Chapter 3
Educational Design for MOOCs: Design Considerations for Technology-Supported Learning at Large Scale

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3.1 Introduction

Massive open online courses (MOOCs) have emerged in the public discourse on potential transition to education using digital technologies (Yuan and Powell 2013; Siemens 2013). Two major MOOC strands have been concretely identified, namely the cMOOC and the xMOOC (Terras and Ramsay 2015). The former strand adopts a learner-oriented approach aiming to actively engage learners toward the formulation of collective knowledge and artifacts through their active participation to the particular xMOOCs community (Kop 2011). The latter, which in practice is the dominant strand, adopts a more traditional teacher-centered approach relying on a centrally designed course from a subject domain expert (Ferguson and Clow 2015).

Despite the considerable differences between cMOOCs and xMOOCs, still MOOCs are considered by many as an extension of existing online courses, introducing the "Massiveness" and "Openness" dimensions (Alario-Hoyos et al. 2014; Ferguson and Sharples 2014). These additional dimensions reasonably introduce new requirements on their educational design. Thus, the educational design of MMOCs is an important issue to study further, especially since certain

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shortcomings have been attributed to poor educational design of MOOCs, such as the significantly high participant drop-out rates, (Guàrdia et al. 2013; Daradoumis et al. 2013), limited learner motivation (Zheng et al. 2015) and learner engagement (Hew 2015), and the overall poor instructional quality (Cooper and Sahami 2013; Yuan and Powell 2013; Margaryan et al. 2015). Within this context, this chapter presents an ADDIE-based educational design considerations framework (EDCF) for xMOOCs, which aim to accommodate the specific characteristics of the "Massiveness" and "Openness" in xMOOCs.

The remainder of this chapter is structured as follows. Section 3.2 presents background information on MOOCs, as well as an analysis of their "Massiveness" and "Openness" dimensions. This analysis will highlight specific characteristics that can affect the educational design process. Section 3.3 discusses existing educational design frameworks and/or guidelines for MOOCs. The existing works are benchmarked against the identified characteristics of the "Massiveness" and "Openness" dimensions and shortcomings are identified. Section 3.4 proposes an xMOOC EDCF based on the ADDIE Model. Section 3.5 discusses the conclusions of the chapter and suggests future work.

3.2 Massive Open Online Courses

3.2.1 Overview

MOOCs have been receiving a significant level of research attention and, as a result, a range of approaches for classifying them has been recently proposed (e.g., Clark 2013; Conole 2014). Two major MOOC strands have been concretely identified, namely the cMOOC and the xMOOC (Terras and Ramsay 2015). These two strands are described, as follows:

- **cMOOCs**. Typically, cMOOCs adopt a learner-oriented approach aiming to actively engage learners toward the formulation of collective knowledge and artifacts through their active participation to the particular xMOOCs community (Kop 2011). cMOOCs can be delivered through a wide range of distributed services connecting the participants and fostering multiple means of knowledge creation (Rodriguez 2012).
- **xMOOCs**. Typically, xMOOCs adopt a more traditional teacher-centered approach relying on a centrally designed course from a subject domain expert (Rubens et al. 2014; Hew and Cheung 2014). xMOOCs are usually delivered through a single infrastructure which hosts all the required educational resources, tools, and services, as well as the interactions and communication channels (Rodriguez 2012).

Even though the initial MOOCs were explicitly cMOOCs, the current reality is that xMOOCs have become the dominant MOOC type, typically designed and delivered by elite world universities (Stewart 2013; Ebben and Murphy 2014).

In this book chapter, we focus on xMOOC, given that it is the most widely deployed type of MOOC for "transforming" existing (online, blended or face–to–face) courses to a massive and online delivery (Daniel 2012; Kay et al. 2013).

The following subsections discuss the two core MOOC dimensions, namely "Massiveness" and "Openness," from an xMOOC perspective. This analysis aims to identify specific educational design consideration categories for each dimension which can then be used to evaluate existing works on the educational design of xMOOCs.

3.2.2 Massiveness Dimension

Massiveness mainly refers to the capacity of xMOOCs to deliver learning experiences at a large-scale transcending the coverage barriers of existing online and blended approaches (Stewart 2013; Terras and Ramsay 2015). Massiveness is commonly linked to the overarching fact that xMOOCs usually attract a considerable number of participants (Kop 2011; Daniel 2012; Conole 2014). More specifically, the level of participation can range from as little as 150 participants (Dunbar's number) which is usually considered to be the threshold for a course to be considered as massive (Downes 2013; cited in Koutropoulos and Zaharias 2015), to as many as a few thousand participants (Ho et al. 2015). Therefore, the delivery of xMOOCs at a large scale (compared to small-scale online courses) can influence the choices that the instructional designer makes in terms of the educational design of xMOOCs.

More specifically, the main aspects of xMOOC's educational design that are directly affected by the massiveness dimension include:

- **Learner analysis**. Given the fact that the participants are not known a priori to the instructional designer, their educational design is very difficult to be based on a solid analysis of their background competences, preferences, and needs. This limitation is even more important considering the usual diversity of the participants in terms of culture, competences, and initial motivation (Ho et al. 2015).
- **Teaching strategy and assessment method**. Considering the large size of the participant group, the instructional designer is often required to exclude specific teaching strategies and assessment methods, due to the anticipated effort in order to handle their delivery. As a result, the vast majority of xMOOCs employing teaching strategies and assessment methods that can be automated to a large degree, namely distribution of digital video-based resources and automatic quizzes (Yousef et al. 2014a). This is a significant shortcoming, however, since it can hinder the overall educational quality of the course (Margaryan et al. 2015). Recent attempts to alleviate this "behaviorist" approach to xMOOC educational design argue in favor of incorporating collaborative learning and assessment activities aimed at artifact formulation and social interaction, thus incorporating aspects of cMOOCs (Purser et al. 2013).

- **Selection and/or Development of educational resources**. As the participants are not known a priori to the instructional designer the selection and/or development of educational resources is typically performed from a "generic" standpoint, i.e., cultural issues of the participants are usually not considered (Nkuyubwatsi 2014). Furthermore, extending the second aspect of the educational design, the selected educational resources are usually disseminated by the instructor, with very limited contribution from the participants, in the formulation of collective knowledge (Rubens et al. 2014).
- **Participant performance monitoring and feedback provision**. Monitoring the progress of individual xMOOC participants and provide individual feedback by tutors is almost impossible considering their vast numbers and diversity of participants. Thus, the instructor should rely on automated analytics mechanisms to monitor the performance of the participants (deBoer et al. 2014). More specifically, such mechanisms can facilitate the instructor to have a granulated overview of a wide range of participants' performance indicators, including among others their forum activity (Kizilcec et al. 2013) and their video viewing and assignment submission patterns (Coffrin et al. 2014).

