Towards a Method to Create Microlearning Capsules: Bullying and Cyberbullying Domain

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Abstract—The development of new information and communication technologies (ICTs) has become widespread due to the technology development and the COVID-19 pandemic; consequently, internet use has increased and impacted different social areas, like communication, education, and the way people relate. Therefore, increasing the cases of bullying and cyberbullying in children and teenagers. In addition, instructional tools, such as microlearning, have emerged in education, allowing for compressing and massifying educational content from different areas of knowledge. This tool aims to reduce learning time and can be deployed on any platform without using traditional means of learning. This paper presents an overview of a method for creating learning capsules in the domain of bullying and cyberbullying named LeCCMe. This method is based on the ADDIE instructional model and incorporates a diffusion phase to reach the largest possible population. Finally, a case study is presented, in which a learning capsule has been created to prevent bullying and cyberbullying.

Keywords— bullying, cyberbullying, education, e-learning, instructional model, microlearning

I. INTRODUCTION

The expansion of Information and Communication Technologies (ICT) infrastructures and Social Networks have turned most of the facts and daily activities into virtuality [1]. This process was accelerated in the last three years due to the COVID-19 pandemic and the lockdown worldwide that forced people to work, study and relate to others from home [2]–[4]. Thence, the education framework has presented one of the most significant changes [5].

On the one hand, digitalizing learning through E-learning and ICT technologies [5]. But, on the other hand, change the interrelationship scenarios and the behaviors between stakeholders in education. For instance, expanding the impacts and operating ways of bullying between classmates in virtuality [6]–[8]. Hereof, it generates an interesting field of action for education entities and governments to eradicate this trouble from class environments [8].

E-learning expands education beyond classrooms and increases its worldwide impact supported by digital electronic tools, web-based or computer-based applications, and processes, including multimedia online activities (e.g., video courses, documents, lessons). Thus, e-learning also covers creating digital content to teach people academically and personally, essential to fit potential users' needs [9], [10].

In the e-learning domain, MOOCs (Massive Online Open Courses) are digital courses that have gained popularity in universities and education centers. These are courses formed by digitized materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, learning, and research [11]. The ideal basis for outlining suitably a MOOC is the instructional design because of its impact on meaningful learning [12]. Besides, the MOOC's design and creation process vary depending on the designer's perspective, the type of course, and the selected instructional model [12]. Nevertheless, in the case of specific topic courses, having a sequenced and structured guideline or creation procedure can make the MOOC creation replicable and repetitive according to context and user needs, thus, facilitating its creation.

In this sense, this paper presents Learning Capsule Creation Method (LeCCMe), a methodology for designing MOOCs oriented to face bullying and cyberbullying problems in children and adolescents. The method aligns with two instructional design models; i) ADDIE (Analysis, Design, Development, Implement, Evaluate) [13], which properly establishes the learning process, ii) SAM (Successive Approximation Model) [14] which allows for detecting and correcting speedily problems in the process, thus making it repetitive. The methodology design follows the SPEM (Software Process Engineering Metamodel) specification [15] to represent each process stage.

This paper is structured as follows. Section II presents the related work. Section III describes the LeCCMe method, roles, guidelines, and artifacts. Section IV states a case study. Finally, Section V presents the conclusions and future work.

II. RELATED WORK

This section describes some related work about methodologies, courses, or online programs based on the ADDIE instructional model to create different types of educational content within e-learning or microlearning.

Nowadays, the research in e-learning based on an instructional model has increased primarily in Medicine learning. Here, Kim et al. [16] proposed an educational design for pediatric heart transplant recipients and their families. This educational content was developed through the first three out of five ADDIE steps: "Analysis," "Design," and "Development". They obtained the educational contents from literature reviews, studies, websites, and children caregivers' interviews who have undergone a heart

transplant. Also, the authors proved the educational contents with a validity index of 0.8 through recommendations based on expert advice. However, at applying only the ADDIE's three first stages, they do not present an educational design evaluation, as well as not to explain the type of multimedia tools that they use to spread the academic content.

