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Using the Addie Model to Produce MOOCs

Experiences from the Oberred Project

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MOOCs have been produced using a variety of instructional design approaches and frameworks. This paper presents experiences from the instructional approach based on the ADDIE model applied to designing and producing MOOCs in the Erasmus+ strategic partnership on Open Badge Ecosystem for Research Data Management (OBERRED). Specifically, this paper describes the case study of the production of the MOOC "Open Badges for Open Science", delivered on the European MOOC platform EMMA. The key goal of this MOOC is to help learners develop a capacity to use Open Badges in the field of Research Data Management (RDM). To produce the MOOC, the ADDIE model was applied as a generic instructional design model and a systematic approach to the design and development following the five design phases: Analysis, Design, Development, Implementation, Evaluation. This paper outlines the MOOC production including methods, templates and tools used in this process including the interactive micro-content created with H5P in form of Open Educational Resources and digital credentials created with Open Badges and issued to MOOC participants upon successful completion of MOOC levels. The paper also outlines the results from qualitative evaluation, which applied the cognitive walkthrough methodology to elicit user requirements. The paper ends with conclusions about pros and cons of using the ADDIE model in MOOC production and formulates recommendations for further work in this area.

1 Introduction

MOOCs have been produced using a variety of instructional design approaches and frameworks. Oftentimes approaches and frameworks have been selected to support specific design objectives such as scalability, openness, adaptability and engagement. MOOC designs focusing on enhancing the openness including cultural and linguistic diversity and inclusion of the participants have applied a range

of strategies and approaches such as Supported Open Learning (SOL) and Universal Design for Learning (UDL) [11, 1, 9]. The production of adaptive MOOCs has been informed by design frameworks rooted in Design Based Research (DBR) [14] and the four-dimensional learning (4DL) model [20]. MOOC productions focusing on enhancing engagement have applied such as approaches as the flipped MOOC and different gamification approaches [12, 16, 6]. Some designers have applied format-oriented approaches such as micro-learning with micro-content and micro-credentials [8], while some have applied process-oriented approaches based on development cycles, such as production phases including course design, preproduction, production, post-production, validation [17], and multi-step models [24].

However, the ADDIE model by Branson, Rayner, Cox, Furman, King, and Hannum [5] stands out as one of the most popular instructional design models. A quick search on Google Scholar using the keywords MOOC and ADDIE generates about 1,270 results, compared to 605 for UDL and 363 for DBR. The ADDIE model is a generic instructional model and a systematic approach to the design and development of training [2]. The ADDIE model divides the process of instructional design into five stages, i.e. analysis, design, development, implementation and evaluation, and can be applied in an interactive manner. ADDIE has been applied worldwide in a number of MOOC productions including vocational training in Malaysia [15] and English for academic purposes MOOCs for undergraduate students in the United Arab Emirates [3]. The ADDIE model has been also combined with other methods such as System Thinking [10] and Universal Design for Learning [22]. It has also informed approaches to MOOC design focused on quality assurance, such as the Quality Reference Framework (QRF) divided into Analysis, Design, Implementation, Realization and Evaluation [21]. The reminder of this paper is structured as follows: section 2 provides an overview of the case study of MOOC design in the OBERRED project based on the ADDIE model. This section is structured into five subsections corresponding to the five phases of the ADDIE model, providing information about the application of the model at each stage.

2 Case Study

This section describes practical experiences in applying the ADDIE model as a generic instructional design approach to produce MOOCs in the OBERRED[1] project. The OBERRED project is founded under the Erasmus+ program on cooperation for innovation and the exchange of good practices in higher education, and is dedicated to designing an Open Badge ecosystem for the recognition of skills in the field of research data management. The key part of this endeavour

is to design and deliver a series of online training programs in the form of Massive Open Online Courses (MOOCs). The first MOOC "Open Badges for Open Science" in this series focuses on understanding Open Badges in the context of Open Science. The objective of this introductory MOOC is to prepare the participants for the use of Open Badges in their work with relevant stakeholders in RDM, for example to design Open Badges in order to recognize skills related to RDM. Following this first MOOC, the two further MOOCs developed in the OBERRED project are "Managing & Sharing Research Data" and "Facilitating the Open Badge Ecosystem". All MOOCs are delivered on the European MOOCs platform EMMA: https://platform.europeanmoocs.eu. All three MOOCs produced in the OBERRED project are designed following the iterative approach of the ADDIE model. The design of the MOOC "Open Badges for Open Research" has been created in a number of iterative stages following the overall framework of the ADDIE model. The process has been documented in a living document in Google Docs, which has been collaboratively edited by the MOOC production team and updated during iterations. This multi-stage process is described below.

