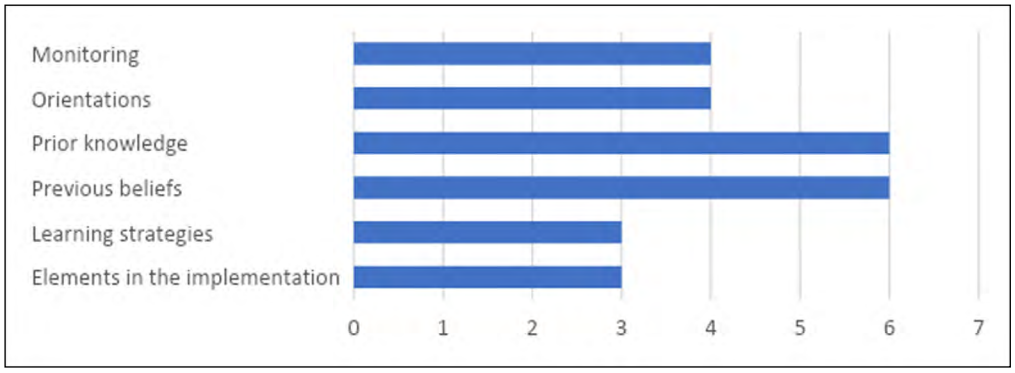

Figure 5 Implementation highlights.

- *Highlights of the reflection process*. In this phase, almost all the points had the same importance for the participants, but the levels of student satisfaction, self-evaluation and new knowledge acquired stand out. In addition, they added the importance of projecting learning into the future (Figure 6).

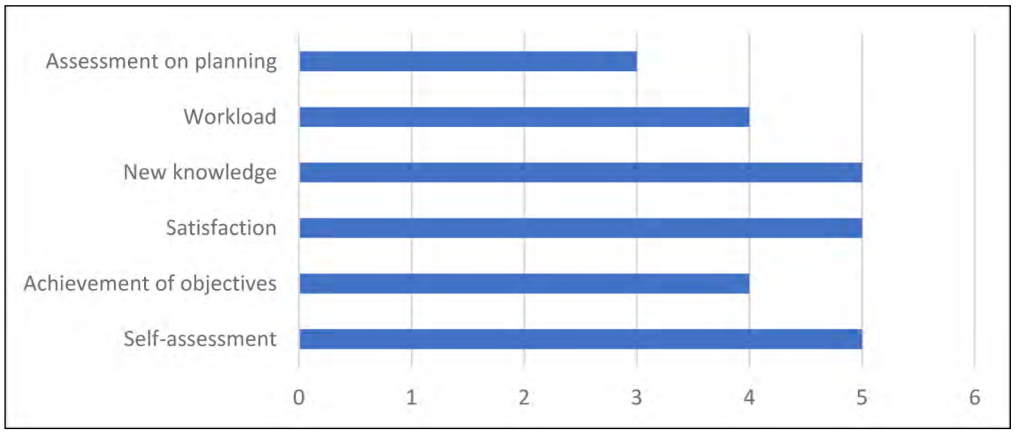

Figure 6 Highlights of the reflection process.

IDENTIFICATION OF THE ELEMENTS OF THE MODEL IN THE FUTURE WORKSHOP

Based on the theoretical contributions, those made by the experts in the previous questionnaire, discussions in the session and the review of the final report, the representation of the model has been carried out. This proposal is based on four dimensions (Figure 7):

- *Personal dimension*. This refers to aspects related to the student and the teaching-learning process. Within this point are the student's personal and material resources, the levels of involvement, the importance of feedback from the teaching team when faced with doubts, personal goals, the type of evaluation at a general level of the pathway and sequences, the influence of previous knowledge when selecting activities, the initiative to carry out actions that help to develop the pathway, the influence of previous knowledge and the ability to reflect, both in the activities and at the end of the process.
- *Organizational dimension*. The elements related to organization and planning. Within this dimension is the development of autonomy to organize one's own pathway considering planning, self-regulation, process control, balance between experiences and workload. The components are closely related to those of the other dimensions, since here it is important to consider the technical aspects, the tools that will be used to develop and represent the pathway, the tools used to carry out tutorials and monitoring and the technological resources destined for the organization of the virtual classroom.
- *Technical dimension*. This refers to the actions related to the configuration and management of the teaching-learning process. The direct relationship with the other dimensions means that many elements are common. The configuration of tools to develop the activities of the learning pathway stand out. They are a fundamental element for organizing the virtual classroom where the pathway 7ill be developed. The configuration must provide easy understanding and navigability within the space to be able to organize, communicate and plan. The didactic design is directly related to the configuration and management.
- *Pedagogical dimension*. This encompasses all aspects related to the teaching-learning process. This dimension includes the objectives, worksheets, methodology and learning sequences. Communication between teacher and students is considered an important element in all dimensions, but in this one it acquires a special role, since it will mark the student's learning process.

