

A Comparative Study of the ADDIE Instructional Design Model in Distance Education

Adamantia G. Spatioti ¹, Ioannis Kazanidis ^{2,*} and Jenny Pange ³

¹ School of Humanities, Hellenic Open University, 26224 Patras, Greece

² Computer Science Department, International Hellenic University, 65404 Kavala, Greece

³ Lab of New Technologies and Distance Learning, School of Education, University of Ioannina, 45110 Ioannina, Greece

* Correspondence: kazanidis@cs.ihu.gr

Abstract: Distance education is now a reality introducing a “specific methodology of flexible and interactive multiform learning”. Due to its characteristics, different instructional design models apply to distance education as guidelines of the design thinking process pursuing specific learning outcomes. This study refers to the investigation of good teaching practices and approaches in relation to the ADDIE model in distance online environments. The purpose of this paper is to investigate both the effectiveness of the ADDIE model in distance education and its contribution to the online teaching process. Meta-analysis is chosen as the research methodology. Specifically, we export a total of 58 articles referring to the ADDIE model. From these, we find that only 23 articles are appropriate for the meta-analysis. According to the results of this study, we observe that the ADDIE model applies to meet different teaching requirements in all online educational environments. In this study, we observe that good practices of teaching are the multimedia presentation, feedback, variety of interactive exercises or activities, combined learning strategy (individualized and collaborative), and role of educators. Then, an asynchronous approach was preferred in distance education. Finally, the ADDIE model is considered as a valuable source of additional information by providing good teaching practices.

Keywords: ADDIE model; instructional design; learning design; e-learning; distance learning; distance education; meta-analysis



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1. Introduction

In the context of the particularity that distinguishes the constantly evolving modern globalized society, e-learning reflects the requirements of the modern age and the respect for the diversity of the “other” contributing to the constructive cooperation of all participants, teachers, and learners, as well as achieving technological literacy (e.g., Keengwe et al. [1]). There is a growing demand for e-courses but this does not go hand in hand with proper pedagogical planning and the necessary skills required as a prerequisite for such educational environments for both teachers and learners (e.g., Johnson-Barlow and Lehen [2]; and Khalil and Elkhider [3]). Indeed, distance education is a process that has been widely applied during the COVID-19 pandemic (e.g., Troussas et al. [4])—especially, in Greece, which has not yet incorporated the pedagogical principles of teaching (e.g., Said [5]). The importance of this paper is the information that it provides for constructive use in the educational process.

1.1. Literature Review

1.1.1. Distance Education and Instructional Design Models

In recent years, according to a literature review, the demand for distance education has been rapidly growing with factors directly related to the context of the labor market (economic, social, and political) and to their interaction on an international scale (e.g.,

Amiti [6]; and Sun et al. [7]). However, several studies highlight the low performance levels of most distance online environments in motivating learners to learn, which is later reflected in their work environment while a systematic strategy for e-learning is almost absent (e.g., Abernathy [8]; Khalil and Elkhider [3]; and Zampelis [9]). According to Ali and Esia-Donkoh [10]; and Sharif and Cho [11], there is no fixed model to be followed, but different models to meet different teaching requirements in an evolving field. In the last two decades, according to the relevant literature, there are various proposed educational models, such as ASSURE, Dick and Carey, and Gagne, many of which are based on ADDIE (e.g., Johnson-Barlow and Lehnen [2]; and Soto [12]). However, there are few surveys that study the ADDIE model in the context of distance learning (e.g., Cheng [13]; and Hess and Greer [14]). Moreover, several researchers have observed that the demand for online courses does not go hand in hand with appropriate pedagogical planning (e.g., Anderson and Dron [15]; Khalil and Elkhider [3]; and Song et al. [16]). This imbalance of statements is expanding when taking into account the abundance of many technological means and tools (e.g., Anderson and Dron [15]; Spatiotis et al. [17]; and Troussas et al. [4]).

Automated artificial intelligence systems, digital educational games, virtual reality worlds, and other online applications have been introduced into the educational process offering adaptability and personalization (e.g., Lameris and Arnab [18]). However, the use of pedagogical models is required in order for such systems to be able to achieve an ideal educational framework for the assimilation of knowledge and development of complex skills as required by modern competitive reality (e.g., Salas-Rueda et al. [19]; and Yu et al. [20]).

1.1.2. Good Teaching Practices in Distance Education

Good teaching practices in distance education are the utilization of collaborative learning, active learning, social presence, and the supportive role of the instructor, including the provision of different learning experiences to enhance both the interaction and learning process in general, and finally the balancing of the amount of the course information with the students' dedication and perseverance (e.g., Creasman [21]). Moreover, the application of teaching is directly related to the space-time frame conditions where this process occurs and can be considered as good or bad teaching practices in advanced online learning environments (e.g., Creasman [21]). Additionally, the phrase "good practices" includes a number of aspects that make the teaching personalized, collaborative, and challenging by enabling an active, experiential, authentic, and democratic approach (e.g., Zemelman et al. [22]). In addition, well-designed courses, suitable instructors, and stable technology without understanding the learning preferences have a direct effect on the involvement of learners in e-learning (e.g., Hatziroufa [23]). Therefore, it is important to take into account some parameters in educational planning, such as the socio-cultural context of the learners (e.g., Vygotsky, as cited in Kozulin et al. [24]), motivation (e.g., Bandura [25]), and expectations of the curriculum (e.g., Jones and Davis [26]).

1.2. Instructional Design Model

The ADDIE Model

The ADDIE model is a teaching model widely used by many educational designers and training programmers to develop education and training programs. It appeared in 1975 at the University of Florida. Its name is an acronym, which depicts the five basic steps of this model for the design and development of the learning experience, which is as follows: *Analysis, Design, Development, Implementation, and Evaluation* (see Figure 1). In the ADDIE model, each step has a result that powers the next step. This sequence, however, does not require strict, linear, progression in the steps (e.g., Johnson-Barlow and Lehnen [2]; and Kakkou [27]).

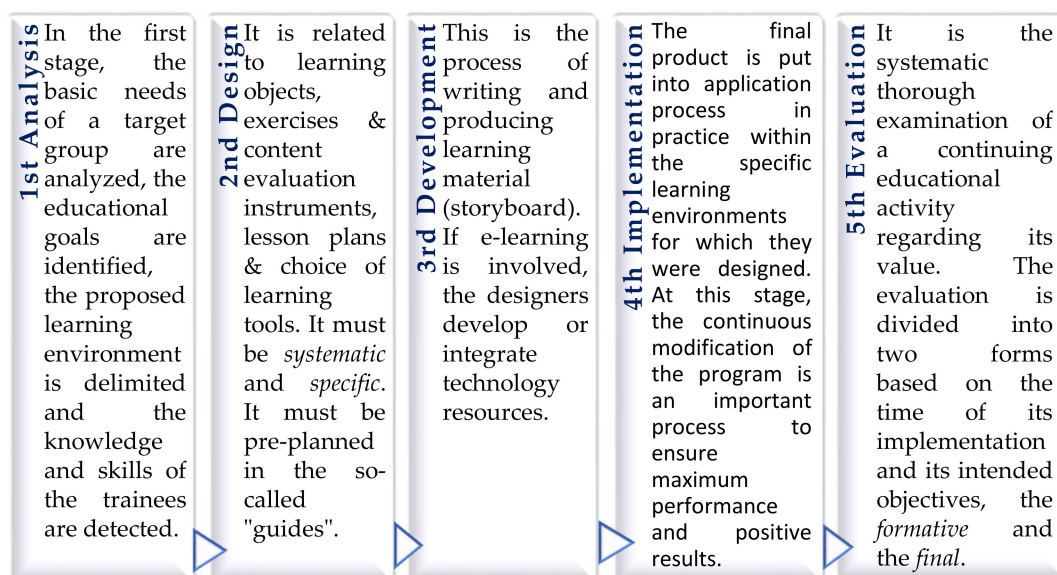


Figure 1. The basic stages of the ADDIE model for the design and development of the learning process.