In order to address the aforementioned issues, first the concept of "Massiveness" should be analyzed in a set of strands, i.e., elements that are directly affected (or caused) by the aforementioned vast number of participants in xMOOCs. Each of these strands can impact the educational design (and delivery) of xMOOCs, and therefore need to be taken explicitly into account when initially designing such courses. Two of the most commonly reported "Massiveness" strands are the participant *cultural diversity* and the participant *motivation*.

These two strands are analyzed as follows:

- **Participant cultural diversity**. The term "culture" in educational design is difficult to pinpoint and it is sometimes reduced to mere generic "national differences" between people (Hofstede 1986; Maitland and Bauer 2001). However, for the purpose of this chapter, Powell's definition of "culture" is adopted: "the sum total of ways of living, including values, beliefs, aesthetic standards, linguistic expression, patterns of thinking, behavioral norms, and styles of communication, which a group of people has developed" (Powell 1997). As the definition implies, culture is not merely defined and restricted within national contexts, but, instead relates to a diverse set of "attributes" that groups of people can possess and which influence their everyday practices, including the manner in which they engage in the learning process. Therefore, the diverse cultural aspects which each participant can possess within a MOOC can greatly affect the way of engagement and interaction with the learning environment (online, blended or face–to–face) (Bentley et al. 2005; Edmundson 2007).

  From this perspective, accommodating learner cultural diversity has been proposed as an important area of research in the overall educational design field (Thomas et al. 2002; Rogers et al. 2007), as well as the specific context of MOOCs (Liyanagunawardena et al. 2013b; Literat 2015). More specifically, the

fact that xMOOCs are designed without the capacity to effectively analyze and profile the participants a priori (Macleod et al. 2015), designing such culture-aware courses is an even more difficult task. Therefore, it is increasingly being argued that xMOOC educational designs should inherently incorporate cultural design considerations in order to enhance the quality of participants' engagement (Tapanes et al. 2009; Parrish and Linder-Van Berschot 2010).

Initial works to alleviate this issue include Marrone et al. (2013) and Nkuyubwatsi (2014), who explicitly addressed the need for providing culturally aware MOOC experiences. More specifically, Marrone et al. (2013) presented a small-scale evaluation of a sample of eight MOOCs against a set of preliminary criteria aiming to depict cultural aspects of the design of these MOOCs. Nkuyubwatsi (2014) performed a qualitative evaluation of a set of five MOOCs based on a self-created cultural translation instrument and utilized their findings to support their argument on the need to provide cultural "translations" in MOOCs, namely to make them more relevant to participants in their respective cultural settings.

Toward addressing the issue of participant cultural diversity, a review of the literature on culture-aware educational design was performed in order to identify recurring cultural design consideration categories and characteristics which influence the process (and product) of educational design (in general). Table 3.1 presents the set of educational design Cultural Consideration (CC) categories, which is the resulting superset of the identified cultural consideration categories and characteristics. Each codified CC category is analyzed and mapped to a set of specific cultural consideration characteristics (CCC). Furthermore, a brief description of each of these characteristics is provided toward presenting the manner of influence it can have on the process of educational design.

- **Participant motivation**. The second commonly reported strand of the "Massiveness" dimension of xMOOCs is the level of learner motivation (Knox 2014). Learner motivation is defined as the reasoning behind a person's behavior which leads to the actual actions (i.e., to the learner's engagement or drop-out) (Darr 2012).

  A key identified problem of xMOOCs is the high drop-out rates (Jordan 2014; Alraimi et al. 2015; Zheng et al. 2015). Despite the fact that these rates cannot be fully attributed to the educational design of the xMOOCs (e.g., different initial participant motivations can influence their level of participation-Chang et al. 2015; Pundak et al. 2014), their significantly high level and recurring appearance has been connected with the limited capacity of existing xMOOCs to effectively motivate the participants (Zheng et al. 2015; Rai and Chunrao 2016). Therefore, research attention has been placed on identifying methods and indicators in order to measure and increase the participant's level of motivation, and thus, engagement (Hew 2015). Examples of such methods include designing and delivering problem-based learning and/or assessment activities (Spoelstra et al. 2014), promoting and monitoring participant collaboration

Table 3.1 Educational design cultural consideration categories and their characteristics

ID	Cultural consideration categories	Cultural consideration characteristic	Description
CCC1	Instruction/interaction	CCC1a. Method of instruction and collaboration	Cultural differences can impact the manner in which participants approach learning, in terms of structured autonomous work or flexible instruction based on collaboration (Hofstede 1986; Banks 1993). More specifically, cultural understandings can implicitly impede (or promote) autonomous individual work, resulting in participants' difficulty (or tendency to) in efficiently expressing their opinion and arguing for it (Liu et al. 2010; Parrish and Linder-Van Berschot 2010; Richter 2011)
CCC2	Communication	CCC2a. Barriers during synchronous communication	Time-zone barriers related to the learners' place/country of residence can significantly impede synchronous communication. Therefore, this aspect should be taken into account when designing for synchronous communication between learners (Liu et al. 2010)
CCC3	Assessment	CCC3a. Assessment methods	Need for accommodating potentially diverse participant culture-based needs and requirements in terms of the preferred assessment methods, e.g., exam-oriented or process-oriented (Liu et al. 2010; Marrone et al. 2013; Nkuyubwatsi 2014)
		CCC3b. Assignment templates	Participants might have a diverse understanding on the ideal deliverable for a given assignment description, based on their own cultural understanding (Mercado et al. 2004). Therefore, explicit descriptions and/or templates of the expected quality and format of the deliverables should be provided (Parrish and Linder-Van Berschot 2010; Higbee et al. 2010)
		CCC3c. Academic conduct	Participants might have a different perspective on what constitutes acceptable academic conduct, e.g., what constitutes plagiarism or what

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ID	Cultural consideration categories	Cultural consideration characteristic	Description
			are the allowed margins for adhering to the assessment timetable (Mercado et al. 2004). Therefore, explicit guidelines describing the academic conduct rules should be explicitly provided (Hayes and Introna 2005; Liu et al. 2010)
CCC4	Feedback	CCC4a. Diversity in feedback method	Participants from different cultural backgrounds might expect and value diverse "methods" of feedback provision, for example direct feedback in contrast to indirect feedback which is elicited through challenges (Mercado et al. 2004; Richter 2011)
		CCC4b. Diversity in feedback provider	The provider of feedback might be a differential attribute of participants, for example, tutor-based feedback vs peer-based feedback (Mercado et al. 2004; Richter 2011)
CCC5	Subject domain content	CCC5a. Examples/content to support instruction	Culture-specific content or examples used to support instruction might lead to imposing difficulty on specific groups of participants due to their unfamiliarity and/or indifference on the specific case (Liu et al. 2010). For example, studying specific societal problems of a particular country or group, might not be relevant to participants who are not familiar to this context (Parrish and Linder-Van Berschot 2010; Higbee et al. 2010; Nkuyubwatsi 2014)
CCC6	Language	CCC6a. Language proficiency and use	Language barriers are an important issue in multi-cultural education (Liyanagunawardena et al. 2013b). Such barriers can develop during learner-content, interactions due to either low language proficiency of the learners (Marrone et al. 2013; Nkuyubwatsi 2014) or use of culturally specific terminology and symbols (Bentley et al. 2005; Rogers et al. 2007). Furthermore, learner–learner and learner-instructor

