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Uncovering factors predicting the effectiveness of MOOC-based academic leadership training

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Abstract The recent trend of utilizing Massive Open Online Courses (MOOCs) in higher education and the drastic changes caused by COVID-19 exacerbated the adoption of online professional development (PD) addressed for academic leaders. Unfortunately, there is a lack of empirical studies investigating perceived effectiveness of academic leadership development MOOCs and its predicting factors. Based on the statistical findings derived from a survey for learners in a series of MOOC-based leadership development programs, the current study aimed at identifying contributors to the effectiveness of online leadership training in higher education contexts. The participants ($N = 185$) were academic leaders and staff who participated in the MOOC-based leadership development programs. Hierarchical regression analyses were employed to answer the research questions. The results showed that course content was the strongest predictor of perceived learning effectiveness, followed by interaction quality. The four scales of motivation have different effects on perceived learning outcomes. The study extended previous research by demonstrating the potentials of using MOOCs as an online platform for leadership development. In addition, the study filled in the gaps in the literature to measure predictors that associate perceived learning outcomes of MOOC-based leadership development programs. Implications for both practice and theory were implied.

Keywords MOOCs · Professional development · Leadership · Academic leaders · Higher education

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Introduction

The concept of leadership is interpreted in many ways by researchers and scholars (Denis et al. 2012; Dinh et al. 2021; McCauley and Palus 2021). Leadership is traditionally perceived as a property of individuals and their interactions with followers (Reyes et al. 2019). Based on relational theory, Denis et al. (2012) conceptualized leadership as "a collective phenomenon that is distributed or shared among different people potentially fluid and constructed interaction" p.212). Regardless of differences, a common thread of those conceptualizations consists of key features including vision, empowering, competence and interpersonal skills (Ries 2019). A leadership development program, also understood as a form of professional development (PD), refers to a structured educational process in which learners have opportunities to learn, share, and apply leadership practices to overcome ongoing challenges they are facing in their job (Ries 2019). As with any other discipline, leadership play a vital role in academic organizations as a critical indicator of institutional success (Jooste et al. 2018). Evans (2014) posits that leadership is crucial in ensuring the quality and performance of academic institutions on the basis of its link to policymaking and governance. Accordingly, leaders—those who have personality traits, abilities, and the power to influence the individuals of a group towards the achievement of a (common) goal (Pani 2017)—play a key role in academic institutions. In the new changing contexts, university leaders are required to be more distinct, cooperative, and flexible in order to deal with the inherent complexities of administration, finance, academia, etc. in managing the institution (Pani 2017). Hence, leadership development training that enhances the capacities of individuals and simultaneously nurtures professional networks and collaboration among the educational community is emphasized (Diep et al. 2016; Dopson et al. 2018).

In line with the recent trend of utilizing Massive Open Online Courses (MOOCs) in higher education, several studies have highlighted the potentiality of using MOOCs in professional development (Kumari 2016; Misra 2018; Urrutia et al. 2016). Moreover, the drastic changes caused by COVID-19 exacerbated the adoption of online learning addressed for both undergraduate students and academic leaders who are adult learners. In adult education settings, learners, who differ from each other in employment status, ages, and educational levels, need to deal with multiple tasks other than fully concentrate on study (Diep et al. 2016). Thus, evaluating effectiveness of the training based on learners' satisfaction, perception of learning experience or benefits is more suitable compared to cognitive outcomes (Koukis and Jimoyiannis 2019; Loizzo et al. 2017).

In a meta-analysis study on MOOC, Zhu et al. (2020) found that learner retention, learning experience, and engagement are among the highest topics conducted by authors. However, most of those studies focus on undergraduate students. In the same sense, a recent systematic review conducted by Philipsen et al. (2019) confirmed that research on teacher training in online environment remains limited. When it comes to leadership training particularly, there is no sufficient knowledge about the perceived effectiveness of academic leadership development

MOOCs. In addition to this, several gaps exist when evaluating effectiveness of the online professional training including leadership development.