2.1 Analysis

The first stage of the ADDIE process focuses on a comprehensive analysis and aims to clarify instructional problems and objectives as well as to establish some groundwork related to the learning outcomes and the learning environment. At this firs stage, the project team conducted an extensive analysis of relevant issues such as (1) the context of the MOOC (including the conceptual links between all three MOOCs and partners involved in the design and production), (2) requirements for the MOOC design and delivery (including content-related and technical requirements), (3) target groups and their characteristics (including a list of relevant target groups and their characteristics in relation to different roles and responsibilities in RDMt), (4) learning outcomes (including their allocation to the levels of the MOOC), (5) required resources (including learning resources, human resources and technical resources), (6) course delivery (including the delivery model, language policy, copyrights policy, assessment policy, micro-credentialing policy), (7) timeline for project completion (including the set-up of the Trello board, the Gantt chart and a table with the description of each milestone).

In this way, the analysis part laid the foundation for the production of the MOOC. The key part of the analysis was the definition of the learning outcomes. The learning outcomes were described following the Competency-Based Design Approach (CBDA) applied to the MOOC design [23]. The MOOC was structured into three levels: (A) Foundations Level, (B) Technology Level, and (C) Application Level. Each level has a specific set of learning outcomes and includes different

forms of an e-assessment of learning outcomes. Additionally, the analysis part outlines the micro-credentialing policy, which specifies that participants have to pass e-assessments at each level in order to obtain a micro-credential (Open Badge) for this level. One of the requirements is that the learning environment/system should allow to automatically issue and notify the participant about the issuing of the micro-credential.

2.2 Design

The design stage in the ADDIE model outlines the instructional design in more detail. The ADDIE model recommends to define the design elements in a systematic and specific way, by applying logical methods for identifying and developing strategies, which can help attain the project's goals [2]. The design stage in the production of the first MOOC in the OBERRED project dealt in more detail with learning outcomes, e-assessment and micro-credentialing and defines the learning activities, content and media in a systematic and specific way. The instructional design principles of micro-learning and micro-content specified at this stage, draw on the guidelines on designing micro-learning as a strategy for ongoing professional development by Buchem and Hamelmann [7] and the MOOC design principles recommended by Guàrdia, Maina, and Sangrà [13], as well as principles laid out by the MOOCs platform EMMA.

The key design principles for the MOOC design described in the design stage were: (a) a competence-based design approach, with focus on the learning outcomes, (b) learner empowerment, with focus on learners as active participants, and (c) collaborative learning with focus on adding value through social networking and peer-feedback. The design stage included the learning plan and a schedule with assignments, milestones and deadlines for clear orientation in each part of the course and also outlined the MOOC structure, which results from the break-down into the three levels and micro-learning units. In order to specify content for each micro-learning unit, the storyboarding technique was applied, and a storyboard created for each learning outcome. Each storyboard specifies learning content, format, media, materials and specific instructional methods such as expository learning and discovery learning. Furthermore, the SOLO Taxonomy by Biggs and Collis [4] was used to map verbs in learning outcomes statements to the levels of learning and to assessment criteria. The design stage includes the specification of the digital micro-credentials and the specification of open licenses for the MOOC content.

2.3 Development

The development stage in the ADDIE model is dedicated to the creation of the content assets specified in the design phase. This stage described the process for creating the MOOC in the EMMA platform and the steps and methods for the production of course materials. The production of course materials included the reuse of selected Open Educational Resources (OERs) and the use of the H5P tool for the production of new MOOC content. The H5P tool was used to create the interactive micro-content for the MOOC in the form of OERs, with each OER published under a Creative Commons Licence. H5P is a free and open-source authoring tool based on JavaScript, which enables to produce interactive content in form of reusable HTML5 packages. The development stage also specifies how reviews are carried out following the iterative approach to the MOOC design. After production of each version of the MOOC, peer-reviews and user-tests are conducted and results are used as feedback and input in the next design iterations. The iterative approach with frequent reviews and tests helps to remove weak spots in the design (e.g. when a design element was omitted) and resolve inconsistencies (e.g. logical links between levels) early in the production process.

2.4 Implementation

The implementation stage describes the procedure for delivering the MOOC in the Europan MOOC platform EMMA with focus on the facilitation of learners and the preparation of the facilitators. The key tasks of the facilitators are listed in the implementation part of the MOOC concept and are based on the model with five stages of online moderation by Gill Salmon: access and motivation, online socialisation, information exchange, knowledge construction and development [19]. To ensure access and motivation, each level of the MOOC (called “lesson” in the EMMA platform) is introduced with a kick-off zoom session with all participants. The kick-off session are meant to provide essential information to the participants, e.g. about the content of each unit, duration, assignments and micro-credentials, and at the same time to initialise the online socialisation which is carried out throughout the MOOC and is supported by the technical tools in the EMMA platform such as discussion forums and personal blogs of the participants. The information exchange, knowledge construction and development are supported by a range of diverse learning activities.