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Table 3.1 (continued)

ID	Cultural consideration categories	Cultural consideration characteristic	Description
			asynchronous communication can be impeded due to lack of visual cues which can potentially support the participants to make their point clear (Reeder et al. 2004; Liyanagunawardena et al. 2013b; Nkuyubwatsi 2014)
CCC7	Technological infrastructure and educational resources	CCC7a. Diversity in available technological infrastructure	Participant diversity in terms of availability of technological infrastructure (e.g., in their country or place of living) which can affect their capacity to engage in learning activities (e.g., low internet connection bandwidth) (Rogers et al. 2007; Yousef et al. 2014a)
		CCC7b. Restrictions in access in educational resources	Participants from specific countries might face restrictions when accessing educational resources required for the course (e.g., YouTube website is restricted in certain countries) (Rogers et al. 2007; Young 2008; Marrone et al. 2013). Furthermore, issues related to learning/physical needs of participants can also hinder their capacity to engage with specific learning resource types

(Hew 2015), and engaging participants in peer-assessment methods (Luo et al. 2014).

Apart from the aforementioned, a commonly reported promising method to increase participant motivation at large scale is the "gamification" of the educational design of xMOOCs (Anderson et al. 2014; Voulgari and Sampson 2014). More specifically, the process of gamification relates to the use of game-based mechanics in nongame situations with the aim of enhancing participant motivation and to promote their engagement in activities (Kapp 2012; Dicheva et al. 2015). Gamification elements can also be traced to the aforementioned examples of methods to enhance participant motivation.

In the context of technology-enhanced education, gamification has been reported to effectively achieve the aforementioned goals of enhancing learner motivation (Domínguez et al. 2013) and has also been used as a method to increase learner motivation (and engagement) in online learning contexts (e.g., Denny 2013; Cheong et al. 2013). Therefore, this potential could be also expanded in the context of xMOOCs toward addressing the aforementioned

shortcoming of low level of participant motivation and engagement at a massive scale. Indeed, existing works toward this direction have highlighted promising results. For example, van Hentenryck and Coffrin (2014) incorporated gamification elements in a MOOC and positively evaluated its influence on the participants' level of motivation. Similarly, Anderson et al. (2014) reported positive results related to participants' level of engagement in the forum discussions in a MOOC, after incorporating a gamification badge system. Therefore, research so far indicates that incorporating gamification elements in the educational design of MOOCs, can potentially enhance the level of motivation (and engagement) of the participants (Gené et al. 2014).

Under this light, a potentially appropriate field for eliciting such gamification elements for xMOOCs, is the field of massively multiplayer online games (MMOG) (Tan 2013; Voulgari and Sampson 2014). MMOG are online games, hosting vast virtual worlds in which massive numbers of players can interact with each other and the environment toward reaching specific objectives (Lin and Lin 2011). The MMOGs' capacity to (a) provide effective methods for supporting educational interventions (de Freitas and Griffiths 2009; Suh et al. 2010; Wu et al. 2014) and (b) effectively foster players' motivation at a *massive scale* (Williams et al. 2008), reveals their potential to act as a basis from which specific design considerations could be extracted toward efficiently "gamifying" xMOOCs (Tan 2013; Gené et al. 2014).

Therefore, in order to incorporate such MMOG-based design considerations in the proposed ECDF, a review of the literature was performed in order to highlight characteristics of MMOGs which have been reported to effectively foster participants' motivation. This set of characteristics, presented in Table 3.2, are based on the motivational categories proposed by Yee (2006) and will be regarded as educational design motivational considerations (MC) categories for xMOOCs. Each codified MC is mapped to a set of specific characteristics (MCC) that further analyze it. Furthermore, a brief description of each of these characteristics is provided toward presenting the manner in which it can affect the process of educational design.

The following subsection is focused on describing and analyzing the "Openness" dimension of xMOOCs, based on existing approaches to define openness in the wider technology-enhanced education domain.

3.2.3 Openness Dimension

"Openness" relates to an overarching trend in the field of online and digital education (Tuomi 2006; OECD 2007). "Openness" has been reported to comprise a set of elements, which in this book chapter will be referred to as "Openness" Considerations (OC) for the educational design of xMOOCs. An "Openness" aspect which is common for all MOOCs relates to the tuition-free registration and

Table 3.2 Educational design motivational consideration categories and their MMOG characteristics

ID	MMOG characteristic category (MC)	MMOG characteristic (MCC)	Description (this characteristic relates to the …)
MCC1	Sociability	MCC1a. Participant communication (a) synchronously	Capacity of MMOG to allow direct communication channels between participants (Dickey 2007; Hung et al. 2009; Peterson 2010). Creating and maintaining communication channels in the context of xMOOCs has been positively correlated with higher learner motivation (Anderson et al. 2014)
		MCC1b. Create and Share user-generated content	Capacity of MMOG to allow participants to create their own content and share it with others, thus engaging them in the process of creating and/or exploiting such content (Peterson 2010; Voulgari et al. 2014). In the context of xMOOCs, actively engaging the participants in the formulation/dissemination of their artifacts is proposed as an effective way to enhance their motivation (de Freitas et al. 2015)
		MCC1c. Collaboration in achieving tasks related to the attainment of learning objectives	Common MMOG principle to require participants' collaboration in groups (e.g., guilds), thus promoting the cultivation of a group experience and resulting in increased levels of motivation (Hung et al. 2009; Suznjevic and Matijasevic 2010) The quality and level of collaboration in MOOCs has been attributed with the capacity to enhance motivation (Voulgari and Sampson 2014)
MCC2	Immersion	MCC2a. Role-playing with avatars	Capacity of MMOG to allow players to engage in the activities by performing a specific role while represented by a unique avatar acting as their personalization in the web-space (Hsu et al. 2009; Suznjevic and Matijasevic 2010). Role-playing with the use of an avatar has been

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ID	MMOG characteristic category (MC)	MMOG characteristic (MCC)	Description (this characteristic relates to the …)
			proposed as a method to promote learner motivation in the educational context (e.g., Dickey 2007; Peterson 2010)
		MCC2b. Narrative	Envelop the educational problem within a progressing nonlinear storyline (Williams et al. 2008) which can facilitate (novice) participants (e.g., in MOOCs) to keep on track in terms of the tasks they have to perform (Voulgari and Sampson 2014). Moreover, having (short) appealing narratives can increase the level of participants' motivation, by allowing them to engage in small tasks that will lead to rewards (see MCC3b) and will help them become more immersed (Dickey 2007)
MCC3	Achievement and advancement	MCC3a. Character advancement and point ranking	Aggregation of "experience" points to the participant profile as a consequence of engaging with tasks. (Hung et al. 2009; Hsu et al. 2009; Voulgari and Sampson 2014). Such approaches have been shown to enhance the participants' motivation in the educational context as well (Muñoz-Merino et al. 2013)
		MCC3b. Rewards	Provision of unique "gifts" to participants when meeting specific criteria within a task or performing specific tasks (Dickey 2007; Hsu et al. 2009; Voulgari and Sampson 2014). Such reward approaches have been shown to enhance the participants' motivation in educational contexts as well (Anderson et al. 2014)
		MCC3c. Diverse methods of accomplishment	Diverse methods that MMOG allow for achieving a specific objective, (Choi and Kim 2004; Lisk et al. 2012; Voulgari and Sampson 2014). In the educational

