DIGITALEDUCATIONREVIEW

A Model of Assessment co-creation in Technology-Enhanced Learning Environments in Higher Education

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ABSTRACT

This paper presents a participatory design-based research that aimed to create a model of co-creation in the curriculum in Technology-Enhanced Learning Environments (TELE) in tertiary education, specifically to co-design assessment between professors and students. This qualitative research followed four phases divided into five stages with two iterative cycles of design and re-design. Accordingly, a mixed method approach was used to collect the data: systematic literature review, semi-structured interviews, and student surveys. As a result, the model highlights and distinguishes four different dimensions: characterization, co-creation, reflection, and technology. The initial three dimensions are depicted in chronological order, while the fourth dimension is pervasive throughout all preceding stages. Furthermore, we depicted how technology is present throughout the co-creation process, delineating its role in each dimension distinctly. In conclusion, this model expands the basis of co-creation in the curriculum literature and provides tools for practitioners to innovate in their academic contexts, enabling student involvement in their own learning journey through co-creation. Further research in this field should be carried out, so we intend to apply this research to other fields of study and educational levels, contexts, and situations.

KEYWORDS: Assessment; co-creation; model; higher education; TELE

1 INTRODUCTION

Twenty-first-century higher education students are generally digital natives, and consequently, they are used to participating in practically all areas of their lives. Kalantzis & Cope (2010) called them Generation P due to their participatory capacity. The authors explained that with the birth of Web 2.0 students became content generators and thus, they have gone from passive agents to active ones. Furthermore, Solano-Fernández et al. (2021) pointed out that students are a reflection of today's societal changes and so, university lecturers face challenges regarding this changing society along with the competences students need to acquire to cope with it. In addition, students are expected to acquire both 21st-century skills and digital ones: information management, critical thinking, creativity, problem-solving, collaboration, communication, technical, self-direction, lifelong learning, ethical awareness, and flexibility (Van Laar et al., 2017). As a result, there has been a proliferation of active methodologies, which enable comprehensive learning as they help students to gain knowledge, acquire and/or strengthen competences, and become aware of their responsibility in their learning process (Martínez-Sanz, 2022). From the variety of these methodologies, only a few approaches attempt to engage students in their learning process through active collaboration between them and their professors: Students' voice (Blau & Shamir-Inbal, 2018), participatory design (Sanders & Stappers, 2008), staff-student partnership (Deeley & Bovill, 2017), students as partners (Healey et al., 2014), learning co-design (Santana-Martel & Pérez-Garcias, 2020) and co-creation of learning and teaching (Bovill, 2020). All these terms have been used interchangeably (Santana-Martel & Pérez-Garcias, 2020).

Nonetheless, Bovill (2020) emphasizes that staff-student partnership, students as partners, and co-creation of learning and teaching imply a greater level of students' engagement and agency. The author also points out that teachers tend to be interested in discussing students' active participation, learners' empowerment, and the negotiation of learning and teaching through co-creation. Therefore, we will predominantly use this term.

According to Sanders & Steppers (2008), co-design and co-creation are terms that are embedded in participatory design. For them, the former refers to the whole process of co-design while the latter focuses on a specific act of creativity within the co-design process. Nonetheless, Dollinger et al. (2019) stated that the main difference between those two concepts focuses on the way the different stakeholders choose to participate. Partnerships can be developed between professors, between students, between students and professors, between professors (Könings et al., 2020), or between students and other agents (from university or external) (McFaul et al. 2020). As a result, both the role of students and professors changes, allowing for adequate communication between the agents so that co-creation can take place (Santana-Martel & Pérez-Garcias, 2022b). Co-creation "advocates a greater democratization of the educational process" since it happens "when staff and students work collaboratively with one another to create components of curricula and/or pedagogical approaches" (Bovill et al., 2016:196).