Few studies have successfully examined learners' reaction regarding learning outcomes and effectiveness of MOOC-based professional development (Griffiths et al. 2021; Koukis and Jimoyiannis 2019) or evaluated impacts of MOOC learning on participant's professional practices (Domingo et al. 2019). However, research to date has not yet determined the relationship between course effectiveness and its related factors including motivation, interaction quality, and course content. Nevertheless, Kim et al. (2021) highlighted that identifying the distinguishable roles of course design-related factors to the learning effectiveness is vital for design strategies in large-scale self-paced MOOCs.

Motivation has been widely examined in previous MOOC studies in which the measurement construct is favorably framed in the intrinsic and extrinsic dichotomy (Alabdullatif and Ángel Velázquez-Iturbide 2020; Moore and Wang 2021). As for adult learners, motivational reasons of joining the course vary from the personal reason of seeking entertainment to uplift their knowledge and skills, opt for qualification, or experience with social interaction (Kao et al. 2011; Loizzo et al. 2017). This suggests that the two-factor motivational scale could not fully capture the motivation of adult learners to join the online courses. Recent qualitative studies on online professional leadership also support this viewpoint (Truong and Murray 2019; West et al. 2022). Yet, quantitative study exploiting a multidimensional construct of motivation has scarcely been researched.

Many MOOC designs emphasize developing content through video lessons, discussion forums and small assessment tasks (Li et al. 2018; Maya-Jariego et al. 2019; Setia et al. 2021). In this type of MOOCs, course content was found as a strongest predictor of learning outcomes (Kim et al. 2021). However, in some MOOC courses, particularly in the present study's context, the MOOC-based courses intentionally go beyond knowledge and skill construction purpose to create and promote a community of practice wherein learners have more opportunities to interact, share personal experiences, and broaden their professional network (Loizzo et al. 2017). In this line, peer interaction and communication are more emphasized compared to course content and other necessities. Consequently, question has been raised about the effect of peer interaction to training effectiveness in this MOOC context compared to the other predicting variables. Yet, no prior work has been examined to resolve the question. This gap indicates a need to measure the contribution of motivation patterns, interaction quality, and course content on perceived learning effectiveness.

Addressing the gap in the literature, the current study aims to (1) uncover the predictive values of motivation, peer interaction, and course content as predictors with regard to the perceived effectiveness of the MOOC-based leadership development programs; and (2) to identify the most important and strongest predictors to the effectiveness of MOOC-based leadership development program. The study makes a major contribution to the field of online professional development training in general, leadership development in particular. The research is more essential as many professional training programs now opt for online courses prompted in part by COVID 19. In addition, the study generates fresh insights into measuring the degree of importance of different factors that affect effectiveness of the MOOC-based

leadership training. This study is among the first attempts to exploit a multidimensional construct of motivation in evaluating the effectiveness of MOOC-based professional training. It is hoped that it will benefit further quantitative study on online professional development in which learners' motivation is emphasized. The study also provides opportunities to advance the understanding of the training programs in the interaction-based MOOC contexts, which is currently under researched highlighted by Kim et al. (2021). The findings are essential for MOOC course designers, instructors, and facilitators in constructing and implementing convenient training courses. Additionally, the results are useful for those in academia to imitate related studies in the field of online learning for adults.

Literature review

The rationale for using MOOCs in academic leadership development stems from three sources: (1) academic leadership development in the new higher education context; (2) the potentials of using MOOCs for leadership development training, and (3) studies on the characteristics and evaluating the effectiveness of leadership development programs. To that end, this section starts by discussing the definition and characteristics of leadership development in academic settings; definition of MOOCs, their characteristics, and the grounds for exploiting MOOCs as a training mode and strategy for leadership development. Subsequently, an evaluation of leadership programs accompanied by related factors is discussed. On this basis, the research questions and a research model derived from the literature are put forth.