Approaching the main characteristics of the examined model—ADDIE—in more detail, several properties can be distinguished. They can be categorized based on certain criteria (see Table 1), some of which are defined based on the guidelines, as presented by Diamantopoulou [28].

The ADDIE model is accompanied by the basic elements of the instructional design models, which were identified by Branch and Merrill [29]. These are (a) *clearly defined steps*; (b) *clearly defined objectives* based on the needs of the trainees; (c) *evaluation* related to the desired learning outcomes (measurable, reliable, and valid); (d) *common stages* (analysis, implementation, and evaluation) with considerable divergences in how they are implemented; (e) *team effort of educational designers*, keeping the fundamental data empirically; and (f) *development of real-life behaviors* as a guarantee for connecting the learning and business needs.

According to its basic theoretical and philosophical characteristics, the specific model—ADDIE—is widely known and recognized as a model for designing and evaluating learning experiences, courses, and educational content (e.g., Trust and Pektas [30]). This model is based on pedagogical scenarios. The ADDIE model is based on the general system's theory/analysis, which ensures that the analysis of tasks follow a logical and smooth process (e.g., Diamantopoulou [28]), and the underlying theory for this model is the theory of behaviorism. Regarding the type of knowledge, the ADDIE model approaches procedural knowledge.

In terms of its structure and the way the ADDIE model works, it was observed that a well-structured process is ensured to respond to various educational environments, whether digital or traditional (e.g., Türker [31]). Additionally, the ADDIE model is characterized by its almost rigid structure—linear and hierarchical, correspondingly—potentially limiting the creativity of educators and programmers. In particular, the ADDIE model has a strict, linear structure with wide phases, but with the dominance of each simple stage being considered as a prerequisite for the success of the next stage. It is a limitation if the design team follows a rigid workflow (e.g., Abernathy [8]). This means that the movement from one stage to another is flexible, but the movement is strictly circular. Therefore, it does not work well without predefined content and without complete prior analysis. Moreover, it creates restrictions, especially for educators who do not consider that learners must follow strict steps in order to achieve effectiveness in their learning. However, its structural integrity, flexibility, and simplicity make it one of the most popular of all design models, most of which are spin-offs or variations, even inspiring those trying to create a different

model (e.g., Jusas et al. [32] and Mullins [33]). For this reason, even the most experienced designers define it as a model for instructional systems design (ISD).

Table 1. Characteristics of the ADDIE instructional design model.

Properties	Criteria		
	1st Philosophy of Models	2nd Specialization of the Model	
(a) Origin	Empirical	(a) Educational context	Secondary education, companies, system
(b) Orientation	Regulative	(b) Scale	Massive level, organization level, curriculum level
(c) Theoretical background	Systems theory/analysis	(c) Experience	Experienced users
(d) Type of learning	Procedural		
(e) Underlying theory	Behaviorism		
3rd Structure		4th Time data & restrictions	
(a) Type	Basic Rigid structure:	(a) Time of creation	Decade of the 1970s
(b) Main feature	Strict linear structure, wide phases, flexible and simple transition, one-way but circular motion	(b) Time of its design/implementation	Demanding and potentially costly
(c) Emphasis	In the structural integrity	(c) Expiration date	Possibly, basis of intense criticism: “failure to meet modern requirements”
(d) Mode of operation	Predefined content and ex-ante analysis	(d) Course in time	Long course
5th Stages		6th Results	
(a) Type	Clearly defined 5 levels/phases	(a) Type	Predefined, reliable, valid and measurable
(b) Comparison	The analysis phase is related to the 4 levels of another model	(b) Resources	Immediately available resources depending on the results
		(c) Research tool	They have a set of research tools
7th Objectives (Kirkpatrick model)		8th Evaluation	
Type	Clearly defined based on the needs of the trainees	Type	Objective based on goals
9th Educational Designers		10th Data mining source	
Method of project preparation	Team effort	Importance	Valuable
11th Learning & Transfer of knowledge			
(a) Advantage	Development of real life behaviors by students	(b) Restrictions	Lack of more thorough training guidelines harmonized with the needs of wider society

Finally, in terms of time data and constraints, the ADDIE model has a long history dating back to the 1970s and it possibly has an expiration date, as several researchers claim. In recent decades, it has been subject to intense criticism, as has been pointed out, since it cannot meet modern requirements (e.g., Adnan and Ritzhaupt [34]). In addition, its design and implementation time are demanding and potentially costly (e.g., Santally et al. [35]). Nevertheless, this model is valuable as a source of information extraction by providing the best teaching and learning practices (e.g., Johnson-Barlow and Lehnert [2]).

1.3. Purpose and Research Questions

Based on the relevant bibliographic researches (e.g., Amiri [6]; Hess and Greer [14]; Johnson-Barlow and Lehnert [2]; and Sharif and Cho [11]) the aim of this study is to present the findings of the meta-analysis of relevant papers concerning good teaching practices, such as multimedia presentation, feedback, interaction, and combined learning strategy (*individualized* and *collaborative*), as well as basic approaches of distance education using a specific instructional design model, namely, the ADDIE model. In order to achieve this goal, the following two research questions were formulated as well as four clarifying sub-questions for the second research question:

1. What are the basic approaches of distance education (synchronous, asynchronous, etc.) in the context of the application of the ADDIE model according to the literature?

2. What are the good teaching practices in synchronous and asynchronous e-learning environments considering the literature? In particular, we would investigate whether this instructional design model:
 - (a) Promotes multimedia presentation;
 - (b) Promotes feedback;
 - (c) Develops a combined learning strategy;
 - (d) Enhances the role of educators.