1.1 Co-creation models

Regarding the above, some authors have attempted to develop models to co-create. De Koning et al. (2016) analyzed fifty co-creation models that they understood as visual representations that offer a better understanding of the concept, the steps to follow in the co-creation process, as well as indicating how it relates to other fields. The authors divided the retrieved models into four groups: (1) the joint space of creation, (2) the spectrum of co-creation, (3) the types of co-creation, and (4) the steps of a co-creation process. In the first, the models studied depicted two partners and overlapping spaces where creation happens, giving an outcome for both agents. In the second, models are related to other approaches/methodologies (mainly related to open innovation and participatory design). In the third, the focus is on the fundamental criteria or axes in the co-creation process (timing, amount of direct benefit, and level of participation), that showed different types of co-creation: (1) personal offering, (2) real-time self-service, (3) mass-customization, (4) co-design and (5) community design. Lastly, all models included in the fourth group offered four to six steps to co-create. The authors differentiate between two categories: co-creation as an innovative approach with 6 steps (identify, analyze, define, design, realize and evaluate) and co-creation as a (design) workshop with five steps (invite, share, combine, select and continue). Despite co-creation in higher education is growing, the literature that involves students as partners and active participants in the teaching-learning process in TELE is limited. Nonetheless, researchers are attempting to devise different models to adapt to this new academic world mediated by new technologies. The following models (see figure 1) are prominent in the current literature and have served as a reference for this research.
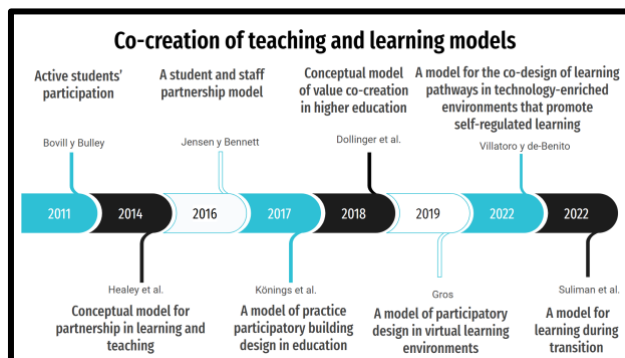

Figure. 1. Prominent co-creation of teaching and learning models in the literature

Firstly, Bovill & Bulley (2011:184) developed "*Active students' participation*" (ASP) model which aimed "to facilitate discussion, supporting tutors and students to develop ASP initiatives in higher education". In this model, they presented the different levels of student participation in the curriculum through a ladder where the level of students' involvement in the curriculum would increase as they move up the ladder. This is an eight rungs ladder that is divided into four groups (each group incorporates two rungs): (1) "Tutors control decision-making", (2) "tutors control decision-making informed by students feedback", (3) Students have some choice and influence" and (4) "Students control decision-making and have substantial influence" (Bovill & Bulley, 2011:180). It is noteworthy to observe that, according to this model, students only start having influence in the curriculum on the fifth rung.

Then, Healey et al. (2014:22-24) built a "*conceptual model for partnership in learning and teaching*" that depicted four overlapping ways of engaging students as partners taking into account two spectrum; the vertical one related to "learning, teaching, and research to quality enhancement of learning and teaching" and the

horizontal linked to "co-learning, co-designing, and co-developing, to co-researching and co-inquiring". Therefore, the authors established that staff-student could work collaboratively in (1) "learning, teaching and assessment", (2) in "curriculum design and pedagogic consultancy", (3) in "subject-based research and inquiry" and (4) in "scholarship of teaching and learning" (Healey et al., 2014:24).

Later, Jensen & Bennett (2016) created "*a student and staff partnership model*" that aimed to improve the teaching and learning process in higher education by empowering students giving them a consultant role to provide professors with valuable feedback about their practices. Authors understood that their model provided academics with a liminal space where students act as consultants giving both actors new roles and, therefore, developing new relationships in their community. They also believe it has given students tools to enhance their confidence and skills as well as to develop new perspectives.

Subsequently, Könings et al. (2017:306) developed a "*model of practice participatory building design in education*" in which different stakeholders (students, professors, educational designers, and architects) from different countries (UK and The Netherlands) participated. They proposed an iterative design process where stakeholders are involved in different moments and various ways. The model is depicted in four cycles: Plan, Experiment, Realise and Use, which are at the same time carried out through four cycles: planning, implementation, observation, and reflection (Könings et al. (2017:314). This model is perceived as a tool for both policymakers in the case of educational building design and professors when co-creating the curricula or the teaching-learning process, including assessment.

On the other hand, Dollinger et al. (2018:2010) created a "*conceptual model of value co-creation in higher education*" that can be used to "inform and guide practice for the faculty and administration" in tertiary education. The authors use the indicators of co-production (information sharing, equity, and interaction) and value-added (experience, personalization, and relationships) as the basis of their model which is reflected in relational, innovation, and knowledge acquisition benefits.

Furthermore, Gros (2019) identified in her model of *participatory design in virtual learning environments* three phases to co-design: the discovery phase, the ideation phase, and the prototyping phase. The first phase aims to familiarise the agents with the different ways of working of each participant. In the second phase, collaborative participation is sought in order to understand and organize the work to be done. In the final phase, they shape the co-designed product in an iterative way until they adjust it to the way they imagined it.

Suliman et al. (2022:1) co-created with students, chief residents, and faculty/leaders a "*model for learning during transition*" that aimed to design "a transition curriculum and determine the value of involving the key stakeholders". The result of it was a model that is underpinned by adaptation, authenticity, autonomy, connectedness, and continuity as pillars, which at the same time is founded on supportive learning environments.