Leadership development in the changing higher education context

As in other disciplines, leadership development is essential in enhancing education quality and boosting innovation within academic institutions. However, leadership and its characteristics in academic settings are more unique and complex than in other contexts due to the needed academic freedom and autonomy in knowledge construction and dissemination (Liu 2019). Additionally, leaders in academic settings concern not only individuals who hold formal administrative positions such as department chairs, deans, heads of department, chancellors, directors but also academicians who have informal leadership positions (e.g., program leaders, research team leaders, project leaders) at the university (Grunefeld et al. 2015; Scott et al. 2008). Caliskan et al. (2021) categorize academic leaders into three different levels: young-, middle-, and senior-levels. Young academic leaders include professors, lecturers, researchers, and graduate learners who do not have formal leadership positions or do not possess power and authority equivalent to a senior or middle-level leader. Middle academic leaders are subject department heads, special educators, or spiritual leaders, etc. or educators who possess outstanding skills that would aid in the advancement of their co-teachers/researchers, or faculty leaders who are between the top or central-level leaders and the basic level academic leaders and members. Senior leaders refer to people

who hold executive leadership positions (e.g., rectors, vice-rectors) at the central units of the universities or senior professors who are seen as role models. Following Caliskan et al. (2021) and Grunefeld et al. (2015), we perceive academic leaders are people who hold formal or informal leadership roles with responsibilities for research and teaching and related services within academic institutions.

Over the past few decades, the global society has undergone substantial changes as a result of changing demographics, globalization, technology, etc. Particularly, the knowledge and information technology evolution not only affect the way of people's lives but also challenge existing business models. Within this context, higher education institutions worldwide have been facing radical challenges that force them to reinvent their institutions in terms of content-wise and organizational structure (Antoine and Van Langenhove 2019). Within the higher education sector as a whole, some of the main challenges include changes in funding framework, competition over research profiles, shifting demographics, and increasing regulation and scrutiny (Zhu and Zayim-Kurtay 2019). Many of these issues are inter-connected, such as the introduction of student fees in universities as a response to declining central funding leading to greater competition between institutions, increasing emphasis on developing a distinct and desirable university profile, and greater expectations from students and other stakeholders (Scott et al. 2008). All in all, the challenges faced by the sector are placing greater demands on institutions and senior figures within them, greater visibility, and accountability, and increasing emphasis on the importance of effective management and leadership processes.

In the new higher education context, academic leaders at different levels must be more distinctive, cooperative, and flexible in dealing with the inherent complexities of administration, finance, academia, etc., in managing the institution (Pani 2017). Several researchers reported on the lack of competencies, skills, and knowledge on the part of academic leaders (Garwe 2014; Parrish 2015). Consequently, leadership development, which strongly supports leaders and staff in enhancing their leadership capacities in the new context, is highlighted in several articles of research (Jooste et al. 2018; Ladyshewsky and Flavell 2011; Pani 2017; Scott et al. 2008; Tran and Tran 2020).

Although leadership in academic settings has been widely emphasized in the literature, research on leadership development design has not been explored rigorously across changing academic institution settings (Dopson et al. 2018). In a study examining peer-reviewed works on the current HE leadership development program, Dopson et al. (2018) found only 11 empirical studies in HE settings that potentially cover leadership program design. In addition to this, most of the studies on academic leadership development are in the face-to-face format (Dopson et al. 2018). Nevertheless, under the current trend in designing online platforms for professional training and the impact of COVID 19, it appears the potentials of using MOOCs as a tool for leadership development. Unfortunately, studies on MOOC-based leadership training and its related success factors are scarce in the available literature (Caliskan et al. 2021; Griffiths et al. 2021; Koukis and Jimoyiannis 2019).

MOOCs as a tool for leadership development program

The definition of Massive Open Online Courses (MOOCs) is defined based on the combination of various concepts including electronic learning (e-learning), mass communication, knowledge sharing, and openness. Being rooted from the distance learning approach which highlights time and space (Morri, 1997), the MOOC concept emphasizes the importance of learning opportunities in an open learning environment using digital communication artifacts for a considerable number of learners globally (Maya-Jariego et al. 2019).

In academic settings, a variety of MOOCs and studies of their effectiveness have been conducted based on undergraduate education (Douglas et al. 2020; Watted and Barak 2018). However, several studies have indicated that MOOCs not only enact useful instructional strategies for undergraduate programs in higher education, but also have exerted a significant influence on adult learning (Alhazzani 2020). Numerous online professional development programs have been designed using MOOCs (Domingo et al. 2019; Garreta-Domingo et al. 2018; Misra 2018). Hence, there appears to be a strong rationale for MOOC-based leadership programs as a form of professional development.