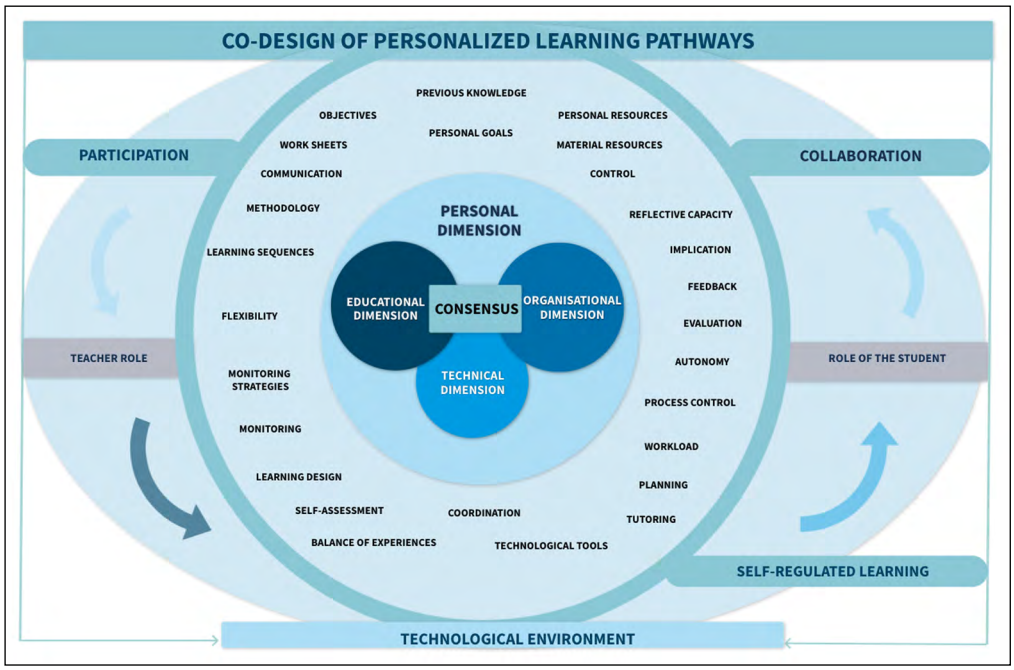

Figure 7 Dimensions of the learning pathways co-design protocol model.

The dimensions are understood from a cross-cutting perspective and all elements are interrelated. The model presented is open and focused on consensus between the students and the teaching staff. The personal dimension has a special weight in comparison to the rest since the student is the central axis of learning. The representation starts from the designer's

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point of view, which is why the personal dimension is placed in the background. The elements are intertwined, as the starting point is the consensus developed through the co-design of the pathway between teachers and students.

RESULTS FROM FUTURE WORKSHOP

Based on the dimensions and the teamwork carried out, consensus was reached on the elements of the model and dimensions. The first step was a proposed map with the points located in the literature (Villatoro & De-Benito 2021) and in the previous interviews. From this starting point, group work was carried out. The experts completed the map and then the groups shared their point of view. The observations are summarized below:

- *Contributions from Group 1*. Their starting point was the phases proposed by Zimmerman and Moylan (2009). Focusing on the construction of itineraries, they proposed a preliminary phase before co-design. This point would refer to the moment of planning between the teaching team or teachers prior to the start of the course. The planning phase includes aspects related to methodology and recommendations for the selection of sequences. In addition, they added descriptive sheets explaining the requirements of the activities (groups, timetables, percentages, among others) and of the student him/herself. In this phase there is the initial representation of the pathway, the subsequent validation, the work schedule as the planning axis of the pathway and the appropriation of the pathway. In the implementation phase, the possibility of changing the pathway, the individual and group follow-up tutorials, the development of the sequences, the follow-up and/or guidance and the reflective closure are emphasized. In the closing phase, it is important to consider the creation of a closing map, aspects related to satisfaction, self-evaluation, difficulties, fulfilled expectations, projection of learning and development of competences.
- *Contributions from Group 2*. The group explained the importance of the interrelation between all the elements that make up the model. Regarding co-design between teachers, they highlighted coordination between teachers, at an interdisciplinary level and open to subjects from other fields that have some point of connection. Negotiations are a fundamental element for developing actions and must be considered in terms of equality. It is necessary for the teacher to come down to a lower level of authority to carry out negotiations. These facts would be related to student motivation, involvement, and availability.
- *Contributions from Group 3*. Group three did not consider the previous phase mentioned by the first group, but they did consider its existence necessary. In the first phase there are the components to be considered in the development of didactic sequences. They refer to the cards, percentages, representation (of the student and the teacher), consensus on the structure, organization, and timing of the sequences. In the execution phase, the sequences, co-responsibility, tutoring, and monitoring are carried out. In the reflection phase are the elements related to self-assessment, workload and the perception of the weight in the mark. Regarding co-design between teachers, it is necessary to consider the organization, consensus, and the type of sequences to be developed jointly. Co-design between teachers and students is determined by interaction, feedback, negotiation, and motivation. In addition, they specified the importance of time management for monitoring activities and planning.