Finally, Villatoro & de-Benito (2022:5) presented four dimensions of "*a model for the co-design of learning pathways in technology-enriched environments that promote self-regulated learning*": personal, organizational, technical, and pedagogical. The first one is related to the teaching-learning process and students' participation. The second refers to all the aspects that need to be

considered in to plan. The third concerns the teaching-learning process management and implementation. And the fourth involves "all aspects related to the teaching-learning process" (Villatoro & de-Benito (2022:10).

All in all, Bovill & Bulley (2011) as well as Healey et al. (2014) are frequently recognise as fundamentals models since they are both remarkable when arguing the needs of implementing learning co-design. Particularly, other authors have developed co-design models that seek solutions for their higher education contexts:

- to promote certain roles within the co-design process (Jensen & Bennett, 2016)

- to involve students in the co-creation of and/or in curricula (Könings et al., 2017)

- to highlight the value of co-creation in higher education (Dollinger et al., 2018)

- to delineate how to co-create technological educational designs (Gros, 2019)

- to address a specific educational need with post-graduate medical students (Suliman et al., 2022)

- to develop a framework for initial teacher training aiming to foster self-regulation among other life-long learning skills.

1.2 Co-creation in the curriculum using digital technologies in higher education

There have been different attempts to co-create in the curriculum in technology-enhance learning environments in higher education: from co-designing assessment (Doyle et. al, 2020) to co-designing learning itineraries (Villatoro & de-Benito, 2022). For instance, co-producing magazines, consulting firms, being mentors for other students or co-designing workshops, curriculum on community interventions, video learning resources, a program at higher education, and/or social media content (Dollinger et al., 2019:3). Other authors attempted to co-create toolset for learning pathways (Hyysalo et al., 2019; Wareing et al., 2019), 3D Virtual Campus for synchronous distance teaching (González-Yebra et al., 2019), peer-assisted learning programme (Higgins et al., 2019), innovative solution for science learning out of the classroom (Dural et al., 2020), learning model (Blau & Shamir-Inbal, 2017) and a course (Bombaerts et al., 2021). In addition, Digital Game-based Learning Resources (Clarke et al., 2020), knowledge using mobile technologies and digital media as pedagogical devices (Reyna & Meier, 2020), ill-structured problem-solving activities online (Pee, 2020), flip classroom models (Uskoković, 2018; Blau & Shamir-Inbal, 2017) and, a variety of artistic initiatives (Chemi & Krogh, 2017) have also been co-design in higher education.

On the other hand, despite ICTs are valuable resources for the assessment of learning (Raposo-Rivas & Cebrian, 2019), the literature on the co-creation of assessment processes in higher education that includes them is scarce (Santana-Martel & Pérez-Garcias, 2022b). Nonetheless, there are different ways of approaching co-design in TELE in such a sensitive area as assessment. For instance, co-creating rubrics or criteria that would then be used to assess their work (Santana-Martel & Pérez-Garcias, 2022a; Deeley & Bovill, 2017). Similarly, other authors negotiated with their students the nature of the assessment and its grid (Walters et al., 2017). In addition, other authors co-designed

students' tests with them, some co-created multiple-choice questions that the professor would later select from (Doyle & Buckley, 2020) and others used student-led and teacher-led workshops in order to create them (Walters et al., 2017). Other authors reached a consensus with their students on the grade to involve them in the evaluation process (Thompson et al.2020; Gómez-Ruiz & Quesada-Serra, 2020). Finally, Triantafyllakos et al. (2011) co-designed a mobile application for assessment through co-creation and educational gamification.

The initiative to create a model of co-design in teaching-learning processes arose based on these models, previous experiences, the willingness to enhance students' four essential and students' active participation in their own learning process (including assessment). Therefore, the objective of our research was to create a model of assessment co-creation in technology-enhanced learning environments in higher education.

2 METHODOLOGY

The present research aims at creating an assessment co-creation model in technology-enhanced learning environments in higher education and is part of a broader research project called "Co-design of personal learning pathways in connected environments in higher education". The model of assessment co-creation in technology-enhanced learning environments in higher education (AC-TELE-HE) was developed through a participatory design-based research (DBR) in educational technology (Salinas & De-Benito, 2020) and, framed in a qualitative approach (Hernádez-Sampieri, 2018). Therefore, we have followed four phases divided into five stages with two iterative cycles of design and re-design (see figure 1). These phases are intended to concurrently address the following specific objectives:

1. To identify how educational co-design using ICT is implemented in higher education. (SO1).

2. To identify how assessment co-creation using ICT is implemented in higher education. (SO2).

3. To design and implement an assessment co-creation model for the higher education context. (SO3).

4. To describe how learners perceive the assessment co-creation process as well as the co-created product. (SO4).

5. To describe how teachers perceive the assessment co-creation process as well as the co-created product. (SO5).
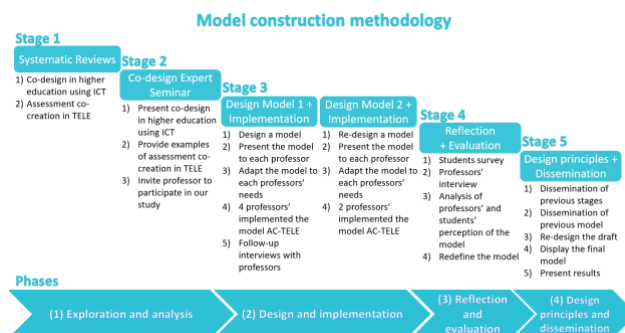