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Table 3.2 (continued)

ID	MMOG characteristic category (MC)	MMOG characteristic (MCC)	Description (this characteristic relates to the …)
			context of MOOCs, multiple methods to attain (educational) objectives can relate to offering flexibility to the participants in the manner in which they will engage with the learning activities (for example, select their own subject in a project task or formulate their own group in a collaborative activity) towards making them more interesting to their own needs and preferences (Guàrdia et al. 2013)
MCC4	Challenges	MCC4a. Direct and regular feedback	Provision of direct and regular feedback to participants based on in-game actions (Choi and Kim 2004). Providing direct and regular direct feedback is considered to be a significant element for fostering participant motivation, since it can potentially facilitate learners to alter their behavioral standpoints regarding drop-out from challenges (Erhel et al. 2013; de Freitas et al. 2015)
		MCC4b. Engagement with tasks	Engagement of participants in specific (problem-solving) tasks which are highly challenging (Kong and Kwok 2009; Hung et al. 2009; Peterson 2010) Providing such tasks, which have also increasing level of difficulty as the tasks progress, is a significant factor for maintaining participant motivation (Tan 2013)

participation (Klobas 2014; Yousef et al. 2014a). Since this aspect is a common practice in MOOCs, it was not considered as an aspect that can inform the educational design process of MOOCs.

The xMOOCs Openness Considerations are based on the four Openness pillars identified in the "Opening Up Higher Education" report (cited in Yuan and Powell 2013) and are described as follows.

- **OC1—Open Curriculum**. This consideration can relate to the capacity of learners to select their own pathway in terms of the curriculum they wish to follow, based on their own needs and preferences. Moreover, it also refers to the lack of entry requirements for participation in courses (Anderson 2013; Yousef et al. 2014a). More specifically, in the context of xMOOCs, key prerequisites for participation (in terms of prior knowledge or demographics) are usually merely described (e.g., in the course syllabus), however are not utilized as a means for blocking registration (Klobas 2014). Therefore, even participants who do not meet the defined pre-requisites are allowed to register to the xMOOC. This should provide insights for the educational design of MOOCs in order to adapt the course to the characteristics of individual learners. For example, learners with low level of initial interest to the course could be provided with a more simplistic version which will exclude specific learning activities (deBoer et al. 2014).
- **OC2—Open Learning**. This consideration is related to the need for allowing participants to engage in collective (and/or individual) knowledge creation and dissemination, moving beyond the mere instructor-participant interactions (Yuan and Powell 2013; Anderson 2013). Despite the fact that this openness consideration is not fully promoted by existing xMOOCs, there has been an emerging trend toward its incorporation and exploitation for increasing the level of participants' engagement (Blom et al. 2013; Conole 2013). More specifically, such approaches argue for the extension of usually employed quiz-based assignments to include evaluation methods comprising artifact formulation (Hew 2015) and social interaction (Grünewald et al. 2013). In order to effectively perform these assessment tasks at large-scale research has been focusing on either automated approaches such as essay scoring (Balfour 2013) or forum posts analysis (Yang et al. 2013) as well as peer-assessment approaches (Suen 2014).
- **OC3—Open Assessment**. This consideration relates to the capacity to allow for assessment led by peers or the instructor, during the learning process, possibly on an "on-demand" basis (Yuan and Powell 2013).
- **OC4—Open platform**. This consideration relates to the requirement for exploiting platforms and educational tools that allow the collection and exploitation of information and educational data. Additionally, it also encapsulates the aspect of educational resources which are either learner-generated (Alraimi et al. 2015) or instructor-generated but have been assigned an open copyright licence, such as a creative commons(CC) licence (OECD 2007; Anderson and McGreal 2012). Existing xMOOCs mainly focus on providing educational resources which are freely accessible but are not subject to CC licences (Rodriguez 2013). Therefore, they only partly accommodate this openness consideration (Tuomi 2013). Moreover, the aspect of platform is usually restrictive since the majority of xMOOCs are being delivered through a specific platform, e.g., Coursera, edX and Udacity (Liyanagunawardena et al. 2013a). The latter characteristic of xMOOCs can affect the educational design of these courses, since they can limit the degrees of freedom that the designer has

(e.g., the existing functionalities of a platform in terms of supporting collaborative activities can influence whether such activities will be designed).

The aforementioned "Openness" considerations, in combination with the considerations derived from the analysis of the "Massiveness" dimension will be exploited in the following section, toward evaluating existing proposed MOOCs educational design frameworks and/or guidelines. As aforementioned, the conclusions drawn from this process will inform the formulation of the proposed EDCF (presented in Sect. 3.4).

3.3 Existing Educational Design Considerations Frameworks for MOOCs

3.3.1 Presentation of Existing Educational Design Considerations Frameworks for MOOCs

In order to address the identified issues related to the need for revisiting the educational design of (x)MOOCs, research has been focusing on proposing specific educational design frameworks and/or guidelines. This section will provide an overview of these works.

Kauffman and Kauffman (2015) proposed the 5C Model which is loosely based on the ADDIE Educational Design Model (Branch 2010) and is aimed at designing MOOCs which can provide active learning experiences, present clear information and informative (intrinsic or extrinsic) feedback. The 5C model outlines the steps to be followed toward creating an effective MOOC, which are generally defined as follows:

- *Construct*, that is, design clear and measurable intended learning outcomes, which are communicated to the learners.
- *Consider*, that is capture learners' prior knowledge and motivation (through online instruments such as questionnaires). This information allows the instructors to track learners' performance during the delivery and potentially offer more personalized feedback.
- *Create*, that is, identify an engaging and appropriate teaching method for structuring the MOOC. The authors argue for the use of problem-based and collaborative approaches.
- *Conceive*, that is, select learning activities to promote learners' active engagement.
- *Conduct*, that is, formative and summative assessment for both assessing the learners as well as for gathering information to evaluate the overall learning process.

The underlying principle in the 5C Model is to consider and align the aforementioned elements towards designing student-engaging learning experiences however no specific guidelines on how to do so are provided.

Margaryan et al. (2015) performed a critical analysis of the educational design quality of existing MOOCs based on a set of ten evaluation criteria. The underlying quality principles of the evaluation criteria relate to the level in which the MOOC design fosters problem-centered and active contribution from the learners. Furthermore, the authors argue in favor of teaching approaches that both demonstrate the intended learning outcomes to the learners as well as engage them in hands-on practice to apply and reflect on them. Furthermore, they argue for the need of collaborative knowledge construction (e.g., through discussion fora and wikis) as well as the provision of feedback and flexible flows of activity engagement. While these criteria were primarily addressed at evaluating existing MOOC designs, they could also serve as a set of guidelines for informing future MOOC designs.