Dopson et al. (2018) highlighted that leadership development is more effective and has a significant impact on organizational and learning outcomes when it is long-term and collaborative. MOOCs lend themselves well to achieving these design principles, and as such they could be utilized to help address ongoing concerns of leadership programs by providing opportunities for continuing collaboration, follow-up, on-going reflection, or support for learners, all of which promote leadership capacity building and address the drawbacks of traditional leadership training in face-to-face settings.

A large number of studies highlights the importance of interaction and networked learning in leadership development programs (Dopson et al. 2018; Lester et al. 2017; McCauley and Palus 2021). With online leadership training, the interactive and networking possibilities can overcome physical constraints. In this virtual learning environment, learners can collaborate in and through discussion forums to share their thoughts and experiences. These online discussions are not limited within the institutions but can go beyond universities to connect learners in similar activities.

McCauley and Palus (2021) posit that leadership development is correlated to the development of its social capital which focuses on enhancing the networked relationships among multiple individuals. MOOCs would also appear to support the facilitation of networked professional learning as they allow the learners to be connected to learning resources and peers anywhere (Chen et al. 2020). In other words, MOOCs enable course designers to create virtual communities in which learners could carry out practice-centered collegial conversations.

Due to the ongoing changes within academic institutions in the twenty-first century, it is now demanded that leadership development be innovative, more sensitive to context and supportive of institutional transformation (McCauley and Palus 2021; Rishi 2016). Accordingly, leadership programs in HE have progressively emphasized the fostering of shared values and visions among individuals who are taking on different leadership roles (Diep et al. 2016). In this light, cross-university leadership

programs are highlighted to provide opportunities for capacity building, networking, and academic collaboration across institutions and countries. While it would be challenging to organize these kinds of leadership programs in face-to-face environments due to the high costs, time, and learning opportunities, MOOCs appear to be promising as they could effectively address these concerns.

An added rationale for MOOC-based leadership programs has been the recent spread of COVID-19. This global pandemic has simultaneously caused the closure of educational establishments and enhanced the ongoing improvement of online learning in academic institutions (Alhazzani 2020). Leadership training, therefore, is not an exception.

Regardless of the promising opportunities offered by MOOCs, problems emerged when online leadership development training was conducted, including the low participation rate, learners' motivation, modality for delivering online leadership development (Littlejohn et al. 2016; Reyes et al. 2019; Semenova 2020; Sowcik et al. 2018). Not surprisingly, Sowcik et al. (2018) called for further research to evaluate leadership development training in a web-based setting. The empirical findings are useful for educators, course designers to maximize the advantages as well as minimize the drawbacks of the MOOC-based leadership training course. To that end, our study is among the few studies that evaluated the effectiveness and related factors of online leadership development program.

Evaluation of leadership development programs

Effectiveness of leadership development training

The measuring of training program effectiveness is emphasized as a valuable learning strategy to uncover knowledge and to better understand the underlying usefulness and impacts of such programs (Newcomer et al. 2015). Dopson et al. (2016) posit that evaluating the usefulness of the PD program contributes to the development of the program itself, thereby enhancing its effectiveness and its potential impact as well. Regarding the mechanisms intended to evaluate development program outcomes, the most influential framework is the evaluation model developed by Kirkpatrick (1996), which suggests four-level measurement criteria (Fig. 1). More specifically, the first level emphasizes a measurement of learners' reactions to the training course reflected via levels of satisfaction or engagement with the courses. The second level focuses on evaluating perceived knowledge, skills, and competencies obtained through the programs. The third level highlights the changes in learners' behaviour when it comes to the application of knowledge and skills into practice, and the last and highest level in Kirkpatrick's model aims at evaluating the long-term impacts of the training programs on organizational effectiveness (Kirkpatrick and Kirkpatrick 2006). In the current study, levels 1 and 2 were emphasized as outcomes in the research model in order to identify strong contributors to the effectiveness of virtual leadership programs.