Figure. 2. Model construction phases

In the exploration and analysis phase, we have conducted two systematic literature reviews to analyse how co-design and assessment co-creation in higher education in TELE have been developed in the last decade. After that, we presented the

information gathered in a co-design expert seminar where we also invited professors that teach subjects related to educational technology at the Balearic Islands University to participate in our study. In the design and implementation phase, we first design a model based on the literature review; present it to each professor (4) that would implement the model, adapting it to his/her context, during the first semester of the academic year 2021-2022. Then, while professors implemented the model, we conducted follow-up interviews that were analysed to re-design the model. Once the model was re-designed, we implemented it bearing in mind the educational needs of the subject of two professors, who implemented the re-designed model in the second semester of the academic year 2021-2022. It is remarkable to say that each professor adapted the model provided with the help of the first author. In the reflection and evaluation phase, we interview all professors that participated in this research in a final interview to apprehend the co-creation procedure of each case, including the adjustments they had to do within the process and how would they do it in future practices. In addition, we survey students to understand students' perspectives of the co-creation process so that we could adapt the model tightly to students' viewpoints too. After analysing students' and professors' perspectives, we redefine the model of assessment co-creation.

This model was developed over three academic years, covering pre-pandemic, pandemic and post-pandemic periods. Learning modalities during this time included both online and blended learning formats.

2.1 Description of the context and participants

To develop this model, six professors from the University of the Balearic Islands who attended the co-design expert seminar agreed to take part in our research, constituting six distinct case studies (CS). As shown in figure 3, the second and third phase of the model was supported by six professors who implemented the AC-TELE-HE model with a total of 138 students. Four professors implemented the first model during the first semester of 2021-2022, while two of them implemented the second version of it during the second semester 2021-2022. It is essential to mention that all professors involved in the research teach subjects related to Educational Technology in different semesters of three Bachelor's degree: Primary Education, Early Childhood Education and Pedagogy (see each case in figure 3). In addition, as a result of the COVID-21 pandemic, adjustments were made to the learning modalities: the first and second cases were conducted in an e-learning format, while the third through sixth cases utilized a blended learning approach. Finally, it should be noted that each professor used the model to co-create different aspects of assessment depending on the subjects and students' interest. Therefore, during this research project professors and students co-designed a variety of assessment aspects: assessment criteria (CS 2-4), assessment percentages and weight that each criteria should have in the final grade (CS 2), assessment instrument (CS 4), rubrics (CS 1, 5 and 6) and the final grade (C3).
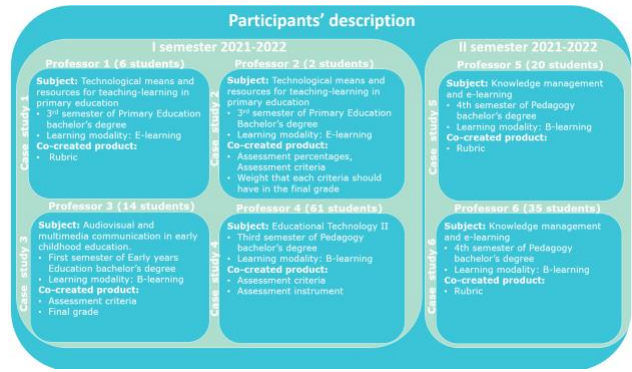

Figure. 3. Participants' description

2.2 Data collection techniques

To design the model of AC-TELE-HE, we had to use different sources of data collection (see table 1): systematic reviews, interviews, and surveys. Therefore, we have employed an eclectic approach using mixed methods as is characteristic of DBR (Salinas & De-Benito, 2020:34).

	Techniques and instruments	ICT Tools
Phase 1	Systematic review	VOSviewer Rayyan.QCRI Atlas.TI
Phase 2	Professors interviews	Videoconference system Atlas.TI
Phase 3	Students survey	GoogleForms Microsoft Excel Atlas.TI
	Professors interviews	Videoconference system Atlas.TI

Table 1. Techniques and instruments

To begin the research, we conducted two systematic literature research where we established three main dimensions (1) bibliometric analysis, (2) characteristics of co-design experiences, and (3) the benefits and challenges of co-design. In the first one, we explored how learning co-design in technology enhanced learning environments are implemented in higher education. Whereas in the second one, we focus on how assessment is co-designed in higher education by its participants (professors and students).

