





Applying Motivational Techniques and Gamified Elements on Instructional Design Models for Effective Instruction in Secondary Education

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Abstract. Teachers in secondary education are involved in many instructional design activities without formal training in learning and/or e-learning, particularly on motivational theories. Motivational theories provide a basis of instructional strategies and allow reliable prediction of their effectiveness in various web-based platforms. ARCS, motivational theory and ADDIE instructional design model are used to guide the development of instructional design strategies, in order to achieve efficient learning outcomes and enhance the learning process. From this viewpoint, this paper proposes a conceptual framework, based on the orchestration of the models of ADDIE and ARCS, through the implementation of a project entitled “Voyage in space and time” for an interdisciplinary e-course in Byzantine history and Art/Archaeology, built in the Moodle Cloud. The Moodle platform was customized by a set of various learning strategies provided by the ARCS model. These included gamified elements such as restrict access and activity completion, as well as embedded digital storytelling. The project was evaluated by an experimental group of 22 teachers – scientists from different disciplines – by using a questionnaire developed for the research and based on Keller’s Checklist regarding the ARCS’ acronym categories. The results showed that future students could align to the proposed framework and potentially achieve greater learning outcomes. Therefore, the proposed conceptual framework provides theoretical evidence for the design and delivery of an instructional workflow in secondary education. More specifically, it highlights the actual implementation of motivational theories in the classroom and especially for history courses, as an effective way to enhance students’ motivation.

Keywords: ADDIE model · ARCS motivation theory · Interdisciplinarity · Byzantine history and art/archaeology · Digital storytelling · Moodle · Gamified elements · Secondary education

1 Introduction

E-learning plays a very important role in the current learning paradigm, due to its cost and time effectiveness, as well as the lack of physical presence in the learning space. As

an effect, it is needed to develop well-designed e-learning courses based on pedagogical models and frameworks, appropriately customized for the end users' needs. However, these e-learning demands in combination with the emergence of modern pedagogical approaches challenge instructional designers and e-trainers as for the customization of learning management systems and the integration of the different learning subjects and digital content into them. E-learning professionals are usually oriented to the cognitive side of learning, paying less attention to the affective side. Therefore, they need to use cutting-edge technology into learning methods, customized to each subject but on the other hand, to take into account the audience's affective factors such as motivation, needs, attitudes etc.

Motivation is a mechanism, which influences people to act in a desired way. Motivation theories are very popular nowadays. This implies orchestrating pedagogical theories in an effective way for learning. Consequently, teachers should attract the students' affective factors by using different motivational strategies, techniques and methods such as gamification based on a pedagogical theory, expecting students to become more active in the learning process. On this basis, according to the researchers, the learning motivation is directly related to self-confidence [4], self-efficacy [2, 15], determination [5], personal goals, behaviors and satisfaction [14]. Motivational theories could ground instructional strategies and provide reliable prediction of their effectiveness in various web-based platforms. In order to achieve efficient learning outcomes, ARCS (Attention – Relevance – Confidence – Satisfaction) motivational theory along the lines of ADDIE (Analysis – Design – Development – Implementation – Evaluation) instructional model is used to guide the development of instructional design strategies and to enhance the learning process.

Therefore, the need for well-designed conceptual frameworks emerges to provide the above-mentioned capabilities to all involved, namely e-trainers, instructional designers, e-learning professionals as well as teachers and students. Regarding technology and well-designed e-courses, very promising opportunities to this achievement can be provided by learning management systems such as Moodle. Not only Moodle is very familiar due to its pedagogical philosophy [1], but it also provides a variety of tools which help teachers without any advanced technological background to design instructions. Moodle enables instructors to engage students in the learning process because it provides a set of activities and resources, settings and utilities that could incorporate gamified elements such as forums, quizzes, certifications, badges, restrict access, activity completion etc. [6]. On the other hand, it is a very flexible, user-friendly and easily customized platform, aligned to motivational theories' guidelines.

To this end, this paper serves the current needs. It aims to present a well-designed conceptual framework on Moodle Cloud platform in order to support its educational potential by providing the design and delivery of learning workflow processes. More specifically, the proposed framework encompasses the specific e-learning environment customized by the educational principles of the ADDIE model and the guidelines of the ARCS motivational model. At the same time, it integrates gamified elements putting more emphasis on digital storytelling, in order to provide motivation for interdisciplinary subjects of Byzantine History, Art/Archeology to the students in secondary schools. In other words, this question refers to the educational potential of an instructional design tool when

combined with motivational strategies for an optimum learning process workflow. The rest of the paper is structured as follows: Sect. 2 contains the theoretical background including the three main pillars of 1) ADDIE model, 2) ARCS model and 3) gamified elements and digital storytelling. Section 3 presents the Methodology. Section 4 provides the research results. Finally, Sect. 5 discusses remarks and conclusions.