Rosewell and Jansen (2014) reported on the OpenupEd Quality Label (OEOL), which is a quality assurance framework providing 32 quality "guidelines" for good practice for MOOC design (and delivery). These "guidelines" are loosely related to the educational design process described in the ADDIE model. The OEOL is an extension of the existing E-xcellence label which has been proposed for assessing the quality of e-learning in European higher education. Additionally, the OEOL framework describes considerations both from a design as well as from a delivery standpoint.

Rubens et al. (2014) proposed a set of 13 pedagogical considerations for designing MOOCs (called online master classes in this work). The formulation of these considerations was based on insights from a series of deliveries of online master classes, and (overall) aim to promote high and diverse levels of interaction for the learners (with the content, the instructor and among themselves) and to engage them in active participation in the course's activities through hands-on formulation of artifacts. Furthermore, the authors highlight the importance of collecting learners' prior competence levels so as to exploit them during the delivery (e.g., for formulating appropriate groups and providing more personalized feedback).

Yousef et al. (2014b) present a set of 74 criteria for driving the design and implementation of MOOCs. They have identified two overarching criteria pillars (i.e., Pedagogical and Technological) which are further distributed in six categories, namely instructional design and assessment (under the pedagogical pillar) and user interface, video content, learning/social tools, and learning analytics (under the Technological pillar). Each category defines a wide range of 'best-practice' indicators that can be exploited by designers in order to improve their MOOC designs. The full set of criteria was validated through a survey of students and professors.

Lackner et al. (2014) proposed a set of 71 indicators that instructors/designers should consider when designing their MOOC, based on the literature study. These indicators are organized under seven categories, namely core requirements, structure, participant requirements, assignments, media design, communication, and resources. In each of these categories, the authors define a series of checklist items

to be followed so as to potentially increase the effectiveness of the MOOC during its delivery.

Read and Rodrigo (2014) report on a set of generic guidelines for designing MOOCs, organized under a set of five aspects:

- *Topic*, that is, the need for defining a clear and specific topic (and educational objectives) for the MOOC.
- *Contents*, that is, the potential of re-using existing educational resources, adapted to meet the specific needs of the MOOC.
- *Duration*, that is, the definition of the expected MOOC duration (overall between 25 and 125 h).
- *Structure*, that is, guidelines for structuring the internal modules of the MOOC and their corresponding educational resources.
- *Specific Instructional Design Guidelines*, that is, the need for selecting teaching methods and activities for promoting learners' active engagement and reflective self-assessment.
- *Social Channels*, that is, the exploitation of diverse social channels (e.g., web 2.0 social media) so as to effectively promote dissemination of experiences and knowledge among learners.

Conole (2013) has proposed the 7Cs of Learning Design framework as a method to guide educational design, also in the context of MOOCs. More specifically, seven generic categories of considerations have been outlined which can be used to design and evaluate the educational design of MOOCs, structured as follows:

- *Conceptualize*, that is, considerations regarding learner analysis and the definition of educational objectives.
- *Capture*, that is, the selection of educational resources for supporting the intended educational objectives (with a focus on Open Educational Resources).
- *Communicate*, that is, the definition of tools and methods to foster asynchronous and synchronous communication.
- *Collaborate*, that is, the definition of tools and methods to foster collaboration.
- *Consider*, that is, the definition of tools and methods to promote reflection and different forms of assessment.
- *Combine*, that is, the process of synthesizing all the aforementioned in a consolidated, structured learning pathway.
- *Consolidate*, that is, the delivery of the (MOOC) design and the process of evaluating and refining it.

Finally, Guàrdia et al. (2013) presented a set of principles for MOOC design based on an exploratory analysis they performed on students' comments from a series of MOOC deliveries. Therefore, the ten principles highlighted reflect the students' opinions on the MOOC design considerations that should be accommodated. Overall, the guidelines of Guàrdia et al. stress the need for competence-based, student-engaging learning experiences. Furthermore, the need for promoting learners' self-regulation and self-assessment is stated, supported by

the definition of explicit educational objectives and flexible learning pathways within the MOOC. Additionally, the authors highlight the importance of designing for collaborative activities that will also foster knowledge dissemination and peer-support and peer-assessment. Finally, the appropriate selection of emerging technologies for supporting the aforementioned tasks is also highlighted as an aspect that needs to be explicitly considered when designing and delivering a MOOC.

The aforementioned existing works will be evaluated in the following section in order to assess the level in which the identified set of characteristics of the "Massiveness" and "Openness" dimensions (from Sects. 3.2.2 and 3.2.3) are accommodated.

3.3.2 *Evaluation of Existing Educational Design Considerations Frameworks for MOOCs*

This section presents the evaluation of existing works in revisiting the Educational Design of MOOCs, toward identifying potential shortcomings and building on them to propose the unifying/extended ECDF. More specifically, the list of identified existing works (presented in the previous section) was benchmarked against the identified characteristics of the "Massiveness" and "Openness" dimensions.

The evaluation process comprised a thorough analysis of the principles and/or guidelines proposed by each existing work, in terms of the level of accommodation they offered for each of the characteristics of the "Massiveness" and "Openness" dimensions. The outcomes of this process, for readability purposes, are depicted in this section as occurrence frequency percentages, i.e., the percentages in which each characteristic is being (fully) accommodated by existing works.

Figure 3.1 presents the results of the evaluation process regarding the educational design *Cultural Considerations* (*CC*).

As the Fig. 3.1 depicts, existing works commonly address cultural aspects related to the provision of feedback to participants from multiple providers (e.g.,

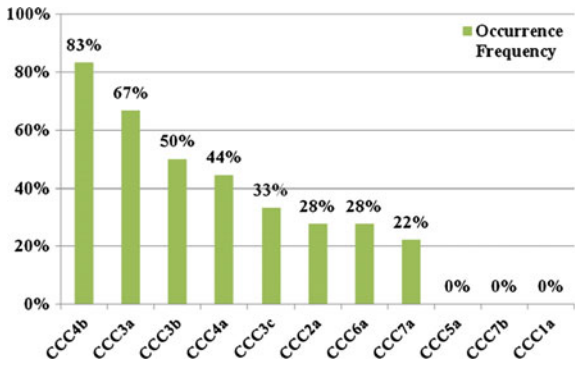

Fig. 3.1 Occurrence frequency (percentage) of the educational design cultural considerations in existing works

peers, instructor, tutor) (CCC4b − x = 83 %) and the design of multiple assessment methods towards evaluating the attainment of educational objectives (CCC3a − x = 67 %). Additionally, other explicitly referenced CC include the provision of clear and elaborated rules related to the expected quality and format of assignments (CCC3b − x = 50 %) and the expected academic conduct of participants (e.g., plagiarism and netiquette rules) (CCC3c − x = 33 %). The aspects of providing diverse methods of feedback (for example, through instructor feedback reports or quiz-based feedback) (CCC4a − x = 44 %) and explicitly considering time-zone differences when designing synchronous collaboration activities (CCC2a − x = 28 %) are also explicitly addressed, even at a less consensual degree. The very significant CC aspect of the language proficiency of participants is not commonly referenced (CCC6a − x = 28 %). However, it has been explicitly accommodated by proposing educational design considerations on limiting the use of symbols and culture-specific language formats, as well as by providing translations of the provided educational content (e.g., translated transcripts of educational videos) (Lackner et al. 2014). Finally, CC aspects related to the diversity of technological infrastructure in different countries, despite being referenced in a very low degree (CCC7a − x = 22 %) are being addressed by proposing the use of multi-versioning of the provided educational content, in terms of technical format and quality toward enabling participants with low capacity technological infrastructure to access it (Yousef et al. 2014b).