2. Materials and Methods

2.1. Research Process

In the present study, initially, the examined model was ADDIE. The factor that was considered was good teaching practices for synchronous and asynchronous online learning environments. For the need of this study, a literature review was conducted on the relevant studies of the time period during 2010–2022, and the process of the meta-analysis of the most appropriate studies was considered. Therefore, a process of a systematic review was followed to extract appropriate information for our study. A meta-analysis was applied and the conclusions of the meta-analysis were implemented, followed by highlighting the methods of application and good practices of the above model for e-learning. Meta-analysis is “an objective and quantitative methodology used for the synthesis (e.g., combination and summary) of research studies that have been done in the past on a specific topic, in order to lead to an overall conclusion” (e.g., Panaretos and Xekalaki [36]). Indeed, meta-analysis is “a mathematical process that statistically combines the results of studies selected after a systematic review of the literature” (e.g., Galanis [37]). Therefore, meta-analysis is a process inextricably linked to systematic reviews and, thus, safe conclusions can be drawn.

2.2. Data Collection Technique

A selective bibliography obtained from international research journals was searched. Specifically, using the systematic review, databases were used, such as SCOPUS, Science Direct Elsevier, Springer Link, EBSCO, Web of Science, ERIC, and ProQuest. Moreover, data were extracted using the web quest process in order to be used to strengthen the bibliographic framework of the work and not to use them as basic data for the meta-analysis process. The collected scientific articles had as their main subjects distance education and technology in education, and more specifically, we collected those articles that referred to educational models in synchronous and asynchronous digital learning environments. Appropriate keywords, such as “ADDIE model”, “educational design”, “instructional design”, “learning design”, “e-learning”, “online learning”, “distance learning”, “distance education”, “meta-analysis”, and various combinations of these words were used to search for the above information.

2.3. Reliability and Validity

For reliability and validity, the application of meta-analysis was chosen (e.g., Galanis [37]) based on certain inclusion and exclusion criteria (e.g., Pellas et al. [38]). Initially, the basic steps of methodological research were followed, as reported by Pellas et al. [39], and we used the PRISMA (Preferred Reported Items for Systematic Reviews and Meta-Analyses) recommendation (e.g., Moher et al. [40]) for the systematic reviews and meta-analyses as it is considered as one of the most appropriate protocols to highlight the advantages and disadvantages of any research review (e.g., Liberati et al. [41]). In order to ensure the good quality of the surveys, appropriate instructions were taken into account regarding the evaluation of the online sources searched and extracted from the specified databases, as presented in a relevant source from the University of Cyprus (e.g., research initiatives [42]) and educational material (e.g., Cohen and Manion [43] and Creswell [44]). Then, for the extraction of the aggregate result, the process of meta-analysis was applied, during which a conclusion was calculated, guided by the results of the individual, appropriate empiri-

cal articles. The aim of the entire process was to obtain a centralized result with the utmost precision, reliability, and validity.

2.4. Detailed Planning of the Research Process

The meta-analysis process was based on the following classified transitional procedures proposed by Kitchenham (2007, as cited by Pellas et al. [39]), and the literature review followed the stages presented in Figure 2.

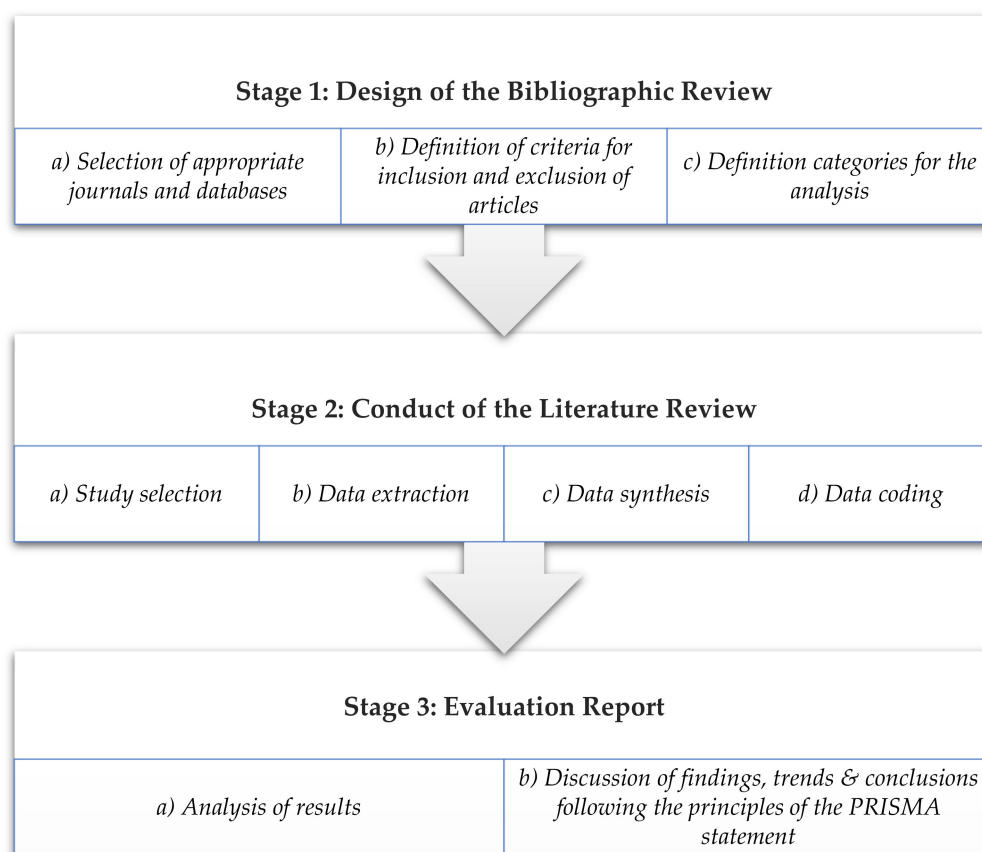


Figure 2. The design stages of the research process.

In the first step (Stage 1 (b)), regarding the criteria for the inclusion and exclusion of appropriate research (e.g., Pellas et al. [38]), these were determined based on the research questions from the present research, the time frame of the literature review, and type of research as Figure 3 indicates.

For the analysis of the results, a thematic analysis of the collected data was used. Specifically, the detection of repetitive patterns of meaning (topics) based on the aforementioned literature review and rendering of interpretive codes, conceptual definitions in the various data sections, were applied (e.g., Tsiolis [45]). Subsequently, the presentation of the results was conducted using *Microsoft Office Professional Plus 2019*, Excel Version 2206.

2.5. Conduct and Analysis of the Relevant Literature Review through a Flowchart

Figure 4 presents a flowchart regarding the process of selecting the appropriate articles followed using instructions obtained from Liberati et al. [41], the brief analysis of which follows the graphic display.