Alike, Positos et al [17]., present a mobile application based on the ADDIE method named Educare app, focused on helping students and nurse educators. Authors used the analysis phase of ADDIE to identify and analyze the gaps in the area, the design phase to develop an application prototype, and finally, the implementation and evaluation phase to validate the usability and app acceptance. The study represents another example of using the ADDIE as an instructional method; nevertheless, the researchers did not include any other input or tasks specific to the nursing context in the model. Likewise, Choi et al., in [18] developed "ComEd", a computer simulation-based interactive communication education program for nursing students. The authors focused on the ADDIE evaluation phase, to assess the program's feasibility, acceptability, and effectiveness in learning nursing students' communication knowledge. This evaluation was conducted with a quasiexperimental design with 30 nursing students. Finally, the study concluded that repetitive learning through the ComEd program improved nursing students' communication skills.

Otherwise, concerning other teaching topics, Gavarkovs et al. [19], present a protocol based on ADDIE for developing an online training platform supporting the implementation of community-based interventions. Besides, the analysis stage they divided into five steps, which collect and provide information for the next stage, primarily to develop the design process. Similarly, the design stage was split into two phases to determine the units and learning activities. The study presents a complete instructional platform; nevertheless, it does not present a new method or modifications to improve the ADDIE model. Besides, there were no multimedia or MOOCs to spread the results.

Further, Dong [20] presents a study case applied in the COVID-19 context about the Rapid Prototyping (RP) instructional system, design model. The paper details instructional content creation for incoming students in first-year writing classes in an online format. Furthermore, the authors compare the RP model with the ADDIE model, and they analyze why the RP model is better than the ADDIE and SAM models. They highlight that the RP Model requires faster implementation time, lower resources, and more frequent assessment. Nevertheless, the authors stated the existence of similarities and differences between the RP and ADDIE models. For example, the ADDIE model performs gap learner analysis, and the RP model excludes these types due to time-consuming front-end analyses. In addition, the RP model relies on prototyping as the main design phase, similar to the development and review stages, and replaces the evaluation stage in the ADDIE model. Finally, the last step of the RP model is to deliver instruction, emulating the implementation phase in ADDIE.

On the other hand, Giumetti & Kowalski [6] created an Interactive video for awareness and prevention of cyberbullying called ACIV. The video helps youth increase their awareness about this topic and how to prevent and tackle cyberbullying cases among youth between 15 to 29 years old. Similarly, ACIV is developed using the ADDIE

model entirely; nevertheless, it does not have a specific explanation about how they applied each phase to cyberbullying context. Although the article presents a similar project to our research, the study did not create a new methodology or a microlearning capsule.

Finally, Cedillo, et al., [21] proposed a method for creating learning capsules in microlearning, taking into account accessibility criteria and andragogic techniques focused on the learning process of older adults. The proposed method was based on the ADDIE and SAM models, and considered a diffusion plan for apprentices to know and access micro-contents. Also, the authors show the step-by-step of creating a learning capsule directed to older adults.

This compilation of works makes it possible to show that the research area to be treated in this article is of great interest within the academic and research areas. In addition, the different topics addressed through MOOCs or micro learning are an example of the potential of this type of instructional tool in the field of education. In this sense, although bullying and cyberbullying have already been addressed in other works through multimedia tools, ADDIE and SAM models have not been presented in conjunction with a learning capsule creation phase that involves the context. For this reason, this work seeks to cover this research gap by giving a model that encompasses all these aspects and the diffusion phase for the target audience.

III. METHOD DESCRIPTION

This section describes the Learning Capsule Creation Method (LeCCMe). The method is based on the ADDIE instructional design model for creating course content focused on bullying and cyberbullying contexts. In addition, the method combines the SAM model, which is an iterative model to improve the contents during the execution of the method and thus optimize resources. The SAM context was applied in the ADDIE model's design, development, and implementation phases [22].

A. LeCCMe: Learning Capsule Creation Method

The LeCCMe method integrates various aspects such as i) action protocol in violent situations in the educational system, ii) methodological proposal for the data mining process to improve and establish adaptive scripts focused on children and adolescents, iii) pedagogical principles to meet the learning objectives, iv) accessibility criteria and v) microlearning principles.