2.5 Evaluation

Finally, the evaluation stage in the ADDIE model defines the methods of formative and summative evaluation. The evaluation stages defines the objectives of the evaluation, items, scales and tools. The formative evaluation in our case study was present at each stage of the MOOC production process and included peer reviews, user tests and cognitive walkthroughs [18]. We conducted altogether three cognitive walkthroughs with three different prototypical learners, who were specifically selected for the study. The aim of the cognitive walkthroughs was to assess the level of comprehension, the ease of use and the usability of the MOOC prototypes developed at different stages in the design and development stages of the ADDIE model, i.e. before the implementation in the first pilot. We asked the three prototypical learners to complete a sequence of learning activities and verbally describe their experience, focusing on how easy or difficult it was to understand and use different learning elements including course and lesson information, interactive H5P content, assignments and tasks. The results were protocolled and change requests documented in a change-log table, which then served as a backlog for the next design and/or development iterations. The summative evaluation encompassed the post-MOOC survey and the use of learning analytics using log data recorded by the EMMA platform. For the purpose of formative-summative evaluation, detailed user surveys were conducted after the completion of each MOOC level (lesson), which helped us to collect the data about participants' perception of the MOOC usability and the overall user experience. The user surveys for each MOOC level also include items related to specific MOOC components, such as OERs, assignments and Open Badges, which are evaluated by the participants after the completion of each level. This feedback is used for improvement of the MOOC design.

3 Discussion and Conclusions

Our experiences from the case study about the application of the ADDIE model to the production of the MOOCs as outlined in this paper show that the ADDIE model offers a comprehensive yet flexible approach, which can be combined with many other instructional approaches and models. For example, in our case study we could easily combine the ADDIE model with further instructional design approaches such as Competency-Based Design Approach (CBDA), expository learning and discovery learning. In this way we could apply different models to design different levels of the MOOC. While the ADDIE model was applied at the macro-level of design of the entire MOOC, further instructional design methods such as competency-based learning were applied to the meso-design of the MOOC

levels, with each level design being guided by the set of pre-defined learning outcomes. Furthermore, more specialised approaches such as expository and discovery learning were applied the micro-level of design of single learning units.

We can summarise our experiences and lessons learned from applying the ADDIE model to the MOOC production as pros and cons. The pros include: (1) ADDIE is a comprehensive and flexible approach and can be combined with diverse didactic approaches and instructional design models; (2) ADDIE is universal and covers all essential phases of the MOOC production process; (3) ADDIE can be subdivided and extended into further sub-steps according the project goals and requirements; (4) ADDIE offers a structured and manageable approach which can be used in larger and smaller MOOC design projects; (5) while ADDIE resembles a linear, waterfall model at the first sight, it can be also applied as an iterative, cyclic model with iteration cycles repeating ADDIE phases to attain expected results as shown in our case study using cognitive walkthroughs and the change-log table to document change requests; (6) the comprehensive analysis at the beginning of the design process allows MOOC developers to validate their assumptions as early as possible in the design process, which helps to ensure quality and make efficient use of available resources; (7) the inclusion of formative evaluation serves as a reminder to the design team to gather feedback from users at different stages of design, development and implementation. The cons include: (1) ADDIE is too general and does not provide detailed guidelines and steps for instructional designers to follow as each stage, so it becomes necessary to supplement this model with further, more specific design approaches; (2) the separation of the design and the development phases in the ADDIE model is not clearly described and in practice both phases are closely interwoven; (3) ADDIE model does not provide any reference to pedagogical approaches.

Based on our experiences in the application of the ADDIE model to the production of the MOOC "Open Badges for Open Science" in the OBERRED project, we can state that the ADDIE model proves to be a flexible, generic framework which covers all main stages of the MOOC production process. It can be easily applied as a meta-design framework to the design of any MOOC as well as extended and subdivided into further substages depending on the project objectives and requirements. Because of the generic nature of this model, in which no specific didactic and/or quality-related principles are recommended to instructional designers, it is necessary, from our point of view, to augment and enrich the ADDIE model with more specific didactic and instructional design approaches to arrive at a sound design of a MOOC.

In order to quantify the impact of our experiences, we have conducted the first evaluation study after the first pilot run of the MOOC and will present the results in subsequent publications. At this point it must suffice to say that our

experiences and observations are in line with similar work reported by [2, 15, 3, 10, 22], mentioned at the beginning of this paper.

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