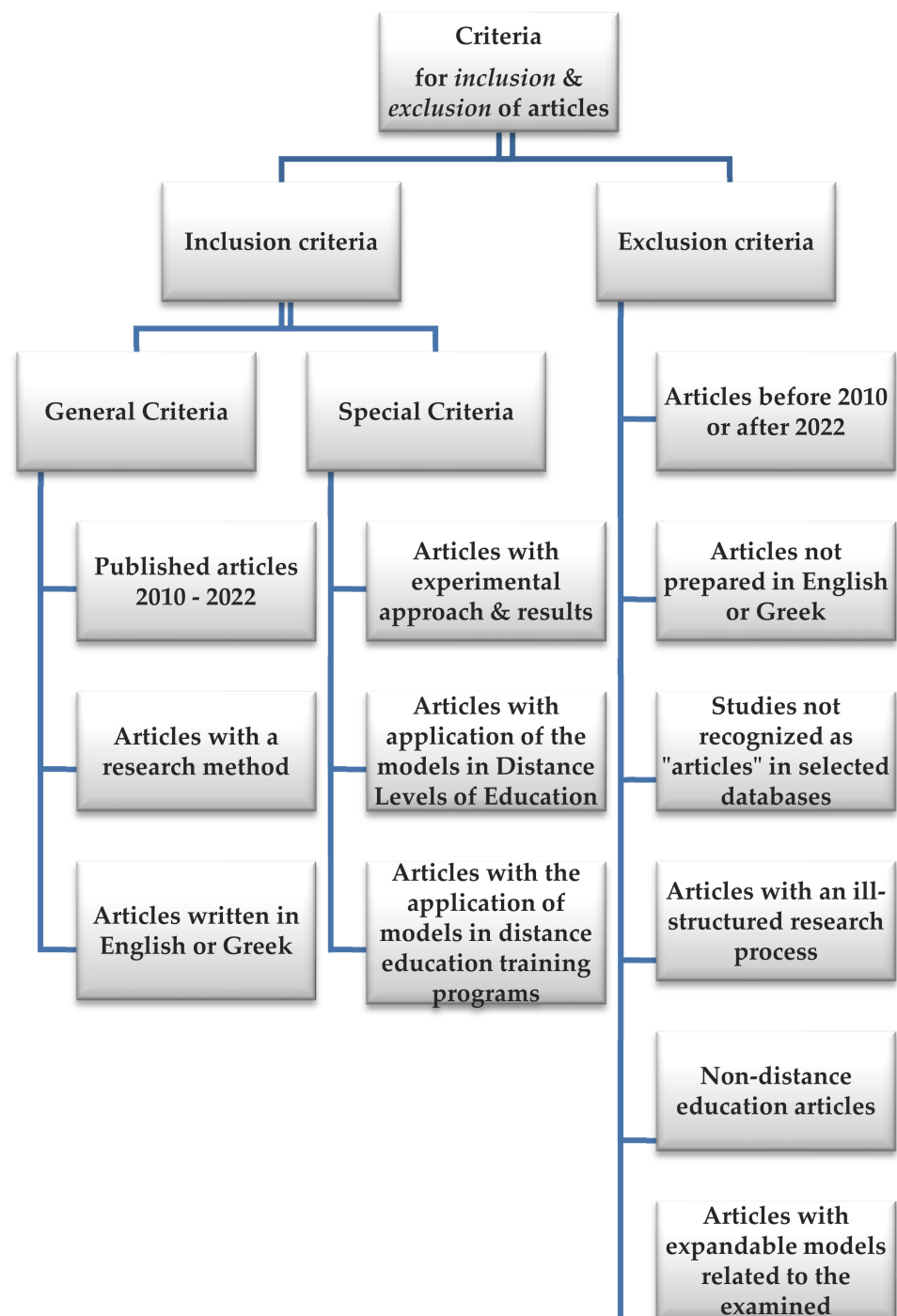


Figure 3. Criteria for inclusion and exclusion of articles.

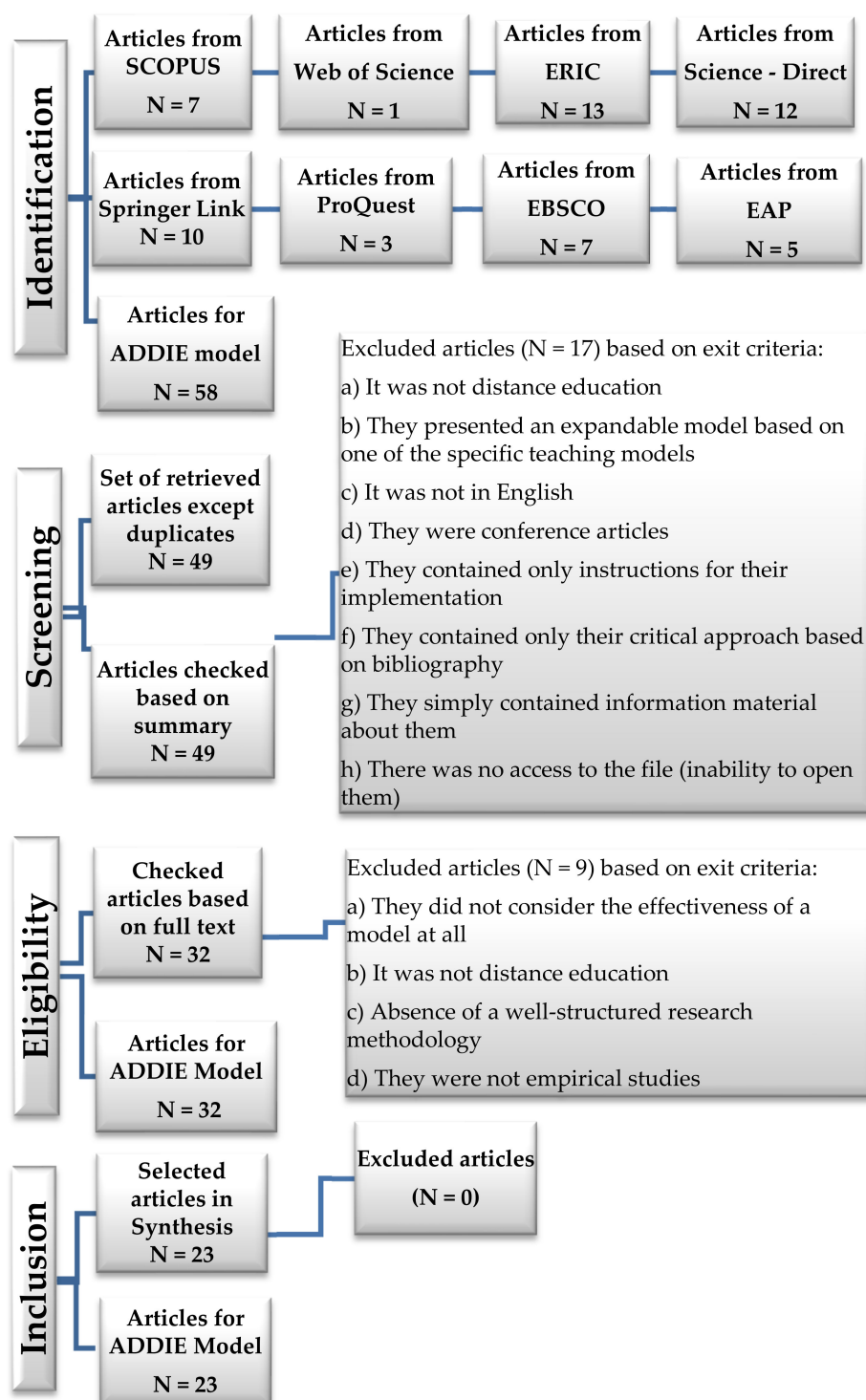


Figure 4. Flowchart for the article selection process.