Fig. 1 shows the LeCCMe general diagram. Here, the phases, guides, roles, and artifacts that intervene in each phase are specified. These components are described below:

In addition, the roles making up this method are: i) Domain expert who knows about bullying and cyberbullying cases treatment, ii) Software engineer who captures requirements and deploys the learning capsule, iii) Instructional expert who knows about instructional models and is an education expert, iv) the project manager who directs the capsules creation and knows about direction and project management, v) graphic designer who is an expert in handling the multimedia micro contents graphic line, and vi) audiovisual producer, who is in charge of managing and carrying out the audio and video production.

Analysis phase: In this phase (Fig. 1, part 1), the main guidelines from different expert approaches in each required area are analyzed and established, which will be input in the next phases. First, the context specification aims to identify and explain the capsule content domain; this task sets the addressed problem, learning needs, and proposed solution. Also, an analysis of the data mining requirements obtained from the attached methodology is performed; this determines the needed information to get both in the microcapsules and the platform. Second, the context selection is guided by the requirements template, data mining requirements, and collected information artifact. Finally, the instructional analysis aims to define the learning requirements for children and adolescents, and the pedagogical definition of techniques and strategies to be used.

Design Phase: In this phase (Fig. 1, part 2), the capsule core is defined and structured in order to be implemented. It involves the documents, media, and evaluation models directed to learners. The learning objectives and the requirement specifications are the essential inputs for this stage. Besides, the graphic design, video guidelines, and accessibility criteria are the guides that will model the capsule oriented to the stakeholders. Therefore, this phase's activities define document content, video sketches, and the overall criteria and scope of each capsule. Finally, as outputs

of this phase, there are the instructional design, audio-visual line, contents of the learning capsule, the learning capsule prototype, and the construction specifications.

Development Phase: The development phase (Fig. 1, part 3) is the stage that makes all the videos, multimedia, and documents that will conform the capsule. Within the context of the LeCCMe method, this phase emphasizes the video creation, from the script and storyboard to the recording, editing, and scenario definition. The inputs for this stage are the instructional design, defined audio-visual line, contents of the learning capsule, learning capsule prototype, and construction specifications. In complement, this stage follows the guide of principles of microlearning. Therefore, the output of this stage is the multimedia microcontent that will take part in the implementation of the capsule.

Implementation Phase: This phase (Fig. 1, part 4) aims to install and deploy the learning capsule, ergo, that the contents are displayed on a dissemination platform to be accessed by students. This phase´s four main tasks are: i) The developed multimedia microcontent is used by the software engineer, project manager, and instructional expert to analyze the form of the deployment. The result of this activity is the deployment specifications. ii) the software engineer and instructional expert organize the micro contents using the deployment specifications and the multimedia
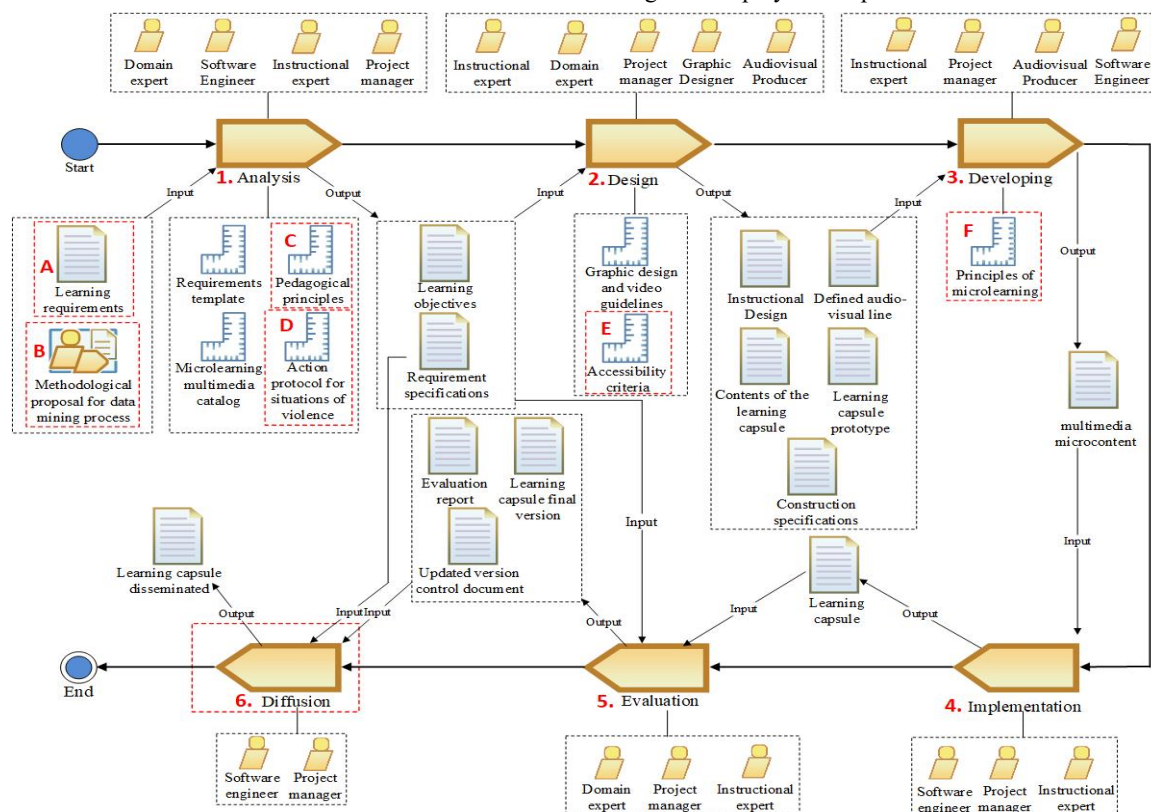
Fig. 1. Phases, artefacts, roles, and guidelines of LeCCMe Method.