In addition, we conducted a survey of 16 questions to all student participants that included open and close-ended questions as well as Likert scale questions. Through this survey we studied eight dimensions related to students' perspective about: (1) participating in their own assessment process, (2) the co-creation process with their professor, (3) skills and learnings acquire within the co-creation process, (4) the co-created product, (5) their own student agency, (6) self-regulation, (7) benefits of assessment co-creation and (8) limitations of assessment co-creation.

Accordingly, the instrument used to collect data with the six professors that participated in this research was a semi-structured

qualitative interview based on eight dimensions: (1) Roles (student, teacher and ICT), (2) level of participation, (3) skills and learning acquired by the students, (4) students' agency, (5) students' self-regulation, and (6) learning and reflections of the teachers as well as (7) benefits and (8) limitations of the co-creation process. Each interview lasted between 40-90 minutes depending on the case.

To analyse the data, we used inductive-deductive criteria. First, pre-established categories associated with the different dimensions to be analysed were identified and, then codes were assigned to each of them using the inductive methodology with the help of the Atlas.ti tool.

3   RESULTS

The design and redesign processes developed in this research lead to a model of assessment co-creation in technology-enhanced learning environments in higher education (AC-TELE-HE).

3.1   Design

During the first phase of this model, we constructed the model based on literature review where we capture different aspects that needed to be taken into account in order to co-create. We included the different levels of partipation (Bovill & Bulley, 2011) and, we limited the kind of co-creation that was aimed within the model to learning, teaching and assessment from the wide spectrum in which it is possible to co-design (Healey et al. , 2014). Besides, we analyse the typology given by Bovill (2019) as well as Gros's (2019) co-design phases. Then, we participated in a co-design expert seminar with other professors which helped us to gain more information to develop our first version of the model, as well as, to recruit participants for ongoing research. This expert seminar assisted us in pinpointing the fundamental elements that would form the initial version of the model (see figure 4).
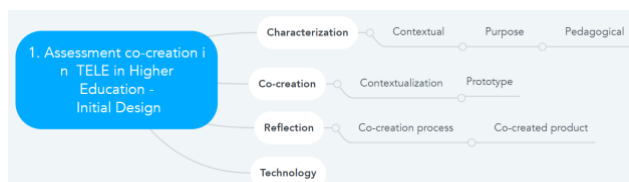

Figure. 4. First design of AC-TELE-HE model

3.2   The model's implementation

It is worth noting that the teachers who implemented the first and second versions of the model held meetings with the first author before, during and after the implementation of the model. Firstly, to help them adapt the model to their specific needs, secondly, to follow the implementation of the AC-TELE-HE model and, thirdly, to receive feedback so as to improve the model among other aspects.

3.3   Following the initial implementation of the model

As soon as the first model was implemented in the first semester of the academic year 2021-2022, interviews were held and surveys were conducted. After that, we analysed the data (Santana-Martel & Pérez-i-Garcias, 2022a; Santana-Martel & Pérez-i-Garcias, 2022b) and redefine the model to be implemented in the second semester of that same academic year.

From the data collected, professors and students highlighted some challenges encountered during co-creation, such as students' capacity to engage in co-creation and their inclination to seek approval for their ideas from the professor. This provided us with crucial insights into the significance of clarifying to students the concept of co-creation. It underscores the necessity of fostering an academic environment wherein both students and professors understand that each viewpoint holds equal importance, facilitating the co-design process effectively. As a result, the concept of contextualisation was redesigned to emphasise the sensitivity of the process. So, the first step of co-creation dimension was change from contextualization to sensitivity. Likewise, students expressed occasional feelings of being lost during co-creation sessions, while professors noted the importance of providing students with a clear outline of the co-creation process. Consequently, an ideation step was developed in the second version of the model, empowering students to determine what to co-create and enabling them to establish the steps to follow, thus mitigating feelings of being lost during the prototype phase. Consequently, the pedagogical step of the Characterization dimension would have to be revised by the professor. Additionally, stakeholders engaged in the co-creation process expressed a desire to test their own co-created product. Therefore, the implementation step was incorporated into the model (see figure 5).
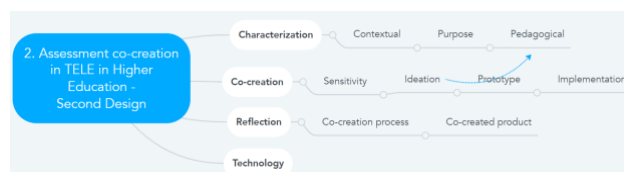

Figure. 5. Second design of AC-TELE-HE model

3.4   Following the second implementation of the model

Once the second version of the model was finalised, we presented it to the teachers who were going to implement it. We adapted the model to their specific needs, ensuring that they would be able to implement it effectively during the second semester of the 2021-2022 academic year. At the conclusion of the second application, we followed the same procedure, gathering valuable feedback (Santana-Martel & Pérez-i-Garcias, 2023; Santana-Martel et al., 2024, Santana-Martel & Pérez-Garcias, in press) that guided us in redesigning the model once again. Most students' and professors' feedback was in line with the previous data collected. Nonetheless, there were insights that hadn't arisen previously.