Kirkpatrick (1996) states the importance of trainees' reactions as being the essential criterion of effectiveness. In line with this, several studies on

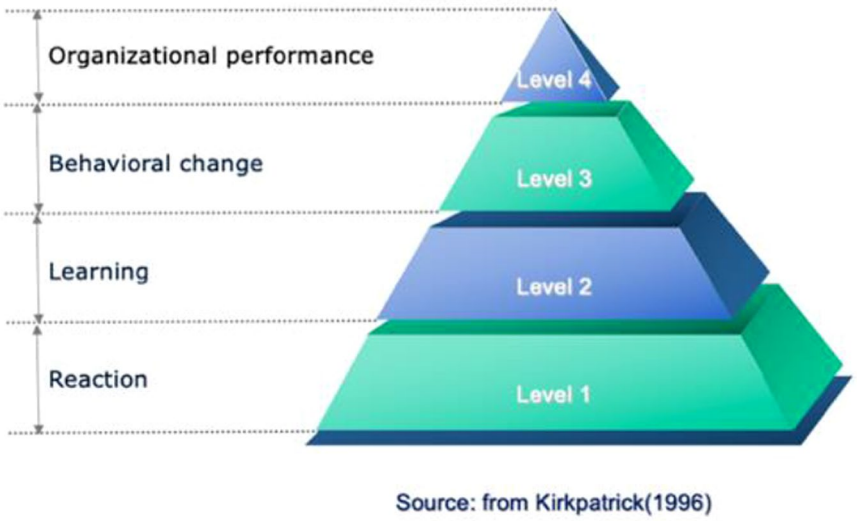

Fig. 1 Kirkpatrick's model

professional development in both face-to-face and online environments have also endorsed the view that evaluating learners' satisfaction and perceived knowledge, and the skills they obtained following completion of the training program is beneficial to optimization of the course designs (Griffiths et al. 2021; Koukis and Jimoyiannis 2019; Post et al. 2019). Thus, satisfaction and perceived learning were emphasized in the present study.

Satisfaction Studies evaluating professional development in educational settings employ satisfaction as an important construct of learning outcomes (Nasser and Shabti 2010; Nir and Bogler 2008). This notion of satisfaction has been adapted from a marketing context referring to "a set of standards or expectation in relation to the product of the service they purchase" (Nasser and Shabti 2010, p. 2740). However, the meaning of this concept varies in the educational contexts. For example, Li and Rienties (2016) generally define satisfaction as the extent to which leaners feel satisfied with their learning experience. Alliger et al. (1997) suggest perceiving satisfaction as being a multi-dimensional construct which consists of effectiveness and application. Morgan and Casper (2000)'s findings illustrate that there are six different dimensions of satisfaction that are preferable for participants, including attitudes toward the content of the training programs and the benefits of such programs. According to Ke and Kwak (2013), online learning satisfaction consists of two main dimensions that are perceived satisfaction with the online course and satisfaction with web-based distance education. In the study on professional development for teachers, Reeves and Pedulla (2011) use general satisfaction scale with three items to evaluate learner's satisfaction with the training course. By nature of this study, we follow Ke and Kwak (2013) and Reeves

and Pedulla (2011) to focus on the general satisfaction of the participants with the online leadership training course.

Perceived effectiveness Perceived learning, as defined by Alavi et al. (2002), is "changes in the learner's perceptions of skill and knowledge levels before and after the learning experience" (p. 406). When it comes to the impact evaluation of a training course, Kirkpatrick (1996) posits that perceived learning can be categorized as knowledge, skills, and attitudes. He also notes that researchers could identify the dimensions that should be emphasized based on the main aims and characteristics of each training program. Along the same lines, the two most popular frameworks of leadership outcome evaluation, namely EvaluLEAD (Black and Earnest 2009) and Logic Models (Russon and Reinelt 2004), also highlight the importance of knowledge and skills obtained from the training courses

Socio-demographic characteristics

Age and gender Concerning age, Chu (2010)'s findings illustrate that learner aged 25–64 tend to achieve better scores than learners aged more than 65 when it comes to internet-self-efficacy, which accordingly influences satisfaction and perceived learning. On the contrary, Ke and Kwak (2013) found that older online learners tend to invest more time into online learning as they appreciate intergenerational interaction. Hence, evaluating how age affects satisfaction and perceived learning may not only provide new empirical results for virtual leadership training, but also potentially shed further light on the mixed findings on online learning for adults.