micro contents. The output is the organized micro contents. iii) The software engineer uses the organized micro contents to deploy the learning capsule application. iv) the instructional expert and the project manager verify the deployed learning capsule validity. In this activity, a version control document is created in case of modifications using a version control template.

Evaluation Phase: This phase (Fig. 1, part 5) aims to know the learning program validity and the student learning and satisfaction level through i) summative evaluation of content where feedback is provided in case of answering erroneously, and ii) student satisfaction evaluation. For this, two activities were proposed. First, the evaluation analysis is carried out using the specification of requirements and the learning objectives in order to establish the learning capsule evaluation parameters; this task is executed by the instructional expert who verifies that the learning objectives are met. The project manager verifies compliance with the requirements, and the domain expert verifies the content suitability for the target population. Second, the instructional expert and the domain expert execute the evaluation using the evaluation parameters and the deployed learning capsule. The evaluation results are documented in an evaluation report. If there are any errors or inconsistencies, a version control document is made, and the learning capsule is obtained in its final version.

Diffusion Phase: This final phase (Fig. 1, part 6) comprises the learning capsule publication and dissemination. First, the software engineer uses the learning capsule gold version to deploy it in a production environment platform to make it available for use by the target population. Second, a dissemination or marketing plan is used to publicize the learning capsules within the target population. Overall, this phase results are the disseminated capsule and its use by the target population.

B. Artifacts in the LeCCMe Method

Learning requirements: Present the specific topics and guidelines to develop the learning contents for the capsules.

Learning objectives: Represent the learning goals that the students must achieve and helps to evaluate their acquired knowledge as well.

Requirements specification: Specifies the requirements engineering process results. Besides, this document is an output of the analysis activity based on the requirements template established by the requirements engineer.

Instructional design: It presents the pedagogical guidelines for developing the capsules. Besides, this document is an output of the design activity and is based on the instructional expert's pedagogical principles and learning objectives.

Defined audio-visual line: It represents the graphical, visual, and audio standards to be obtained from recordings and to be implemented into the created multimedia.

Contents of the learning capsule: These represent the thematic that will be considered within learning capsules.

Learning capsule prototype: It is the capsule prototype that is structured by the contents and multimedia. Therefore, it defines the chapters, evaluation and duration of the capsule.

Construction specifications: This artifact sets the technical specifications for learning capsule construction such as the deployment platform, front and back-end resources.

Multimedia microcontent: Are multimedia files (e.g., audio, video, text) created and directed to teach the population.