Identification: In order to obtain and identify suitable articles for subsequent inclusion in the critical editing, a search was performed in certain databases during the period of two consecutive months: January and February 2022. The search for appropriate articles was defined based on the topic of the current research, and their scope was defined based on the framework: “The Model of ADDIE in online distance learning”.

Screening: During the bibliographic review process, 58 articles were extracted and after removing 9 duplicates, 49 articles were checked by reading their titles and their abstracts based on criteria that had already been defined.

During the screening process, 17 articles were rejected, while in the next phase, 32 articles were selected to be thoroughly reviewed. During the screening process, of the 17 rejected articles, 5 articles were not distance education, 3 articles were conference papers, while 4 articles presented an expanding model based on the specific model. Moreover, 4 articles contained a critical approach of the model based on the literature and 1 article simply contained information about it.

Eligibility: During the selection phase, a full text analysis is required. For this reason, the 32 articles were thoroughly studied following specific eligibility criteria, or otherwise entry criteria. The eligibility criteria were as follows: 1. The full text of the article contains a review of multiple articles; 2. The article provides evidence of educational potential based on a well-structured research method; and 3. The article includes an experimental application indicating the effectiveness or not of the examined model in distance education, whether it is courses at education levels or in the framework of an employee training program.

During this stage, 9 articles underwent the exclusion procedure as ineligible, while 23 articles were deemed appropriate for data extraction. In particular, of the 9 rejected articles, 2 articles did not examine the effectiveness of the specific model at all, although during the methodological process, they emphasized the development of the specific model. The 3 articles were not distance education, although they referred to virtual reality environments, multimedia classrooms, mobile learning, or TV programs without being specified in the summary in order to be rejected in the previous stage of checking their suitability (*screening phase*). A total of 4 articles were not empirical studies, of which 2 articles were comparative studies of ADDIE and Agile or SAM models based on the relevant literature.

Inclusion: For this stage, as mentioned above, 23 articles were deemed appropriate. Thus, 23 articles referring to the ADDIE model were obtained.

3. Results

All the articles mentioned above were processed to extract the results and conclusions based on parameters, as defined in the detailed design of the research process. Regarding Stage 2 (a), after a manual search in the selected databases, 23 suitable journal articles were selected by applying the defined inclusion and exclusion criteria. Stages 2 (b) and 2 (c) were performed by carefully reading the appropriate articles, and the data coding process was performed based on the categories defined in Stage 1 (c). The results were presented according to the research questions.

3.1. Presentation of the Main Characteristics of the Relevant Articles for the ADDIE Model

The main characteristics of the relevant articles for the ADDIE model are illustrated in Table 2.

3.1.1. Results of the Type of Methodological Procedure of the Relevant Articles for the ADDIE Model

Regarding the type of methodological procedure followed in each research process—quantitative, qualitative, or mixed—most articles chose quantitative research (a total of 11 articles). The articles that followed a qualitative research process were a total of six, while the remaining articles, a total of six, followed a mixed research process (see Figure 5).

Table 2. The main characteristics of the relevant articles for the ADDIE model.

Authors	Subject	Research Methods/Tools	Sample/Time	Observations/Good Practices
Almelhi [46]	The effectiveness of this model as used for improving the creative writing skills of students	Mixed pre-test, post-test, and control group design	N = 60 T = 4 weeks	Developing students' writing performance through blackboard blogs and discussion boards based on the design of the ADDIE model
Gournakis [47]	Development and evaluation of an e-learning system for software quality	Quantitative questionnaire	N = 9 T = 4 weeks	The addition of video lessons and interactive activities and exercises
Hanafi et al. [48]	Mobile-learning management system (e-BBQ) application for Islamic religious education courses	Qualitative pre- and post-tests, and interview	N = 100 T = 16 weeks	The application of mobile learning for educational purposes Difficulty only with the small screen ⇒ from 6 inches and above for learning Video tutorial presentation (video lessons) Instructor connection menu ⇒ (Symbol explanation: ⇒ = it entails/leads or the consequence of that is ...) instant feedback Seminars or workshops for educators as designers or instructors of distance education Time management is important in distance learning ⇒ a study schedule is required Limitations: course instructors also serve as course designers with added weight
KOÇ [49]	Online academic writing course in English	Mixed interview with semi-structured questions and questionnaire	N = 25 T = 9 weeks	The quality of the digital material is important
Manitsara [50]	E-learning for electronic patient file in the SAP information system	Quantitative questionnaire	N = 50 T = 4 weeks	The ADDIE model allows the organization of this game taking into account the needs of the students and the design learning outcomes at higher levels of <i>knowledge</i> Educators can create pleasant, attractive, easy e-training context and web interface The quality use of multimedia activates the interest of the students increasing their retention rates in the course
Salas-Rueda et al. [19]	Analysis and design of the interactive quiz game (WOODS)	Mixed research questionnaire and interview	N = 61 students T = spring semester	The role of the quality of the educational material in the effectiveness of e-courses is important Limitations: there are always a percentage of students who drop out of the MOOCs that the factors are independent with the model Need for practical, individualized, active engagement of students in learning Therefore, higher levels of cognitive processes (types of <i>knowledge</i>) directly related to learning objectives are required
Zampelis [9]	Development of MOOCs based primarily on asynchronous communication	Quantitative questionnaire	N = 52 T = 6 weeks	Limitations: the e-teaching development, e-course design, strategy selection, working time and relevance of learning often present deficiencies/disadvantages in terms of developing learning effectiveness Tests and quizzes were characterized as a pleasant way of learning that enhances thinking, knowledge, and facilitates the deepening of concepts
Abernathy [8]	Design and implementation process of an e-course	Qualitative comments and observation	N = - T = 8 weeks	Case studies facilitate the exchange of views, provoke discussions, and are a means of enhancing interaction and feedback The main video teaching was more liked, but with a shortened time period (10–12')
Hatziroufa [23]	Design, implementation, distance evaluation of an in-company staff-training program of "Hellenic Petroleum SA"	Qualitative interview with semi-structured questions Case study	N = 12 T = 4 weeks	Interaction between students and multimedia material is very important for active learning Limitations: there are always a percentage of students who drop out of the MOOC and the factors are independent from the model
Ismail et al. [51]	Development of a MOOC on food presentation topics	Quantitative questionnaire	N = 60 T = -	Instructional design models, such as ADDIE, may offer educational designers and educators a flexible and systematic approach or strategy for the development of multifaceted e-learning
Patel et al. [52]	Development and evaluation of three IPS e-learning modules	Mixed questionnaire and interview	N = 100 T = 2017–2018	

Table 2. Cont.