As for gender, Reeves and Pedulla (2011)'s study found that gender is statistically associated with learners' satisfaction in online professional development programs. A study conducted by Diep et al. (2016) support the assumptions that males tend to show more positive attitudes towards online learning than females. We replicated this study in an online leadership training session so as to evaluate the extent to which gender contributes to differences in the perceived effectiveness of online leadership programs.

Leadership experience In the meta-analysis research on leadership development training, Lacerenza et al. (2017) indicate that leadership experience may affect the reception of individuals into the course. Particularly, junior leaders were found to be more eager to change their habits or attitudes compared to middle-, or senior-leaders (Lacerenza et al. 2017). The reason for this might be the higher status the leaders have. In other words, the higher level of seniority they hold, the more they feel further development or input is not necessary. As there have not been any similar findings in the online leadership programs, the current program has aimed to measure the association between leadership experience and the perceived effectiveness of the programs.

Motivation

Understanding the motivation of learners to participate in learning activities and how this relates to learning outcomes and learning experience have been highlighted

in the literature over the past decade (Douglas et al. 2020; Watted and Barak 2018). As MOOCs are widely used for professional development, recent studies started exploring what motivates learners to join the course (Koukis and Jimoyiannis 2019; Truong and Murray 2019; West et al. 2022). By using qualitative approaches, these studies commonly highlight that motivation of learners to take part in MOOC-based professional training is diverse from personal interest, experience sharing, credentials to social networking. As there are little studies that surveyed motivation of adult learners to partake in MOOC-based professional training, the current study sought to examine the contributing roles of different motivational to effectiveness of online leadership training using quantitative approach. To that end, multidimensional scale developed by Kao et al. (2011) mainly because the measurement construct covers multiple facets of motivation and the closeness of the study context.

Interaction quality

Interactivity and communication play essential role in traditional professional development including leadership training highlighted in both theoretical and empirical research (Lacerenza et al. 2017; McCauley and Palus 2021). Not supprisingly, studies on MOOCs used for proffesional development also suggested that the MOOC design should emphasize building a professional community wherein participants have an opportunities to learn and share their practical experience (Koukis and Jimoyiannis 2019; Loizzo et al. 2017; Mahmood and Bibi 2017). What is less clear in the literature is to what extent interaction quality contribute to the effectiveness of the training, particularly in the comparision with other contribuing factors. Understanding this issue greatly help course designers, instructors and facilitators in constructing an effective programs. Adapted from Diep et al. (2016), the notion interaction quality used in the present study is understood as the degree to which online learners interact with their peers and contribute to discussion activities.

Course content

In the online learning context, course content plays an essential role when it comes to the perceived quality of the training course, and as such has been measured in recent literature (Kim et al. 2021). Diep et al. (2016) posit that posit that learners in virtual learning environments tend to be more engaged and active if the course content is well-structured, relevent and interesting. As those studies conducted only represent the MOOC courses where knowledge construction is underlined, Kim et al. (2021) called for further research with different types of MOOC. Hence, our study shed light on examining the role of course content in the MOOC designs developed from connectivist approach.

Research structure

The research structure of the current research is presented in Fig. 2. The study focused on the following 5 research questions.

1. How do learners' socio-demographic characteristics affect the perceived effectiveness of the MOOC-based leadership program?
2. How do different sources of motivation affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic variables?
3. How does the interaction quality affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic characteristics and motivation?
4. How does the course content variable affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic characteristics, and motivation?
5. What are the strongest predicting contributors to the perceived effectiveness of the MOOC-based leadership program?