Learning capsule: This artifact contains the multimedia microcontents organized in a learning platform.

Evaluation report: This artifact contains the details of the evaluation carried out on the learning capsule.

C. Guidelines in the LeCCMe Method

Requirements template: This guideline is a complete template used during the Requirements Elicitation process. It is developed by the Requirement Engineer, who uses the most suitable elicitation techniques base on standards like ISO 29148 [23] or ISO 24766 [24]. This requirements template is an income to the analysis phase, which should be followed to obtain the requirements specification.

Pedagogical principles: This template presents the essential considerations to establish the learning objectives and the instructional design. It allows the instructional expert set the learning objectives based on the pedagogical standards or guidelines to structure the capsule according to the adequate educational strategies.

Microlearning multimedia catalog: This guide brings the set of multimedia that can be used in a learning capsule (e.g., video, audio, infographics, images, types of documentation)

Action protocol for situations of violence: It contains guidelines about how to face violent situations such as bullying and cyberbullying. It orients the capsule creation to determine the themes being covered in the capsule.

Accessibility Criteria: This guideline (Fig.1, part E) refers to the LeCCMe method's accessibility criteria for users of the learning capsules. For instance, some users have several limitations, such as vision, hearing, and cognitive problems [17]. Sanchez-Gordon and Luján-Mora [25] describe these criteria. Also, it is recommended the use of the Web Content Accessibility Guidelines (WCAG) international standard that contains guidelines to make web content more accessible to people with disabilities [26].

Principles of Microlearning: For the creation of learning capsules, all the characteristics for learning using microlearning must be considered.

D. Methodological Proposal for Data Mining Process

The methodology Cross-Industry Standard Process for Data Mining (CRISP-DM) guides work in data mining. It has six phases, these are: i) business understanding, ii) data understanding, iii) data preparation, iv) modeling, v) evaluation, and vi) deployment. This methodology is proposed by IBM [27]. The objective of including the CRISP-DM methodology in LeCCMe is to create adaptive scripts according to the learning objective.

IV. CASE OF STUDY

A study was carried out in the city of Cuenca in a secondary school whose results were that 52.1% of cyberbullying comes from social networks, 21.7% through

text messages and 13.1% through Internet, and email and 13.1% video games. Likewise, it is stated that 9.47% of students surveyed have suffered cyberbullying [27].

In this context, the learning capsules creation is proposed with the aim of making the population aware of the prevention of cyberbullying.

Fig. 2a and Fig. 2b presents the LeCCMe method to create learning capsules focused on the prevention of cyberbullying. Here, the steps in each phase and the activities performed by each role are observed.

V. CONCLUSIONS AND FUTURE WORK

This paper presents the overview the Learning Capsule Creation Method (LeCCMe) in the microlearning field. This method is based on the ADDIE instructional model.