2 Theoretical Background

This section discusses the theoretical background of the project. It refers to the three pillars of the instructional design and the ADDIE model, the learning process and the ARCS motivational model and the digital storytelling corresponding to gamified techniques. The following paragraphs provide a clear picture.

2.1 The ADDIE Model

ADDIE (Analysis – Design – Development – Implementation – Evaluation) is a design model widely used for instructional design, in order to create technology-based e-learning courses [3, 11]. ADDIE was implemented by professional instructional designer to create a base, on which e-learning programs could take shape. There are, also, some other versions of ADDIE, such as “PADDIE” (Planning, Analysis, Design, Development, Implementation, Evaluation), where planning and/or preparation are added in the initial stage. The model is usually applied on projects, because it is convenient for complex teaching designs. The five phases of ADDIE model are as follows:

1. Analyze. The Analysis phase can be characterized as the “Goal-Setting Stage.” In this phase, the focus of the designer should be put on the target audience. Depending on the trainees, the lesson will be adjusted accordingly. The trainer has to research learning resources and determine delivery and assessment strategies. They also have to identify learning space and devices, taking into consideration the learners’ profiles.

2. Design. This phase determines setting goals, designing, planning, testing, tools to be used for performance, subject matter analysis, planning and resources. In the design phase, the focus is on exploring technology options, learning objectives, content, subject matter analysis, exercise, lesson planning, assessment instruments used and media selection.

3. Develop. The Development phase starts with the production and testing of the methodology being used in the project. In this stage, designers conduct testing, ensure security and backup, confirm copyright and accessibility. The development stage is nothing else but the realization of the desired project. This phase includes three tasks, namely drafting, production and evaluation.

4. Implement. The implementation phase reflects the tools which the e-teacher will use to achieve the maximum efficiency and desirable results. Updates and redesign help to the best implementation of each project. Feedback will help further for the improvement and understanding of the best tools in each situation.

5. Evaluate. The last phase of the ADDIE model is Evaluation. This is the phase where answers are being given regarding the “what, how, why, when” of the targets that were accomplished (or not) during the project execution. The main goal of the evaluation stage is to assess if the goals have been achieved; and to establish what will be required to enhance the efficacy and improve the results.

2.2 The ARCS Motivational Model

The use of ARCS (Attention – Relevance – Confidence – Satisfaction) motivation theory is a technique widely used in e-learning, as evidenced by other dissertations dealing with Keller’s theory and its application to e-learning. According to the ARCS model, learners will be motivated when they feel that they can be successful and worth learning [7]. Clearly, an e-learning environment enables instructors to enrich their lessons with various tools, in this case the moodle tools. Thus, students will be satisfied with the lesson and the chances of succeeding will be much higher. According to Nilson [12], the teacher must stimulate students’ imagination, enchant them to acquire knowledge, so as to challenge and invite them into the learning process.

More specifically, Keller [7] developed the ARCS model, which is a four-category training strategy designed to measure the levels of motivation offered to the individual, described briefly as follows:

Attention: This is a strategy designed to focus students’ attention and stimulate their curiosity through Perceptual Arousal using real-world examples, Inquiry Arousal which can take place with the active participation of students in games or through student questions and Variability which can be ensured through a variety of tools such as video, quiz, educational games, forums etc.

Relevance: this factor relates to the extent to which the teaching responds to the learner’s needs and goals. The subcategories that can be divided into this category are goal orientation, motive matching, and familiarity, which can be built either on past experience or for improvement of students’ life.

Confidence: Confidence relates to students’ confidence and attitude to success or failure, which can determine students’ performance.

Satisfaction: The last factor is student satisfaction, which can be defined as positive feelings about students’ learning experiences, in order to maintain motivation at a fair level.