Authors	Subject	Research Methods/Tools	Sample/Time	Observations/Good Practices
Trust and Pektas [30]	The creation of an open online course (MOOCs)	Mixed questionnaire and comments	N = 48 T = 4 weeks	The posting of tasks (Google) and the interaction (Twitter) with the participants Activities with a choice of development type and theme contribute to active learning Limitations: there is always a percentage of students who drop out of the MOOCs and the factors are independent from the model Special attention should be paid especially to the analysis phase of an e-course design and, necessary decisions should be made in the design phase
Durak and Ataizi [53]	Language programming e-course (DLP)	Quantitative questionnaire	N = - T = 14 weeks	The role of interaction is important, especially in asynchronous learning
Hess and Greer [14]	Computer science e-course offered by Oakland University Libraries	Qualitative interview and comments Case study	N = 24 T = 3 weeks	Small learning groups and interactive tasks were highly desirable
Nordin et al. [54]	The creation of an MOOC	Quantitative questionnaire	N = 1055 T = 10–12 weeks	The addition of video lessons and 2D animated videos Incorporating local culture into video learning content Pilot procedures are necessary
Türker [31]	Turkish language e-courses for foreign students	Quantitative questionnaire	N = 108 T = 2015–2016	Additionally, testing should be performed to check how the learning resources are used depending on the device or Web browser or operating system
Santiari [55]	Determining the value of a student's attitude in each stage of emotional learning	Quantitative questionnaire	N = 40 T = 14 weeks	The model enables smooth training planning, even while transferring the acquired knowledge (<i>a positive workplace attitude</i>)
Hsu et al. [56]	Development of e-courses in the context of care in Taiwanese hospital clinical practice	Mixed group semi-structured interviews before and after e-course Participant evaluation by patients	N = 19 student nurses (& 113 patients) T = 10–12 weeks	The goal orientation of this model helped meet the diverse needs of all participants Videos of role model nurses had a strong pedagogical effect, especially those with examples of negative behavior ⇒ role modeling
Mavroudi and Hadzilacos [57]	Distance learning computer training program for lifelong learning for people in remote areas internationally	Quantitative questionnaire	N = 136 T = 10–13 weeks	Educational materials are required to be available in various formats and adapted to the local culture Lessons organized in groups (preference for groups of 3–5 people) Selection of activities with international standards without losing the local culture The analysis phase was very important to the success of the entire effort
Reinbold [58]	EBM medical e-course for 1st-year medical students (MPSI-Library/law seminars)	Qualitative interviews, reviews, and review of material pre-/post-test	N = 100 T = 8 weeks	Preference for active, blended, and online learning ADDIE is not a guarantee by itself that the training will be successful. The educator can make a well-designed lesson succeed or fail
Robinson and Dearmon [59]	E-course using simulation experiential learning in nursing education	Qualitative interview	N = - T = -	Simulation, even if it has followed the model, cannot replace real-life practice in a traditional clinical environment
Soto [12]	Investigating existing identity model on suitability for virtual world sharing and appropriate stages	Quantitative questionnaire	N = 61 T = 3 weeks	The ADDIE model offers fundamental approaches and provides a set of guidelines for educational designers and educators Emphasis is on the modification and adaptation of the existing model integrating it with the desired levels of immersion, interactivity, virtual reality elements, and game design
Cheng [13]	E-learning training program for auditors in an international accounting company	Quantitative questionnaire (interview in the analysis phase)	N = - T = -	Use of multimedia ⇒ effective and flexible learning and interaction The model is a useful tool for designing high-quality external learning experiences

The Type of Methodological Process of Relevant Articles for the ADDIE model

■ quantitative research ■ qualitative research ■ mixed research



Figure 5. The type of methodological process of the relevant articles for the ADDIE model.

3.1.2. Results of the Type of Educational Programs of the Relevant Articles for the ADDIE Model

Regarding the type of e-learning programs—education levels or employee training programs—and the type of e-courses, some of the results are illustrated in Figure 6.

The Type of Educational Programs of the Relevant Articles for the ADDIE Model

■ Higher Education ■ Employee Training Programs

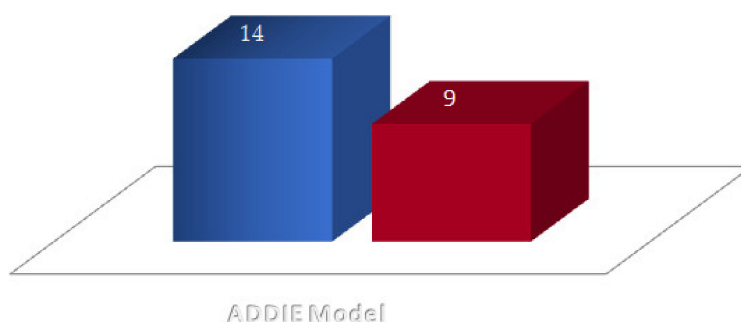


Figure 6. The type of educational programs of the relevant articles for the ADDIE model.

In more detail, from the ADDIE model, 14 articles were about e-courses in higher education, of which 3 articles were about college students collaborating with the university and 9 articles were about employee training programs or, more generally, people who wanted further learning. In particular, out of the 14 articles that related to higher education, 4 articles referred to informatics and programming languages, 2 articles referred to medicine and nursing courses, 1 article referred to international relations courses, 3 articles referred to foreign language courses (English and Turkish), and the remaining articles referred to courses in engineering, religious and aesthetic education, and finally food. Of the nine training program articles, two were for company employees, three were for medical and nursing staff, two were for teachers, one was for training program designers, and one was for the general public (computer training).

3.2. Results of the Application of the ADDIE Model in Distance Education

Tables 3 and 4 present the overall results regarding the aforementioned variables for the examined model and per category (basic approaches and good teaching practices in distance online teaching environments).

Table 3. Basic approaches from the application of the model in distance education.

Basic Approaches	ADDIE Model	
	Number of Studies	Percentage
Synchronous distance education	-	-
Asynchronous distance education	16	70%
Combination of synchronous and asynchronous distance education	3	13%
Blended learning (distance and face to face)	-	-
Massive e-courses (MOOCs)	4	17%
Virtual learning	1	5%
Mobile learning	1	5%
Combination of a technological tool/algorithm	1	5%

In particular, Table 3 presents the findings for the ADDIE model in terms of type of learning (synchronous e-learning, asynchronous e-learning, or a combination of these). Specifically, 3 articles presented synchronous and asynchronous e-learning without MOOCs e-courses, 4 with MOOCs online courses, and 16 with courses in asynchronous online environments (70%). Out of the remaining 16 articles on asynchronous learning, 1 article was about the combination of a technology tool (WGODs) and 2 articles were about either virtual or mobile learning.

Table 4. Good teaching practices from the application of the model in distance education.

Good Teaching Practices for the ADDIE Model	Number of Studies	Percentage
Multimedia presentation (quality use of multimedia, audio, and graphics files; use of short films; animation)	8	35%
Quality, educational material available in various forms and in combination with the use of self-assessment tools (tests and quizzes)	4	17%
The role of educators in distance education	4	17%
Feedback (from instructor, co-learners, or in exercises through direct answers)	4	17%
Interaction (use of interactive films, simulation software, virtual reality technology)	3	13%
Prior training of educators as e-learning designers	3	13%
Use of the local culture or role modeling in multimedia	3	13%
Combined learning strategy (individualized and collaborative learning)	3	13%

As Table 4 indicates, the application of the ADDIE model emphasizes the use of multimedia presentations, mainly short films (35%); quality educational material available in various formats and in combination with the use of self-assessment tools (17%); role of educators in distance education (17%); feedback (17%); interaction (13%); prior training of trainers as e-learning designers (13%); local culture or the role modeling in multimedia (13%); and the choice of a combined learning strategy (13%).