All these contributions were included in the final map drawn up based on the contributions made and the participants subsequently made the final modifications to arrive at the proposed co-design model. Using the mapping technique and collaborative maps, the final construction of the model was achieved.

VALIDATION AND FINAL IMPROVEMENTS

As a result, the experts made the final modifications. In the representation of the model, two perspectives can be distinguished, on the one hand, the development of the pathway from the teacher's position and on the other hand, from the students' perspective. The figure represents the development of the pathway in different phases for each of the participants, with co-design as the main axis and enriched by technology.

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From the teaching point of view, there is a previous phase before the design of the pathway where agreements are reached between other teachers on the proposed, shared, or new sequences. Aspects such as a common sequence repository, group management and the use of an application called FLIC (Flexible Learning Itineraries Configurator), created to manage, and validate the learning pathways, are also agreed upon. This application was created within the framework of the larger project in which the investigation of this work participated. Then, the co-design of the pathway begins with the students, the teachers present the sequences that make up the pathway, tutorials and specific guidance are given to help students co-design the sequences, a schedule for monitoring the sequences is completed and the phase ends with the validation of the pathway to the students. This point is the beginning of the implementation phase where the methodology is carried out, the students start to develop the sequences that make up their pathway and the teacher carries out the monitoring, co-creation of activities, tutorials, and necessary guidance. These phases conclude with the reflection phase where learning is evaluated, possible final orientations are made, and the teaching group helps the participants to reflect on the process. For this purpose, the final sessions conclude with group reflection sessions, interviews, and a final questionnaire.

From the student's perspective, the process starts with the planning phase, where teachers explain the methodology and present the sequences with their explanatory sheets. From this point onwards, the student selects the sequences that will make up his or her learning pathway, represents his or her pathway freely with technological tools, plans, defines objectives, goals, and personal needs. Then, there is a co-evaluation with the teacher on the selected itinerary and the student takes ownership of his/her learning pathway. After this phase, the student moves on to its execution, establishing the learning strategies with personal and material resources, the influence of personal beliefs to develop his/her own pathway. The teacher monitors the sequences of the pathway with the necessary guidance through group or individual tutorials. Finally, the process closes with the reflection phase, where the level of satisfaction at the end of the pathway, the reflective capacity of the whole process, the self-evaluation, the fulfilment of expectations, the level of learning acquired, the evaluation and the closure of the pathway with specific activities such as group reflection sessions, interviews or questionnaires take place. Both perspectives of the development of the pathway are united by the participation and collaboration between teachers and students during the development of the pathway, managing to promote self-regulation and the acquisition of learning from the methodology implemented (Figure 8).

CONCLUSIONS

The model presented is the result of the research carried out in iterative cycles of the project to which this work is linked. Among the outstanding aspects of this proposal is the approach to students and the needs demanded by the educational community (OECD Skills Outlook 2019, 2019), adapting to who learns, how they learn and the circumstances that may occur at a social level. The methodology provides flexibility in the designs on the part of the student and teachers, and encourages autonomy, favouring the student's self-regulation in their own process. In this regard, there is no model of these characteristics, but other authors have investigated this, establishing the first lines of research (Marin & Villagrá 2020). There is no scientific production in this regard either, but research work is beginning in these fields (EDUCAUSE 2020; Gros 2019).

The participation and collaboration of the participants achieves a balance in the experience: the approach made to students and the benefit of the learning they all gain, turning them into partners (Bovill 2020). This methodology is adaptive and flexible, giving the design freedom in its development. The phases that the model uses to develop follow the phases of the Cyclical Model (Zimmerman & Moylan 2009), concluding with the self-regulation of the subject. This is very important, since self-regulation strategies can become learning that can be extrapolated to other contexts.

Current learning models often neglect the students' perspective proposing generalized strategies. The methodology presented considers the students as the main axis of the process, being the main actor of the whole process. Therefore, the representation of the theoretical model differentiates the two perspectives to help the designer to implement the strategy. Moreover, the collaborative perspective means that the participants are enriched at all stages. In addition, the model includes another perspective of the trainer, in this case as a guide who accompanies the different phases until self-regulation is achieved.