The results of Fig. 3.1 show that three CC are not being accommodated, namely (a) the provision of multicultural educational content or examples for supporting instruction (CCC5a), (b) the explicit consideration related to potential restrictions in accessing educational resources in specific countries (CCC7b) and (c) the explicit considerations related to the potential cultural differences of participants which can impact the manner in which they engage with collaborative activities (CCC1a). Therefore, these CCs will need to be accommodated in the proposed EDCF, toward providing educational design considerations to address them.

Figure 3.2 presents the results of the evaluation process regarding the educational design *Motivation Considerations (MC)*, namely the percentages in which each MC was accommodated by existing works.

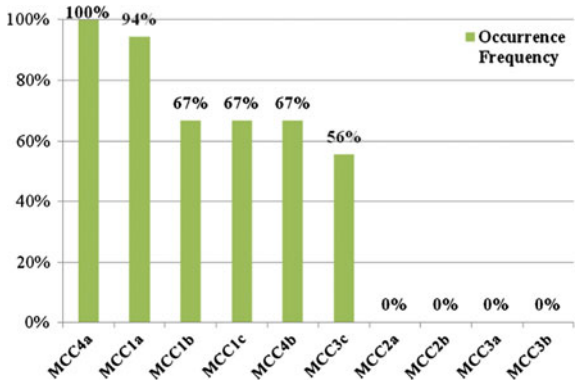

Fig. 3.2 Occurrence frequency (percentage) of the educational design motivational considerations in existing works

As the Fig. 3.2 depicts, existing works commonly reference motivational aspects related to the provision of regular and direct feedback to the participants (MCC4a − x = 100 %) and the formulation of communication channels amongst them (MCC1a − x = 94 %). Additionally, other commonly referenced MC include educational design considerations aiming to promote (a) the creation and sharing of participant-generated educational content (MCC1b − x = 67 %), (b) the formulation of collaboration teams (or "guilds") among participants toward collaboratively achieving specific learning tasks (MCC1c − x = 67 %) and (c) the design of (progressively) challenging learning tasks and activities (MCC4b − x = 67 %). Finally, the aspect of providing diversity in the method of accomplishing specific educational objectives is also commonly referenced (MCC3c, x = 56 %).

The results of Fig. 3.2 show that four MCs are not being fully accommodated. The four MCs which are currently not accommodated are (a) the incorporation of role-playing aspects (supported with avatars) (MCC2a), (b) the design of a progressing nonlinear storyline toward facilitating participants to become immersed in the educational problem of the xMOOC (MCC2b), (c) the incorporation of mechanisms to aggregate "experience" points to the participants' profile as a consequence of engaging with learning tasks (MCC3a) and (d) the provision of reward to participants when meeting specific criteria within an task or performing specific tasks (MCC3b). All these aspects can be related to the "gamification" of xMOOCs, a process which has been shown to be effective in enhancing participant motivation in xMOOCs (Gené et al. 2014). Therefore, these MC will be explicitly accommodated in the proposed EDCF, toward providing educational design considerations to address them.

Figure 3.2 presents the results of the evaluation process regarding the educational design *Openness Considerations (OC)*, namely the percentages in which each OC was accommodated by existing works. As the Fig. 3.3 depicts, existing works reference all "Openness" aspects. More specifically, the Open Learning (OC2) consideration is universally accommodated, namely all approaches argue toward actively engaging the participants in collective (and/or individual) knowledge creation and dissemination. Furthermore, all existing approaches support the engagement of participants in community building through communication channels. The latter has been proposed as a significant aspect to be considered (de Freitas et al. 2015).

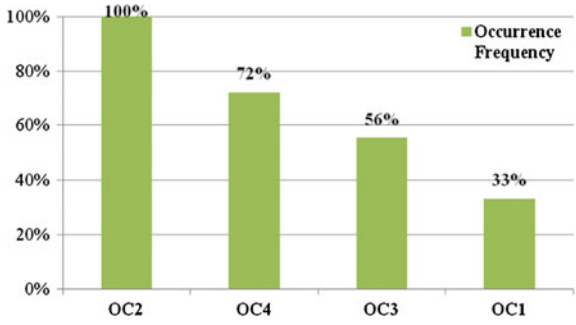

Fig. 3.3 Occurrence Frequency (percentage) of the educational design openness considerations in existing works

The open platform (OC4) consideration is also commonly accommodated. More specifically, collecting and exploiting educational data for providing better learning experiences is commonly discussed (e.g., deBoer et al. 2014). Additionally, (and related to the OC1) existing approaches argue toward the engaging participants to actively create (and disseminate) their own educational content, toward moving beyond using merely the instructor-generated educational resources. The latter (which is a common characteristic of cMOOCs) has been proposed as improve the design of xMOOCs in terms of participants' motivation (Hew 2015).

The Open Assessment (OC3) consideration despite being commonly referenced, it is not widely accommodated. More specifically, despite the fact that providing both peer-led and instructor-led means of assessment to the participants is commonly reported as an educational design consideration, the aspect of "on-demand" assessment is not explicitly described. The latter includes the capacity of participants to be assessed and certified (if successful) on an "on-demand" basis, without having to complete the entire course first (Yuan and Powell 2013).

Finally, the open curriculum (OC1) consideration is also partly addressed by existing approaches. More specifically, the aspect of allowing participants to select their own curriculum pathway based on their own needs and preferences is indeed accommodated. However, based on the latter, existing educational design considerations do not propose exploiting the profiling data of the registered participants in the xMOOC. Therefore, given that there are no entry restrictions for entering a xMOOC, educational design considerations should take into account the aforementioned characteristics in order to adapt the course flow to meet them. That is, based on their individual characteristics, the participants could be proposed to follow a different path within a xMOOC, possibly comprising a subset of the overall learning activities (deBoer et al. 2014).