4. Discussion and Conclusions

4.1. Basic Approaches from the Application of the ADDIE Model in Distance Education

According to our findings, the effectiveness of the instructional design model, ADDIE, in online distance education appears in all educational environments. This model applies to online processes, but meets different educational requirements. During the application of the examined model, the asynchronous approach was preferred in distance education.

More specifically, the ADDIE model has a flexible structure that allows it to be applied to all learning environments (e.g., Türker [31]; and Almelhi [46]). The educational

planning process of online learning with the ADDIE model is most often used for the design of massive online courses (MOOCs) and is considered effective, although there is always a negligible percentage of students who drop out of massive online courses with abandonment factors, as indicated in the relevant literature (e.g., Ismail et al. [51]; Nordin et al. [54]; and Zampelis [9]), unrelated to the ADDIE model (e.g., difficulty due to lack of previous experience with MOOCs programs, time commitments, and perceptions of the trainer). Additionally, the ADDIE model is preferred for the development of virtual reality commands (e.g., Soto [12]) and is considered suitable for the design and implementation of mobile learning by enhancing learners' positive attitudes and perceptions regarding the adoption and use of technology for educational purposes (e.g., Hanafi et al. [48]). The examined model enables training planning that can work efficiently, creating a positive attitude for the trainees, even while transferring the acquired knowledge to their workplace. This is important as e-learning is considered as completely successful when a positive workplace attitude is also achieved (e.g., Santiari [55]). Therefore, the ADDIE model may offer educational designers and educators a flexible and systematic approach/strategy for the development of a multifaceted e-learning (e.g., Patel [52]). In distance education, this model is used more frequently in asynchronous e-learning environments, and mainly by the school of informatics. Finally, during the literature search, the frequent use of the ADDIE model was considered as a basis for the application of expanding models, such as IDEA (e.g., Mullins [33]), and the critical approach of articles related to this model (e.g., Anderson and Dron [15]; Draper-Rodi et al. [60]; Kuciapski [61]; Sharif and Cho [11]; and Van Rooij [62]).

4.2. Good Teaching Practices from the Application of the ADDIE Model to Synchronous and Asynchronous Online Distance Environments

During the application of the ADDIE model to synchronous and asynchronous online distance environments, it was emphasized that the ADDIE model was considered as a valuable source of additional information by providing good teaching practices enhancing the work of both instructional designers and educators. Specifically, during the application of the examined model, the good teaching practices were multimedia presentation, feedback, the variety of interactive exercises or activities, a combined learning strategy (*individualized* and *collaborative*), and the role of educators. In addition to the above-mentioned good teaching practices, some others emerged during the application of the aforementioned model. All the above are mentioned in greater detail below.

4.2.1. Multimedia Presentation

During the application of the ADDIE model to distance education, the multimedia presentation was a common preference. The quality use of multimedia, short films, audio files, and graphics motivated and maintained the students' interest by increasing their attendance rates, while also providing interaction and flexibility (e.g., Cheng [13]). The main form of teaching through short films/video was more pleasing to the trainees, but with a decrease in the time about 10–12 min (e.g., Hanafi et al. [48]) and was suitable for the acquisition of all levels of knowledge (e.g., Hadullo [63]). In addition, for the ADDIE model, everyday experiences and even examples of negative behavior (e.g., non-patient care) could be used to provide authentic educational material and offer role modeling (e.g., Hsu et al. [56]). Therefore, they can be integrated not only into simple videos, but also into animated videos (e.g., Nordin et al. [54]). Moreover, there was a strong preference of the trainees for the educational material to be available in various forms or in combination with tests and quizzes and, in fact, with an adaptation to the local culture (e.g., Manitsara [50]; Mavroudi and Hadzilacos [57]; and Nordin et al. [54]), a parameter that must be taken into account in the educational planning of distance education (Vygotsky, as cited in Kozulin [24]).

4.2.2. Feedback and Variety of Interactive Exercises or Activities

In accordance with the examined model, the feedback that learners receive from both the instructors and co-learners in collaborative learning environments, or from exercises through which answers are received immediately, has a positive impact on the students (e.g., Almelhi [46]). For this reason, the connection menu with the educator, especially in mobile learning or in asynchronous online environments, can encourage students to obtain more learning experiences (e.g., Hanafi et al. [48]). However, in mobile learning, the size of a small screen created difficulties, which is why it was recommended to use mobile devices from six inches and up for e-learning (e.g., Hanafi et al. [48]). In addition, the ADDIE model emphasizes exercises that are intended even for collaborative learning by even adapting them to mobile devices or virtual reality worlds. Moreover, such exercises and learning activities based on virtual discussion forums in teaching enhance cognitive and self-regulatory skills, and function as feedback when they are accompanied by immediate responses (e.g., Hatziroufa [23]; and Almelhi [46]). Additionally, different interactions of exercises and interactive self-assessment exercises not only function as feedback, but also create the right conditions to achieve effective learning. Thus, learners achieve higher levels of *knowledge* without engaging in repetitive, same-level exercises and losing interest in learning (e.g., Mavroudi and Hadzilacos [57]).

4.2.3. Combined Learning Strategy

Although individualized learning is a key feature of distance education, the results of the present study highlight a combined learning strategy (*individualized* and *collaborative*). This is why a combined learning strategy is a good practice that leads to important benefits, in the acquisition of both skills and knowledge, in addition to the interaction of all participants (e.g., Koç [49]). This interaction can often increase learners' motivation and reduce the number of students who drop out of e-courses before they have been completed (e.g., Durak and Ataizi [53]). Indeed, self-regulated students have greater motivation and control over their learning behaviors, and thus create better learning outcomes on the individual level, but especially as a team (e.g., Wang and Hwang [64]). Finally, each trainee through group assignments and activities draws useful data, which are evaluated and incorporated in their learning (e.g., Almelhi [46]).

4.2.4. The Role of Educators in Distance Education

Online course and digital activity designers shoulder a multifaceted and multidimensional role that can undoubtedly not be perceived as fixed due to the ever-changing thematic area (e.g., Koç [49]; and Sharif and Cho [11]). In addition, the disadvantages of a model, namely, ADDIE, are directly related to the mistakes of educational designers (e.g., Adnan and Ritzhaupt [34]; and Reinbold [58]). Educational design specialists spend most of their resources on the training process that produces the lowest level of business results. More specifically, they do not devote more time to activities that are decoded in a positive behavior change and corresponding results, even if they are in the analysis and design phase of the ADDIE model, which also lack more thorough educational instructions (e.g., Reinbold [58]). These mistakes are inextricably linked to the ways in which they are trained, thus maintaining a vicious circle regarding learning. That is, educators–designers use strategies that focus more on cognitive performances, and the design of the learning outcomes reflect the lower levels of *knowledge* while ignoring the emotional factors, the basic principle of effective and efficient educational intervention (e.g., Smith and Ragan [65]). Moreover, the strategies are designed whilst ignoring the achievement of the goals in the shortest possible time, as well as the transfer of knowledge to the wider, competitive, reality at present.