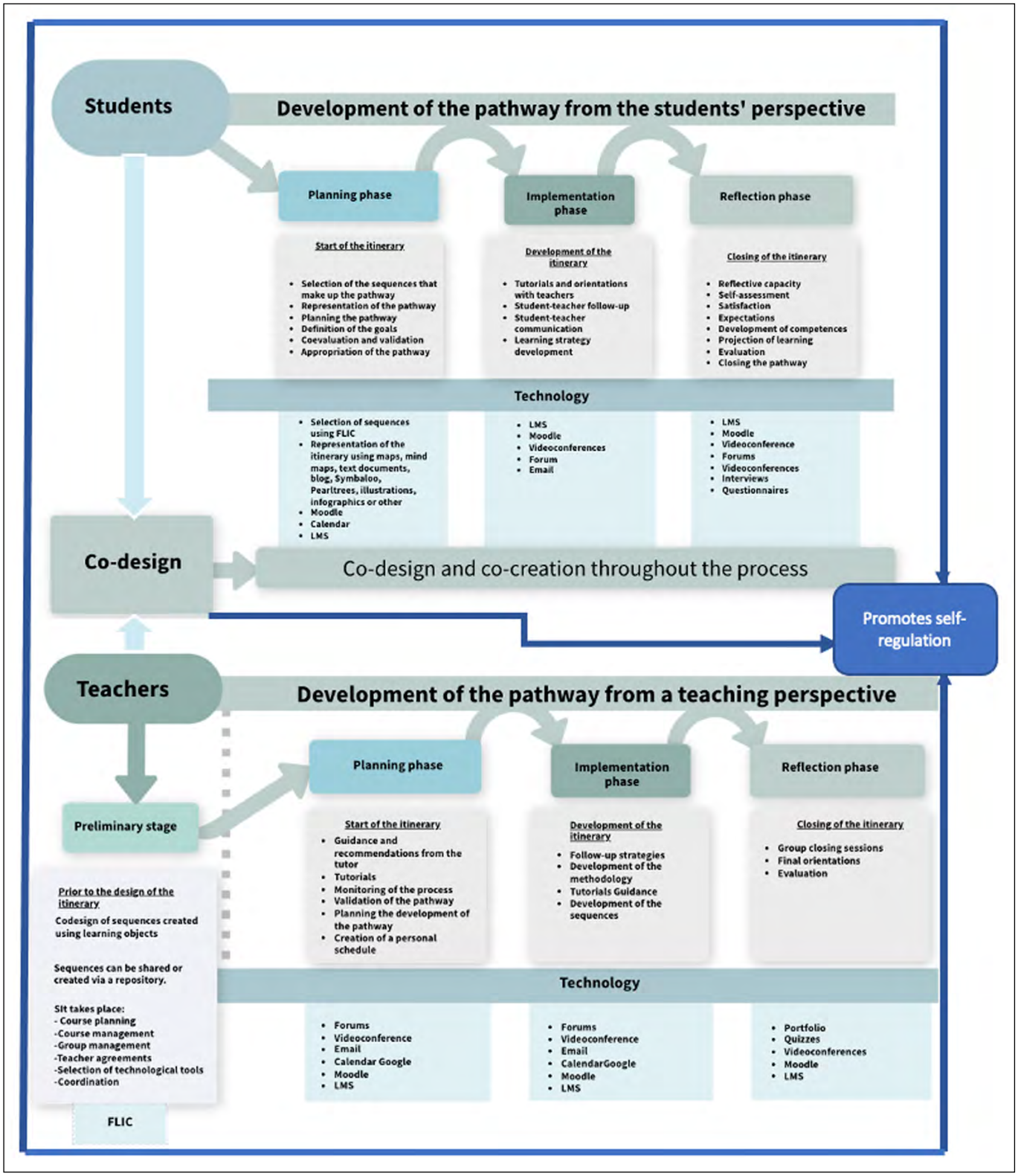

Figure 8 Representation of the co-design model of learning pathways for self-regulated learning.

The teaching proposal presented in this paper is intended to be an example from which to start in online, hybrid or blended learning contexts within higher education. It can also contribute to structuring the new environments that have been produced after the pandemic, where educational centers have had to adapt to what could happen without having a starting point (UNESCO 2020). Implementations of the model, within the wider project, were carried out during the pandemic, adapting to hybrid, online and blended learning contexts. The results of the development of the pathways were satisfactory as a new formula for adaptation to new contexts (Villatoro & De-Benito 2022).

There are no limitations in the application of the model, as it can be applied to any subject, but it is necessary for the whole process to be enriched by technology, as the tools help in the co-design, monitoring and construction of the itinerary itself. On the other hand, there

are limitations related to the scope of application since the model is oriented towards higher education. Therefore, results in other contexts should be considered with caution. In the case of the experience presented, a specific application was created to manage the selection of pathways and allow them to be consulted from any electronic device (FLIC). This model is currently being put into practice in various subjects together with new versions and improvements to the application.

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COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

The authors have contributed equally to the development of the work.

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