Overall, the existing works on the educational design of MOOCs are either not structured based on an educational design model (but instead comprise general considerations to adhere to), or they do not provide explicit guidelines to follow. Furthermore, despite implicitly aiming to address the "Massiveness" and "Openness" dimensions of MOOCs, they do not report on how these dimensions can been accommodated, since they do not base their design in the detailed analyses of these dimensions, i.e., what are their constituent elements and how these can inform the process of educational design of MOOCs. This has led to a significant degree of diversity in terms of the educational design considerations proposed for MOOCs, as well as to the lack of accommodation of specific characteristics of the "Massiveness" and "Openness" dimensions.

Thus, to alleviate these shortcomings we propose a unifying/extended Educational Design Considerations Framework (EDCF) for xMOOCs, structured based on the widely accepted ADDIE Educational Design model. The proposed xMOOCs-EDCF is presented in the following section.

Table 3.3 Educational design considerations framework for xMOOCs

ADDIE phases	Phase elements	xMOOC characteristics	EDCF guideline	Existing works
Cross-phase considerations		CCC6a	**EDCF 1**: All instructor-participant and participant-content interactions should avoid the use of cultural symbols and context-specific language. Translated transcripts/subtitles/glossaries should be provided for participant-content interactions	Lackner et al. (2014), Yousef et al. (2014b)
		Cross-Characteristic	**EDCF 2**: The xMOOC should provide a clear, detailed and informative syllabus	Lackner et al. (2014), Rosewell and Jansen (2014)
			EDCF 3: Pre-requisite competences for effective participation should be clearly defined to allow the instructor/designer to build on and exploit the participants' prior competences	Rubens et al. (2014), Margaryan et al. (2015)
Analysis	A1. Educational problem identification	CCC5a	**EDCF 4**: The educational problem should be designed in order to be relevant (or adaptable to) to a wide range of cultural contexts	Lackner et al. (2014)
		MCC2b	**EDCF 5**: The educational problem should be designed as an overarching progressing narrative offering potential side-tracks to follow	–
		MCC4b	**EDCF 6**: The educational problem should be specific and oriented at engaging participants with problem-solving tasks (i.e., not topic-oriented)	Read and Rodrigo (2014), Margaryan et al. (2015)
	A2. Contextual Analysis	CCC2a CCC7a	**EDCF 7**: The overall duration of the xMOOC (if not self-paced) and the duration of each unit/lesson should consider time-zone differences and diversity in the quality of access from different participants	
	A3. Learner Analysis	OC1 Cross-Characteristic	**EDCF 8**: The xMOOC should gather and exploit participant data related to their cultural background (e.g., language, country of origin, profession, and expertise) and initial motivation for engaging in the course	Kauffman and Kauffman (2015)
Design	Des1. Definition of educational objectives	CCC5a	**EDCF 9**: The educational objectives should be mapped to international professional competence standards, in order to facilitate participants to map them to their own context	Rosewell and Jansen (2014)

(continued)

Table 3.3 (continued)

ADDIE phases	Phase elements	xMOOC characteristics	EDCF guideline	Existing works
		MCC4b	**EDCF 10**: The educational objectives should be clearly defined and aimed at cultivating state-of-the-art competences (i.e., knowledge, skills, and attitudes)	Guàrdia et al. (2013), Kauffman and Kauffman (2015)
		MCC3c OC1	**EDCF 11**: Different levels can be defined for the stated educational objectives in order to allow different attainment thresholds for participants with diverse prior competences/motivation/preferences	–
	Des2. Selection of teaching approach/strategy	CCC1a	**EDCF 12**: Collaboration groups should be formulated by the participants themselves considering their cultural characteristics (e.g., language, country of origin)	–
		CCC2a	**EDCF 13**: Learning activities which require participant synchronous communication and collaboration should allow for alternative timeslots to engage	Lackner et al. (2014), Yousef et al. (2014b)
		CCC5a	**EDCF 14**: Learning activities should include cases of study and examples from multiple cultural contexts	–
		CCC7a MCC3c	**EDCF 15**: Learning activities should provide alternate methods of engagement in order to allow participants with diverse quality of technological infrastructure to engage (e.g., videoconference-based activities should allow for substitute methods, such as chat or forum)	–
		MCC1a OC2	**EDCF 16**: Learning activities should promote/require communication among the participants	Conole (2013), Rubens et al. (2014)
		MCC1c	**EDCF 17**: Collaboration groups should include the definition of specific participant tasks to be performed by each group member	Guàrdia et al. (2013)
		MCC2a	**EDCF 18**: Participants can be assigned an avatar to represent them in the digital space during engagement with learning activities	–
		MCC2b	**EDCF 19**: Learning activities should be clearly structured (in topics) and enveloped in an engaging, progressing narrative offering potential side-tasks to achieve	–
		MCC3c OC1	**EDCF 20**: Participants should be allowed to engage with learning activities in a nonlinear, conditional manner (e.g., based on their initial motivation, preferences, and/or competences)	Lackner et al. (2014), Rubens et al. (2014)
		MCC4b OC2	**EDCF 21**: The teaching approach should be relevant to the educational objectives and actively engage the participants in challenging tasks and artifact formulation	Kauffman and Kauffman (2015)

(continued)

Table 3.3 (continued)

ADDIE phases	Phase elements	xMOOC characteristics	EDCF guideline	Existing works
	Des3. Selection of assessment method	CCC3A MCC3c	**EDCF 22**: Multiple assessment methods for successfully evaluating the level of attainment of the course's educational objectives should be provided	Rosewell and Jansen (2014), Margaryan et al. (2015)
		CCC3b CCC3c	**EDCF 23**: Clear requirements to be met for each assessment activity should be provided, including evaluation criteria, exemplary deliverables, submission timetables (in international time), and academic conduct rules	Guàrdia et al. (2013), Lackner et al. (2014)
		CCC4a MCC4a	**EDCF 24**: Regular and/or direct feedback should be provided to the participants, either directly (e.g., by the instructor/tutor) or through their engagement with assessment activities	Guàrdia et al. (2013), Margaryan et al. (2015)
		CCC4b	**EDCF 25**: Feedback provision should be performed in a 360° manner, by the instructor, tutors, peers, and automated mechanisms (e.g., analytics dashboards)	Rubens et al. (2014)
		CCC5a	**EDCF 26**: If the assessment method includes project formulation, the xMOOC could allow participants to select their own project subject	–
		CCC7a	**EDCF 27**: Assessment activities should alternate methods of engagement in order to allow participants with diverse quality of technological infrastructure to engage	—
		MCC3a	**EDCF 28**: Engaging in learning/assessment activities will assign the participants' avatar/profile with points, which can be utilized as a method of assessment of educational objectives' attainment	–
		MCC3b	**EDCF 29**: Reward mechanisms can be employed in order to acknowledge participants' achievements (e.g., badges)	–
		MCC3c	**EDCF 30**: Diverse assessment methods can be employed to evaluate the attainment of educational objectives by the participants (e.g., formative, summative, stealth assessment)	Read and Rodrigo (2014)
		MCC4b	**EDCF 31**: Assessment activities should be designed with progressing difficulty and level of challenge	–
		OC2	**EDCF 32**: assessment methods which engage participants in artifact formulation (ideally in a collaborative manner) should be exploited	Margaryan et al. (2015)
		OC3	**EDCF 33**: Assessment activities contributing to the certification of participants should be available on an "on-demand" basis	–