2.3 Gamified Elements and Digital Storytelling

Motivation is inseparably linked to the terms of “Gamification Elements” or “Gamified Elements” because e-courses developed with respect to this approach, consist of gamified practices [17]. These practices in turn are combined with motivational theories and often are evaluated through motivational factors [16]. Certainly, motivation could be enhanced

by incorporating strategies that provide stimuli for interaction between the teacher and the students. Gamification here provides the necessary stimuli. According to Werbach et al. [18] gamified elements are classified into a pyramid of three layers. The first layer at the bottom includes the game components such as badges, points, levels, and quests. The second middle layer includes the mechanisms such as collaboration, discovery, and feedback. The third and most important at the top refers to the dynamics such as emotions, progress, narration, and relationships as well.

From this perspective, narration becomes an integral part of a gamified e-course. Narration is related to a hypothetical scenario, a fictional story, often intended to be a breakthrough in solving a learning problem. Narration provides guidance all over the learning process because it maintains the sequence of the learning task and the interaction with the e-learner. As such, narration could be characterized as an educational strategy formally known as storytelling or digital storytelling when digital media is exploited. According to Lambert [9] the seven following features formulate storytelling:

1. The perspective: What is the main point of the story and what is the perspective of the author?
2. The Scientific Question: A key question that holds the viewer's attention and will be answered at the end of the story.
3. Emotional Content: Serious issues that come alive in a personal and dynamic way and connect the audience with history.
4. Voice Charisma: It's a way to personalize the story and help the public understand the context.
5. The Power of Music: Music or other sounds that support and decorate history.
6. Frugality: Using just enough content to tell the story without tiring the learner out.
7. Pacing: The pace of story and how slowly or rapidly it evolves [11].

Consequently, digital storytelling has many positive effects on learning [13] and is an innovative teaching method that enhances learning skills, stimulates students' interest, and humanizes teaching. In addition, such techniques can be combined and applied to serious games in order to enhance entrepreneurship in educational settings for emerging economies [10].

3 Methodology

This article aims to present a well-designed conceptual framework on Moodle Cloud platform in order to support its (the framework) educational potential by providing design and delivery of the learning workflow processes. More specifically, the proposed framework encompasses the specific e-learning environment customized by the educational principles of the ADDIE model, in which the guidelines of the ARCS motivational model are implemented. The motivations for the ARCS theory implementation are being given via gamified elements and digital storytelling, in order to provide motivation for interdisciplinary subjects of Byzantine History, Art/Archeology to the students in secondary schools. In accordance with the research aim, the research question is articulated as follows:

RQ1. What is the educational potential of an instructional design (macro scenario) based on ADDIE phases and the learning process of ARCS model (workflow) and its categories on the Moodle platform?

In order to give answers to the above research question, a project titled “Voyage in space and time” was constructed, founded on the proposed conceptual framework (Fig. 1). The ADDIE model was exploited in order for the macro-script to be designed. Each phase of the model as well as the subsequent steps are described below.

Analyze: In this phase, the teaching problem was initially clarified. Specifically, in Greek current learning paradigm, students often are not able to understand that there is a connection between historical events and art achievements; and how this connection is established; because this connection is not sufficiently distinguished in the curriculum. Thus, the educational goal was the investigation of that issue by the students through a variety of educational activities. For this purpose, Moodle Cloud was used as the hosting environment of the project. Vyond and Voki were used as video-making tools for the storytelling-gamification elements, embedded in the Moodle Cloud project.

Design: In this phase, a four-step micro-script was designed. This procedure included mainly the goals setting, the provision of supporting material, the number, the content and the sequence of the educational activities referring to the learning goals, as well as the selection and description of the assessment tools. In addition, roles and means were defined systematically and in detail. This means that in this phase, ARCS learning process workflow was enriched with gamified elements, giving greater emphasis on the narration, namely the digital storytelling. The following table (Table 1) presents a matching between ARCS (Categories and Strategies) and gamified elements, corresponding storytelling features and digital tools, as they are indicated by literature and are instrumented appropriately into the conceptual framework.

Development: In this phase, the educational scenario was constructed. It encompassed seven stages – four stops among them related to History, Art, Museology and Present, (Fig. 2). For each stage, a Moodle topic was formulated and covered by a set of activities and resources. Digital Storytelling was implemented mainly through educational videos. According to the educational scenario, four imaginary friends, Orfeas, Alexander, Ismini and Faidra – the heroes of the story – decided to go to Alexander’s home library to study for the next day’s history test regarding Byzantium. In this library, they discovered a time machine. Ismini accidentally pressed a button and the heroes got lost in another dimension, another time and place. Suddenly Alexander’s grandfather, Nestoras appeared and informed them that if they passed a set of challenges and quests, so as to unlock the time machine at a given historical period, they would go back to the present. Taking this proposal as a chance for succeeding in the history course test, they traveled back to Byzantium. Students, therefore, had to accomplish the assigned activities in order to help the heroes of the story unlock the time machine and return to the present. In Fig. 1, the educational scenario is imprinted, indicating the micro-script for the first stop, where Orfeas is involved in history subjects.