This method's main objective is the creation of learning capsules within the domain of bullying and cyberbullying because it applies i) a protocol for action in cases of school violence, ii) pedagogical principles, iii) accessibility criteria for users with disabilities or older adults, and iv) considers the participation of a multidisciplinary team comprising areas of education, technology, and psychology. In addition, a case
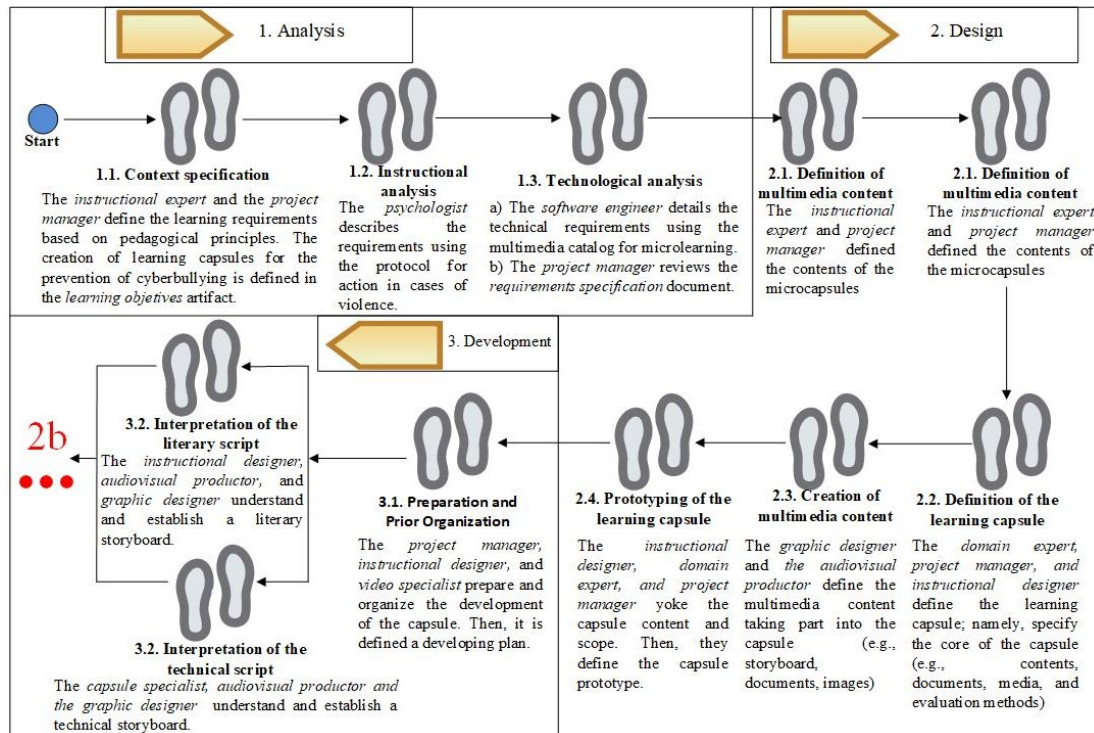
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1. Analysis

Start

1.1. Context specification
The *instructional expert* and the *project manager* define the learning requirements based on pedagogical principles. The creation of learning capsules for the prevention of cyberbullying is defined in the *learning objetives* artifact.

1.2. Instructional analysis
The *psychologist* describes the requirements using the protocol for action in cases of violence.

1.3. Technological analysis
a) The *software engineer* details the technical requirements using the multimedia catalog for microlearning.
b) The *project manager* reviews the *requirements specification* document.

2. Design

2.1. Definition of multimedia content
The *instructional expert* and *project manager* defined the contents of the microcapsules

2.1. Definition of multimedia content
The *instructional expert* and *project manager* defined the contents of the microcapsules

3. Development

3.2. Interpretation of the literary script
The *instructional designer, audiovisual producer,* and *graphic designer* understand and establish a literary storyboard.

2b
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3.2. Interpretation of the technical script
The *capsule specialist, audiovisual producer and the graphic designer* understand and establish a technical storyboard.

3.1. Preparation and Prior Organization
The *project manager, instructional designer,* and *video specialist* prepare and organize the development of the capsule. Then, it is defined a developing plan.

2.4. Prototyping of the learning capsule
The *instructional designer, domain expert, and project manager* yoke the capsule content and scope. Then, they define the capsule prototype.

2.3. Creation of multimedia content
The *graphic designer* and *the audiovisual producer* define the multimedia content taking part into the capsule (e.g., storyboard, documents, images)

2.2. Definition of the learning capsule
The *domain expert, project manager, and instructional designer* define the learning capsule; namely, specify the core of the capsule (e.g., contents, documents, media, and evaluation methods)

Fig. 2a. Building of a learning capsule using the analysis, design and development phases of the LeCCMe method.

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3. Development

2a
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3.5. Preparation of technical equipment
The audiovisual producor prepares the recording equipment for audio and video.

3.3. Prototyping of the video and Microcapsule
The instructional designer, audiovisual producor, graphic designer and project manager understand and establish a literary storyboard.

3.6. Preparation of the recording set
The audiovisual producor prepares the scenarios, clothing and characters imaging.

3.6. video recording
The audiovisual producor records the videos and audios stated in the sketckes.

3.7. video editing
The audiovisual producor and *graphic designer* edit the videos and audios, accomplishing final video..