For instance, a professor highlighted that through the reflection of students and professors on the co-creation product and process, she learned how to redesign her own specific co-creation experience. Therefore, a connection between the reflection section and the beginning of the Characterization dimension was added to the model. Similarly, another professor pointed out that they had utilized the co-created product to assess students' assignments on more than one occasion. This process prompted them to revisit various stages of the co-creation dimension, specifically, they found it necessary to return to ideation and prototyping before implementing new adjustments. Consequently, a connection was added between the implementation and ideation steps, which may

or may not be necessary, depending on the needs of the participants involved in the co-creation process.

Additionally, the importance of activating student self-regulation and agency in order to co-create was emphasized in the final interviews. Thus, more criteria were added to be taken into account within the sensitivity phase, along with the need to clearly expose concepts (both co-creation and evaluation) to provide students with the necessary tools for the co-creation process to occur within the higher levels of the participation ladder (Bovill & Bulley, 2011).

On the other hand, in the final semi-structured interview, teachers emphasized the use of ICT across all dimensions of the co-creation model of assessment. Therefore, the technology dimension, previously isolated, is now perceived as an independent yet integrated component across all dimensions and steps of the AC-TELE-HE model. Similarly, the necessity to reflect on the technology employed throughout the process was highlighted. Consequently, an additional step was incorporated into the reflection dimension.

3.5 Final Model of assessment co-creation in technology-enhanced learning environments in higher education.

Accordingly, we present this model that broadly aimed to address the considerations of AC-TELE-HE by examining the whole process that is necessary to enable a pedagogical design to be implemented to meet modern-day educational needs. The intended outcome of our research was, therefore, to support pedagogical design by taking into account the different moments of planning, implementation, and reflection in co-creation processes. Hence, we developed a model (see figure 6) that encompasses four dimensions: Characterization, Co-creation, Reflection, and Technology.
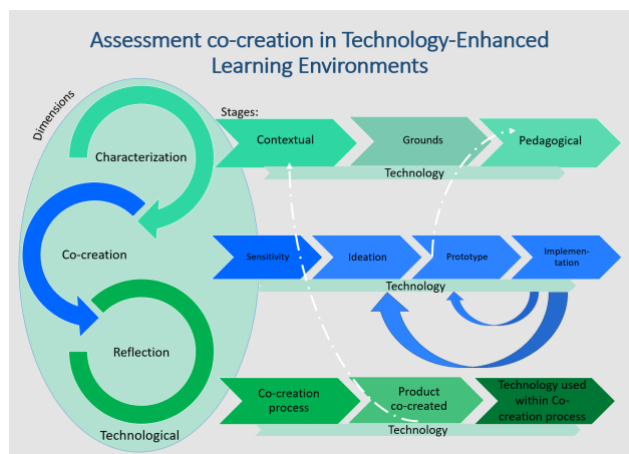

Figure. 6. Assessment co-creation in Technology-Enhanced Learning Environments

Each dimension is framed to be developed in a specific moment of the teaching-learning process (pre-co-creation, while-co-creating, and post-co-creation), except for the technological dimension that is present throughout the whole process. Each dimension and its stages will be described hereunder:

- Characterization dimension: it refers to all the aspects that should be taken into consideration when implementing co-creation processes. Hence, there are three stages within this dimension: (1) contextual, (2) grounds, and (3) pedagogical. In the first stage, students' characteristics, context, the focus

of the co-creation process, and the length of it should be analyzed. In the second phase, the problem and purpose as well as the recipients of the co-created product have to be determined so as to have solid grounds. In the third stage, all the pedagogical aspects that need to be taken into account and need to be developed in the co-creation process should be included in a teaching guide. To do so, there should be a documentation phase, which would then lead to the guidelines. It should reflect: the level of student participation, learning modality, pedagogical tools and resources needed (including ICT ones), the planning timeline, how to create a good environment to co-create, how to generate ideas, how to reach consensus, where the co-creation process would take place, how communication would be developed as well as how the information would be managed. The characterization dimension is related to the initial phase of the co-creation process, so we could also see it as the pre-co-creation phase.