Implementation: In this phase, the whole e-course was implemented in the Moodle Cloud. It is clear from the figures (Fig. 1, Fig. 2) how a workflow process of ARCS

Table 1. Design phase, learning process workflow

Micro-script design	*ARCS categories & strategies [7]			Gamified elements [18]			Digital storytelling features [9]	Digital means	
	A	R	C	S	Components	Mechanics			Dynamics
1. Goals setting	A1	R1	C3	S1			Narration (Storytelling) Emotions	<ul style="list-style-type: none"> - The perspective - Emotional content - Voice - Music - Frugality 	<ul style="list-style-type: none"> • Voiki • Vyond
	A2	R2							
	A3	R3							
	A1	R1	C1	S2		Challenges		The scientific question	
	A2	R2	C2	S3					
	A3	R3	C3						
2. Supporting material							Progress	- Pacing	
	A1	R1	C3	S1	Content unlocking		Constraints progress		<ul style="list-style-type: none"> • Moodle Cloud/ - Restrict access - Activity completion - Pages/URLs - Blocks
	A2	R2		S2					
3. Educational activities	A1	R1	C1	S2	Quests content unlocking	Points feedback cooperation	Constraints progress emotions		<ul style="list-style-type: none"> • Moodle Cloud/ - Restrict access - Activity completion - Assignments - Wikis
	A2	R2	C2	S3					
	A3	R3	C3						

(continued)

Table 1. (continued)

Micro-script design	*ARCS categories & strategies [7]			Gamified elements [18]			Digital storytelling features [9]	Digital means	
	A	R	C	S	Components	Mechanics			Dynamics
4. Assessment	A3	R1 R2 R3	C1 C2	S1 S2 S3	Achievements content unlocking	Feedback rewards collections	Constraints progress narration (storytelling) emotions	- Emotional content - Voice - Music - Frugality	<ul style="list-style-type: none"> • Vyond • Moodle Cloud/ - Restrict access - Activity completion - Rubrics/grades - Locked lesson - Quiz
*A – Attention (A1) - Perceptual Arousal (A2) - Inquiry Arousal (A3) – Variability					R – Relevance (R1) - Goal Orientation (R2) - Motive Matching (R3) - Familiarity	C – Confidence (C1) – Learning Requirements (C2) – Success Opportunities (C3) – Personal Responsibilities	S – Satisfaction (S1) – Intrinsic Reinforcements (S2) – Extrinsic Reinforcements (S3) – Equity		

model is accomplished by a set of activities enriched by motivational strategies and gamified element techniques. Each topic/section of the moodle e-course was identical to a stop in the imaginative journey in time. There were four stops on the journey, which means four moodle topics. Each topic ends with a number which was given to students as a praise for their achievement. The four numbers constructed a four-digit code which was able to unlock the time machine.

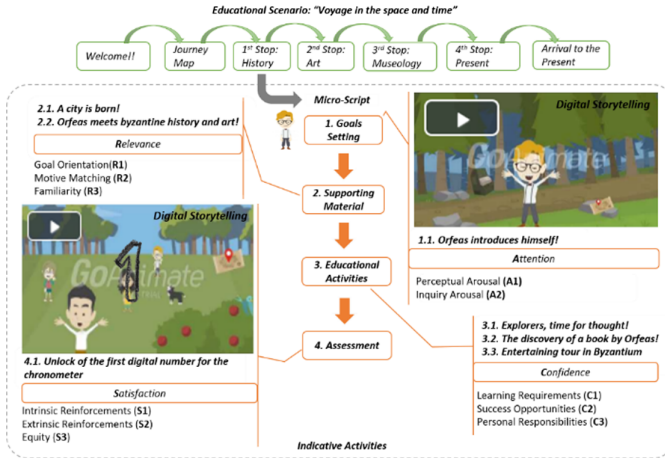


Fig. 2. The educational scenario, the micro-script and indicative activities

In particular, the previous figure clearly presents the embedded storytelling videos. Undoubtedly, these could capture students’ attention and maintain their interest in high level. While attention is stimulated through imaginative stories, the digitization of the story accelerates students’ cognitive comprehension. On the other hand, students identify with the heroes of the story as each hero presents him/herself by giving information about his/her personal characteristics (i.e. personality, behavior etc.). This means that apart from attention, relevance and motive matching are applied too. In addition, students could gain confidence and satisfaction (Confidence-Satisfaction) through the accomplishment of the educational activities.