(continued)

Table 3.3 (continued)

ADDIE phases	Phase elements	xMOOC characteristics	EDCF guideline	Existing works
Develop	Dev1. Development/selection of educational resources	CCC5a	**EDCF 34**: Diverse educational resources should be selected in order to meet the local contexts of a wide range of participants	–
		CCC7a	**EDCF 35**: Different versions of the required educational resources with diverse technical quality in order to accommodate different participants' level and quality of access should be utilized	Yousef et al. (2014b)
		CCC7b	**EDCF 36**: Different versions of the required educational resources using different (but widely used) technical formats and meeting diverse accessibility standards	Yousef et al. (2014b)
		MCC1b OC2	**EDCF 37**: Participants should be promoted to engage in the formulation/dissemination of their own educational resources	Rubens et al. (2014)
		OC4	**EDCF 38**: Educational resources under Creative Commons licenses should be formulates/utilized	Lackner et al. (2014)
	Dev2. Development or selection of educational tools and/or services	CCC3a	**EDCF 39**: Instructions of expected use for the utilized tools and/or services should be provided	Guàrdia et al. (2013)
		CCC4a MCC4a	**EDCF 40**: Educational tools that allow for the provision of automatic and/or personalized feedback should be selected	Rosewell and Jansen (2014)
		CCC7a	**EDCF 41**: Educational tools with high levels of interoperability, exploiting common technical formats and offering cross-device compatibility should be used	Yousef et al. (2014b)
		MCC1a MCC1c	**EDCF 42**: Educational tools that support the formulation of communication and collaboration channels should be selected, based on the type of learning/assessment activities of the xMOOC	Lackner et al. (2014)
		MCC1b OC2	**EDCF 43**: Educational tools that support the formulation of educational content by participants (depending on the requirements of the xMOOC) should be selected	Rosewell and Jansen (2014)
		OC4	**EDCF 44**: Freely available and accessible educational tools and/or services should be utilized (Open)	Yousef et al. (2014b)
	Dev3. Arrangement of the appropriate delivery setting	Cross-characteristic	**EDCF 45**: The most appropriate technical platform should be selected in order to provide affordances to accommodate all the required educational design considerations for a given xMOOC	Rosewell and Jansen (2014)

(continued)

Table 3.3 (continued)

ADDIE phases	Phase elements	xMOOC characteristics	EDCF guideline	Existing works
Implement	I1. Delivery	MCC3a	**EDCF 46**: Mechanisms should be utilized to inform participants on their completion status (e.g., a progress bar)	Yousef et al. (2014b)
		CCC4a MCC4a	**EDCF 47**: Notification/reminder emails can be sent on a regular interval regarding aspects of the course (e.g., upcoming deadlines, next lesson overviews, or individualized progress reports)	Lackner et al. (2014)
	I2. Monitoring	MCC3b	**EDCF 48**: The instructor should identify high contributing participants at regular intervals and provide unique rewards in order to engage others	Guàrdia et al. (2013)
		MCC3a MCC4a OC4	**EDCF 49**: Learning analytics mechanisms should be used to identify participants at risk of drop out or high achievers (e.g., through assessment results, level of activity engagement or contributions in discussions)	Yousef et al. (2014b)
Evaluate	E1. Formative evaluation	MCC4a	**EDCF 50**: Feedback on assessment activities should be provided quickly and inform/scaffold the participant in terms of their specific shortcomings	Yousef et al. (2014b)
		MCC3a MCC4a	**EDCF 51**: Formative evaluation results and feedback could be provided using diverse means to signify the participant's progress (e.g., text, badges, or ratings) and allow for self-reflection	Margaryan et al. (2015)
	E2. Summative evaluation	CCC3c	**EDCF 52**: (Diverse) Accreditation information and requirements should be clearly defined	Lackner et al. (2014)
		CCC4b	**EDCF 53**: Summative evaluation could be performed by both instructors and peers in order to actively engage the latter. Peers could be selected in terms of culturally similar attributes	Guàrdia et al. (2013), Lackner et al. (2014)
		OC3	**EDCF 54**: Summative evaluation (and possible accreditation) should be available on-demand	–
		Cross-characteristic	**EDCF 55**: The instructor/designer should consider both provided and generated evaluation data both in a consolidated manner as well as in a group-level manner, to identify and remedy for shortcomings concerning all participants as well as specific groups	–

3.4 Educational Design Considerations Framework for xMOOCS

This section presents the Educational Design Considerations Framework for xMOOCs. As aforementioned, the EDCF is structured using the ADDIE model as a foundational framework. Furthermore, it extends previous works to incorporate design considerations for "Massiveness" and "Openness" characteristics that have not accommodated elsewhere.

Table 3.3 depicts the proposed xMOOC EDCF, which comprises 55 educational design considerations. As aforementioned, these considerations are structured based on the ADDIE Educational Design model and are defined in order to fully accommodate the identified characteristics of the "Massiveness" and "Openness" dimensions. Therefore, for each of the identified characteristics (i.e., CC, MC, or OC), Table 3.3 presents the manner in which each one is accommodated at the various ADDIE Phases. Furthermore, given that certain characteristics of the "Massiveness" and "Openness" dimensions were already accommodated in existing works, any educational design considerations that emerged from these works are supported by an indicative sample of the supporting references.

Overall, the proposed xMOOC EDCF aims to fully accommodate the identified characteristics of the "Massiveness" and "Openness" dimensions of xMOOCs in order to facilitate instructional designers to explicitly consider in their designs specific factors that can potentially affect their xMOOC delivery.

3.5 Conclusions and Discussion

Recently, MOOCs have been a popular development in online education. The key characteristics of MOOCs are "Massiveness" and "Openness." These dimensions, however, despite presenting the "added value" of (x)MOOCs, have also contributed in their identified shortcomings relating to the overall "quality" of the educational value (Margaryan et al. 2015).

This chapter discussed issues related with the educational design of MOOCs with emphasis to cultural and motivational issues, presents an analysis of existing educational design frameworks and/or guidelines for MOOCs and, finally, proposes an ADDIE-based educational design considerations framework (EDCF) for xMOOCs, which incorporate the "Massiveness" and "Openness" requirements.

Future work in this agenda could include an evaluation of the aforementioned EDCF in terms of its actual capacity to address the identified key shortcomings of xMOOCs. More specifically, the ECDF could be utilized to identify existing or design new xMOOCs which would accommodate these considerations. These xMOOCs could undergo a scrutinizing evaluation process in line with the emerging research-based MOOC foci (e.g., Veletsianos et al. 2015) in order to identify

whether the incorporation of the EDCF actually resulted in addressing (or minimizing) xMOOC shortcomings and improving the learning experiences of the participants.

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