- Co-creation dimension: in this dimension, the co-creation process takes place and it has four different stages where technology is used to enrich the process: (1) sensitivity, (2) ideation, (3) prototype, and (4) implementation. In the first stage, professors present the pedagogical strategy that they want to implement (co-creation) and the different elements of assessment. They ask students about their willingness to participate in the process and offer an alternative for those who do not want to co-create. Then, professors and students who agreed to co-create will carry out the ideation stage, where an ice-breaking activity is carried out and ideas for co-creation are generated. At the end of this stage, professors would have to adapt the teaching guide considering the agreements reached with his/her students. In the third stage, students and professors prototype the product/products they agreed upon in the previous stage. While prototyping, challenges may arise and the process may need to be adapted depending on contextual needs. Finally, it takes place the implementation stage, where the agents that have been previously established use the co-created product. The co-creation dimension is related to the middle phase of the co-creation process, so we could also see it as the while-co-creation phase.

- Reflection dimension: In this dimension, three stages are developed regarding the criteria to be reflected upon. Hence, professors, students or both reflect and/or evaluate (1) the co-creation process, (2) the product co-created, and/or (3) the technology used within the process. To do so, and mediated by technology, agents that would participate in this process should be defined. Also, the methodology to evaluate or reflect should be determined as well as when to perform the reflection phase and how to analyze the results. The co-creation dimension is related to the final phase of the co-creation process when the co-creation process has finished. Consequently, we could also see it as the post-co-creation phase.

- Technological dimension: this dimension involves all the ICTs (tools, resources, apps…) used in the whole assessment co-creation process. From our research, we have depicted how ICTs have been used so far in AC-TELE-HE (see figure 7). There are tools that have been used to facilitate communication in the process of co-creation: Moodle chat and forum, videoconferences systems (specifically, Zoom and Skype), Facebook, and e-mails. Technology has been

present in the three previous stages. Videoconferences systems and Google docs were used in the characterization and reflection dimension. Although in the latter, it has also been used Google Forms and Atlas.TI to collect and analyze data respectively. In the co-creation dimension, we have distinguished the tools used in each stage. In the sensitivity stage, Looping slideshow, PowerPoint, Zoom, Calendar, Canva, Moodle Forum, and Google Forms have been used. In the ideation stage, the chosen ICTs have been: chat, Zoom, Google Forms, and Jamboard. As to prototype, Aropä, Padlet, wikis, simulations tools, Zoom, e-mails, Cloud Storage, as well as Google Docs, Forms and Sheet have been selected. In the last stage, AropÄ, PeerWise, Google Forms, and Classroom as well as Moodle have been used to facilitate the implementation of the co-created product.
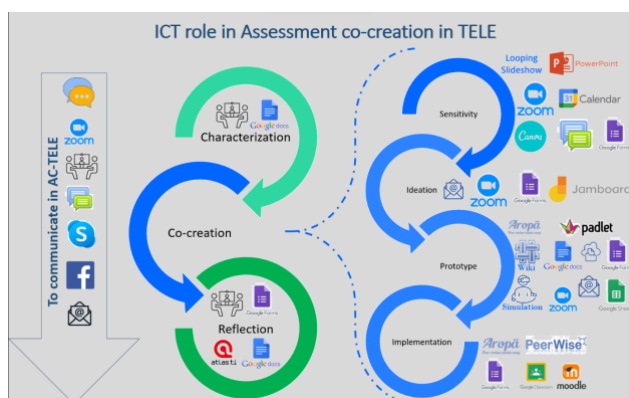

Figure. 7. ICT Role in AC-TELE-HE

4   DISCUSSION AND CONCLUSIONS

This research offers a model that seeks to improve educational practice as well as the interventions of the different agents within the teaching-learning process in a specific context. In addition, we highlight the importance of students' active participation in their academic process. Furthermore, it is essential to offer students learning opportunities that aim to enhance students' 21st-century skills, as well as digital ones, and within these processes promote students' self-regulation and agency. Therefore, learning co-design should be valued as a great opportunity to involve students in their own learning process.

Accordingly, this model tries to target higher level of students' engagement (Bovill & Bulley, 2011) in their own academic process, especially in assessment (Healey et al., 2014). This model assumed four main dimensions that can be associated to other models as it relates to their vision in a particular way. For instance, within the Characterization dimension, we have considered several aspects highlighted by Bovill (2019) in her study. Additionally, we have identified similarities with the pedagogical dimension outlined by Villatoro and de Benito (2022). Furthermore, the co-creation dimension diverges from its original model, which was based on Gros (2019). The AC-TELE-HE model departs from the original by incorporating the second and third steps (ideation and prototype) and adapts them to assessment co-creation. Additionally, it introduces two additional steps: the first step aims to raise awareness of assessment co-creation and garner students' willingness to participate, while the fourth step involves both parties utilizing the co-created product.