4. Implementation

4.1. Deployment analysis
The *software engineer* analyzes the *multimedia microcontent* create the *deployment specifications*

4.2. Organization of microcontents
The *instructional expert* organize the microcontents according to the learning objectives.

6. Diffusion

End

6.2. Capsule difusion
The *project manager* diffuse the learning capsule on social networks and digital media.

6.1. Capsule publication
The *software engineer* and the *project manager* publish the learning capsule in the platform.

5. Evaluation

5.2. Execution of the evaluation
The *instructional expert* and the *psychologist* performs the assessment using the learning parameters.

5.1. Deployment analysis
The *project manager, instructional expert and psychologist* defines the evaluation parameters of the learning capsule.

4.4. Verification
The *instructional expert* and *project manager* verifies the functioning of the learning capsule. The changes are notified in a *version control document*

4.3. Learning capsule deployment
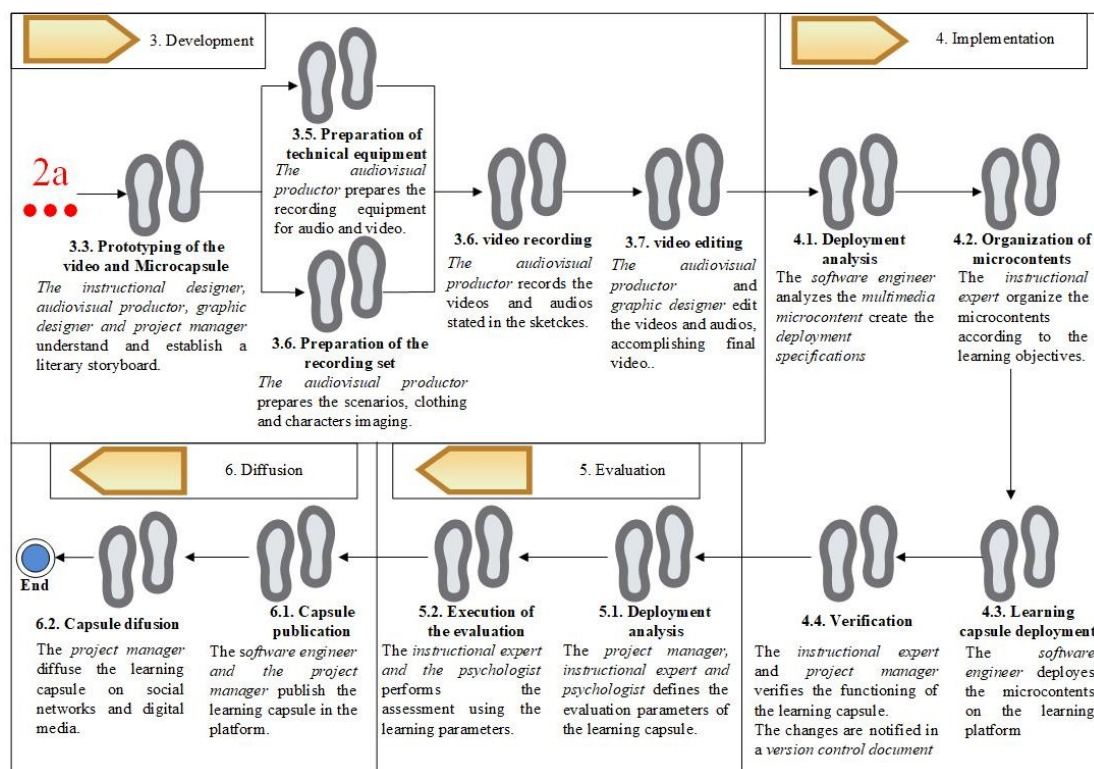The *software engineer* deployes the microcontents on the learning platform

Fig. 2b. Building of a learning capsule using the development, implementation, evaluation, and diffusion phases of the LeCCMe method.

study is included that shows the step-by-step creation of a learning capsule on cyberbullying prevention.

As a future work, it is planned to perform an in-depth analysis from the instructional point of view of the proposed method, the empirical evaluation of the LeCCMe method through an experiment using the Method Evaluation Model (MEM) [28]. Finally, the evaluation of the learning capsule created using the Technology Acceptance Model (TAM) [29] is planned.

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