Thus, considering the fact that teachers are still the most important guides in learning processes, and also often serve as course designers carrying an extra burden (e.g., Huang et al. [66]), the above role requires, foremost, special knowledge and skills for continuing training (e.g., Koç [49]). Then, the role also presupposes a collective effort, so that educators

meet the needs of contemporary requirements and bridge the gaps between theory and practice more constructively (e.g., Sharif and Cho [11]; and Van Rooij [62]). Sharif and Cho [11] proposed group meetings of educators and designers from each sector or educational institution so that these support, distance learning programs occurred every 6–7 weeks, which would host special speakers, exchange views, and involve teamwork with innovative ideas, always taking into account the needs of the trainees and the utilization of the increasing and modern technological resources aiming at achieving more effective learning practices. It is important to consider the emotional issues when designing e-learning devices, such as the motivations or factors that influence motivation simultaneously with cognitive focus, as well as the operational business priorities within a broader competitive society (e.g., Bandura [25]; and Jones and Davis [26]). Finally, educational designers should design learning outcomes at higher levels in the cognitive domain because, according to the results of the meta-analysis, only learning outcomes designed at higher levels of cognitive demand—*type of knowledge*—(e.g., Hadullo [63]) enhance the learning process, as more complex ways of thinking are required and the learners become more effective in today's competitive world (e.g., Anderson and Dron [15]).

4.2.5. Additional Good Practices obtained from the Application of the ADDIE Model

In addition to the above-mentioned good teaching practices, some others emerged during the application of the examined model. Regarding the ADDIE model, simulation or virtual reality software mobilizes and maintains the students' interest by increasing their attendance rates, while providing both interaction and flexibility (e.g., Cheng [13]), but it cannot replace face to face practice in the traditional environment (e.g., Robinson and Dearmon [59]). Additionally, the simulation of learning situations through virtual workshops contributes to the acquisition of higher-level thinking skills. Although the trainees stated that they preferred classes or activities organized in groups, they expressed their satisfaction for a certain group size of 3–5 people (e.g., Hess and Greer [14] and Mavroudi and Hadzilacos [57]). Furthermore, time management in e-learning is important (e.g., Coogler and Floyd [67]). Hence, the instructors should provide students with a study schedule (e.g., Koç [49]). Moreover, learners' characteristics, such as abilities or skills, motivation, and personality play an important role in e-learning and they are directly related to the transfer of knowledge in the work environment (e.g., Santiari [55]). Therefore, these factors must be taken into account by e-learning designers (e.g., Bandura [25]; Jones and Davis [26]; and Santiari [55]).

In conclusion, according to our results, the ADDIE model and, more generally, each model has to show remarkable findings, which is important to take into consideration when planning learning in online distance education and in some cases to be used interactively or extensively. This result is consistent with the views of Sharif and Cho [11] who argued that there was no fixed model to follow, but rather different models to meet different teaching and learning requirements in an evolving field, such as distance education (e.g., Pange et al. [68]). Taking into account the abundance of new technological means and tools (e.g., Spatiotis et al. [17]), such as automated artificial intelligence systems, digital educational games, and virtual reality worlds, an instructional design model—either new or old—contributes to scientific knowledge (e.g., Lameris and Arnab [18]; and Soto [12]).

In recent decades, the examined model was subjected to intense criticism, because, as claimed by several researchers, it could meet contemporary requirements (e.g., Anderson and Dron [15]; Draper-Rodi et al. [60]; and Kuciapski [61]). Nevertheless, according to the present research, many scientists (e.g., Ali and Esia-Donkoh [10]; and Soto [12]) emphasized the adaptation of the existing model, such as the ADDIE model for virtual reality environments, as many of them achieved both the constructive analysis of students' learning behaviors and provided corresponding targeted feedback for the learners' improvement based on their needs (e.g., Yu et al. [20]). Additionally, this model encourages the organization and creation of innovative, useful, and creative spaces in an online training context, thus contributing to the improvement of learners' academic performance, motivation, and

involvement (e.g., Salas-Rueda et al. [19]). Finally, this model is able to design learning outcomes at higher levels of *knowledge* (e.g., Hadullo [63]). This is important as only learning outcomes designed at higher levels of cognitive demand enhance the learning process. This is achieved as more complex ways of thinking are required. In this way, as argued by Anderson and Dron [15], learning is transformed into a creative process, thus creating strong parallels with constructivist approaches that emphasize creation as a central role in the construction of knowledge, and learners acquiring higher class skills become more effective in today's competitive world (e.g., Puzziferro and Shelton [69]).

Additionally, considering the present research, the ADDIE model is still a fundamental method. A possible explanation of this can be obtained from the wider literature, in which the ADDIE model is a good illustration of the basic steps in the educational process of designing and developing e-learning courses (e.g., Draper-Rodi et al. [60]), but it lacks basic elements that correspond to the specifics of e-learning projects (e.g., Kuciapski [61]). Therefore, its main role is focused on creating more formal and fully developed e-learning project-management models. In addition, the percentage of relevant articles mentioned in the ADDIE model is not negligible for online distance education environments. All the above issues may be related to the greater problem of the imbalance between the demand for e-courses and appropriate pedagogical planning (e.g., Abernathy [8]; Alonso et al. [70]; Khalil nd Elkhider [3]; and Song et al. [16]).

Regarding good practices, our results converge with those of Creasman [21], Smith and Ragan [65], and Zemelman et al. [22]. Given that time management in online learning is important (e.g., Coogle and Floyd [67]), none of the specific researchers examined the principle of effective and efficient learning in terms of the achievement of goals in the shortest possible time, or the teleconferencing and the impact of it on learning and emotional abilities. Additionally, the social media tools (such as Facebook and Twitter) used as educational resources to develop students' social participation in the teaching process were suggested in the examined model (e.g., Trust and Pektas [30]). This is a finding also confirmed by the wider literature (e.g., Dogoriti et al. [71] and Toki and Pange [72]). Moreover, the findings of the present study are consistent with those of Castro and Tumibay [73] in terms of the interactive course content and feedback, but also highlight other good practices, as mentioned above.

All of the above factors are important training strategies and educational resources for distance learning that it is necessary to examine the appropriate methods of their implementation through pilot processes (e.g., Türker [31]). This is necessary as the application of teaching is directly related to the conditions of a spatio-temporal context in which this process occurs, and so can be considered as good or bad teaching practices in advanced online learning environments (e.g., Creasman [21]). Finally, the ADDIE model was valuable as a source of information extraction by providing good teaching practices and enhancing the work of both educational designers and educators (e.g., Alliger et al. [74]; Dong [75]; and Johnson-Barlow and Lehnen [2]).

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