On the other hand, the reflection dimension of the model overlaps with other areas of Healey et al. (2014) model. It is noteworthy as it emphasizes reviewing the entire co-creation process, the resulting product, and the ICT tools employed. This reflection aims to continually enhance pedagogical practices and assist students in analysing their performance throughout the process. Finally, it is remarkable to understand that the technological dimension is crucial and it is integrated in the rest of the dimensions when co-designing of learning, as they serve a range of purposes based on communication, planning, organisation, task execution and reflection processes (Villatoro & de Benito, 2021).

In this paper, we present a model of co-creating assessments in technology-enhanced learning environments in higher education, drawing upon the works of other authors (Bovill & Bulley, 2011; Healey et al., 2014; Gros, 2019; Villatoro and de Benito, 2022), as well as participatory design and redesign research processes. The added value of this model is noteworthy as it provides the tertiary education academic community with a tool for co-designing the teaching and learning process in technology-enhanced learning environments and therefore, actively engage students in their learning process. Additionally, we highlight the value of the results of our investigation, as the AC-TELE-HE model shows the different dimensions and stages that should be taken into account when co-designing the teaching-learning processes. Moreover, this research is set in a real context, which provides validity to the study and while the results of this research are not intended to be generalizable, it is proposed to extrapolate the AC-TELE-HE model to other contexts. This being our major limitation, it is worth mentioning that the model should be adapted to the educational and contextual needs to which it is intended to be applied.

In summary, this model broadens the foundation of co-creation in the curriculum literature, giving practitioners a tool that enables learning co-design. Future research will be conducted in order to apply and validate the model in other fields of study and educational levels, contexts, and situations. In addition, more research is needed to better understand how learners' digital and 21st-century skills are enhanced through learning co-design.

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UN MODEL DE COCREACIÓ D'AVALUACIÓ EN ENTORNS D'APRENENTATGE MILLORATS PER LA TECNOLOGIA A L'EDUCACIÓ SUPERIOR

Aquest article presenta una investigació basada en disseny participatiu que va tenir com a objectiu crear un model de cocreació al currículum en entorns d'aprenentatge millorats per tecnologia (TELE) en educació terciària, específicament per codissenyar l'avaluació entre professors i estudiants. Aquesta investigació qualitativa va seguir quatre fases dividides en cinc etapes amb dos cicles iteratius de disseny i redisseny. En conseqüència, es va fer servir un enfocament de mètodes mixtos per recopilar les dades: revisió sistemàtica de la literatura, entrevistes semiestructurades i enquestes a estudiants. Com a resultat, el model destaca i distingeix quatre dimensions diferents: caracterització, cocreació, reflexió i tecnologia. Les tres dimensions inicials es representen en ordre cronològic, mentre que la quarta dimensió és present en totes les etapes precedents. A més, descrivim com la tecnologia és present en tot el procés de cocreació, delineant clarament el seu paper en cada dimensió. En conclusió, aquest model amplia la base de la cocreació a la literatura curricular i proporciona eines perquè els professionals innovin en els seus contextos acadèmics, permetent la participació dels estudiants en el propi viatge d'aprenentatge a través de la cocreació. És necessari fer més investigacions en aquest camp, per la qual cosa pretenem aplicar aquesta recerca a altres camps d'estudi i nivells, contextos i situacions educatives.

PARAULES CLAU: Avaluació; co-creació; model; educació superior; TELE

UN MODELO DE COCREACIÓN DE EVALUACIÓN EN ENTORNOS DE APRENDIZAJE MEJORADOS POR LA TECNOLOGÍA EN LA EDUCACIÓN SUPERIOR

Este artículo presenta una investigación basada en diseño participativo que tuvo como objetivo crear un modelo de cocreación en el currículo en entornos de aprendizaje mejorados por tecnología (TELE) en educación terciaria, específicamente para codiseñar la evaluación entre profesores y estudiantes. Esta investigación cualitativa siguió cuatro fases divididas en cinco etapas con dos ciclos iterativos de diseño y rediseño. En consecuencia, se utilizó un enfoque de métodos mixtos para recopilar los datos: revisión sistemática de la literatura, entrevistas semiestructuradas y encuestas a estudiantes. Como resultado, el modelo destaca y distingue cuatro dimensiones diferentes: caracterización, cocreación, reflexión y tecnología. Las tres dimensiones iniciales se representan en orden cronológico, mientras que la cuarta dimensión está presente en todas las etapas precedentes. Además, describimos cómo la tecnología está presente en todo el proceso de cocreación, delineando claramente su papel en cada dimensión. En conclusión, este modelo amplía la base de la cocreación en la literatura curricular y proporciona herramientas para que los profesionales innoven en sus contextos académicos, permitiendo la participación de los estudiantes en su propio viaje de aprendizaje a través de la cocreación. Es necesario realizar más investigaciones en este campo, por lo que pretendemos aplicar esta investigación a otros campos de estudio y niveles, contextos y situaciones educativas.

PALABRAS CLAVE: Evaluación; co-creación; modelo; educación superior; TELE