Evaluation: In this final phase, the project was evaluated by the participants. The current study was based on a quasi-experimental research design method. The participants, namely the sample of the study consisting of 22 teachers from different disciplines filled in a questionnaire of 25 questions to specifically address the purposes of the research study. The data yielded provide results about the extent to which electronic material (content - strategies) enhance students’ motivation regarding the categories of Attention, Relevance, Confidence and Satisfaction. The questionnaire was based on the Motivational Tactics Checklist questionnaire proposed by Keller [8], which is a Likert-type Questionnaire (1 = “Yes”, 2 = “Maybe” and 3 = “No”).

4 Research Findings

The questionnaire that was constructed for the research needs consisted of 5 groups, introductory questions such as field of study, working experience, gender. The questions in group B of the questionnaire examined the factor of Attention of the ARCS model. Questions in group C examined the Relevance component. Accordingly, the questionnaire group "D" examined the Confidence component. Finally, the Satisfaction component was examined in group "E". In order to determine whether teachers considered the motivation of the learners to be components of the ARCS model, statistical tests, using the one-sample t-test, were performed. The questions from group B to group E were based on the Keller's questionnaire, Motivational Tactics Checklist [8].

For the questions from B group to E group, the respondent could choose from 3 answers (No = 1 point, Maybe = 2 points, Yes = 3 points). Each group of questions consisted of 6 questions per average. So, in case the respondent evaluated inefficiency of motives' giving and answered No = 1 to all the 6 questions of a group, the minimum score would be 6, otherwise in case the respondent estimated that the project was giving motives and answered Yes = 3 points, the maximum score would be 18. In case of uncertainty in the efficiency – Maybe = 2 the base is 12.

Table 2. One-Sample T-Test for B = Attention, C = Relevance, D = Confidence, E = Satisfaction, Test Value = 12

Questions	Factors	N	Mean	Std. deviation	T	df	Sig. (2-tailed)	95% Confidence interval of the difference	
								Lower	Upper
Group B	Attention	22	15,7273	1,51757	11,520	21	,000	3,0544	4,4001
Group C	Relevance	22	15,0000	1,90238	7,397	21	,000	2,1565	3,8435
Group D	Confidence	22	14,7273	1,48586	8,609	21	,000	2,0685	3,3861
Group E	Satisfaction	22	15,5909	1,89383	8,894	21	,000	2,7512	4,4306

The one-sample t-test results (Table 2), showed that the average of teachers' scores in all components was statistically significantly higher than the basis 12, as shown in 8th column: sig (2 – tailed) = 0,000 < 0,001.

The results were rather positively oriented and encouraging towards the current project. However, the limitations of the research are that the sample was small (only 22 respondents), and that the project was not implemented on students.

It would be interesting to proceed with further research on this field, so as to evaluate the efficiency of such learning strategies, on a wider sample consisting not only of trainers, but also of learners. This would ensure a higher level of accuracy and acceptance of these methods.

5 Conclusion

This study was situated in the practice of secondary-level programs. The first part of this study was a thorough review of the applied theories on e-learning education literature focusing on issues of scenario-based methods. From this review, a conceptual framework was created and tested for further application into educational practices in order to be generated in the future. The conceptual framework included five phases as core elements of ADDIE instructional design model in which the four categories of ARCS motivational model were used in order to support learning processing for different disciplines-educational experience. (Fig. 1). Gamification was the way of implementing the ARCS theory, by giving motives to the learners. Finally, indicators corresponding to the categories were proposed to generate the conceptual framework. This constitutes a proposition because well-designed frameworks could be exploited as templates to apply instructional design models (ADDIE) into learning theories, emphasizing on the process of learning (ARCS), intending to guide learning context into every-day e-learning practices.

In particular, the proposed framework will be used in future applied research of interdisciplinary approaches in secondary education. The initial finding of this study is that scenario-based frameworks appear to have considerable potential in enhancing cognitive and affective factors of learning. However, much work remains to be done in the field of designing and delivering these frameworks to every-day practice. Progress in this area will depend upon further testing in different educational approaches with detailed strategies in facilitating students' motivation.

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