Methodology

Context of the study

The data in the current study was collected from three editions of implemented MOOCs on academic leadership development during 2019–2020. The research is undertaken linked to a capacity-building project in higher education funded by European Union's Erasmus + program. The academic leadership development

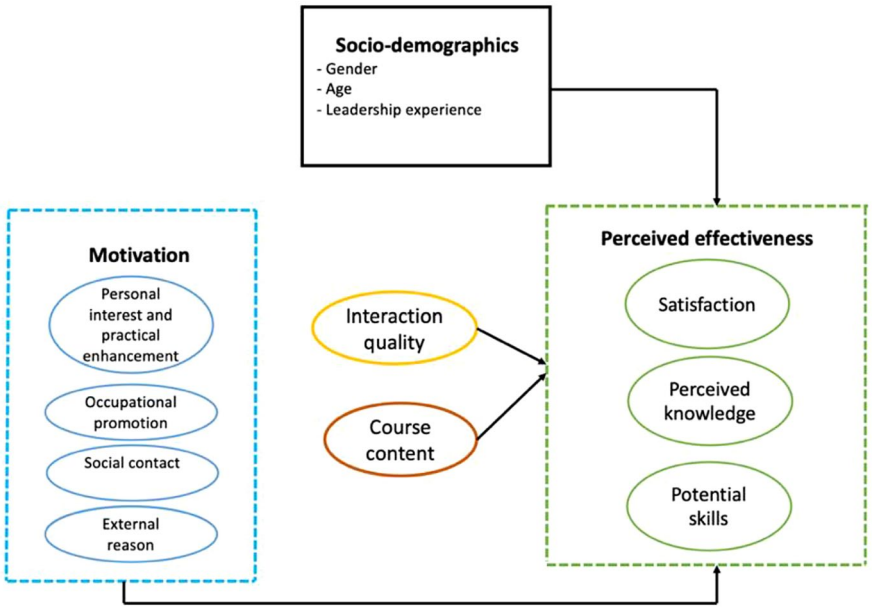

Fig. 2 The research model

MOOC developed under the EU-supported project have been launched since 2018. The course was among the very first free MOOC-based academic leadership programs offered twice a year on the CANVAS platform (https://www.canvas.net/, later in 2021 shifted to https://canvas.instructure.com/ due to the organizational changes of the Canvas Network). The MOOC training course aimed at capacity building on university governance and leadership for leaders and staff working in academic institutions. By using community-based and practice-based learning approaches, the programs were designed for academic leaders and staff working in academic institutions to advance their knowledge and skills on academic leadership. The course consists of four main modules: 1. University Governance Structures; 2. University Governance for Research, Innovation, and Valorisation; 3. Academic Leadership for Education and Internationalization; 4. Comprehensive Academic Leadership: from institutional to personal skills. The MOOC is open for any learners worldwide, and since its launch it has attracted a very wide range of learners from Europe, Asia, North America, South America, Africa, Middle East, etc. In addition to this, the programs, determined by connectivist approach, promoted a learning community where learners can share their experience and broaden their networks, during and after the course. To that end, an online knowledge base and an online interactive platform, called professional community, serves as e-collaborative learning tools was built. Each edition stretched over 12 weeks in which learners self-regulated to follow the course and contribute to the tasks. After the courses, learners still can be active in the professional communities as alumni and take part in follow-up interactive workshops and seminars organized by the course organizers.

Concerning participation rate in the three selected editions, in total, 2145 participants registered for these courses. Regarding the participation in course activities, about 10% of the participants who were active in the course activities such as discussion forums, taking the quizzes, and submitting assignments. In order to obtain the MOOC course certificates, participants need to be actively engaged in course activities and tasks including discussion forums, quizzes and assignments. The criteria for completion is set and communicated to the learners at the start of the course. Therefore, the certificates are only awarded to participants who have actively engaged, completed the course tasks and met the completion criteria.

Research design

The current study presents the findings from a quantitative study of three editions of the online leadership training programs implemented from 2019 to 2020. The main aim of the current study is to uncover unique values of contributors to the effectiveness of the MOOC-based leadership programs. The results can serve as a stepstone for the design of an online leadership program at different organizational levels.

Participants

In total, 191 participants, who were completers of the courses, took part in the surveys. After removing the incomplete and unengaged responses, 185 valid

questionnaires remained. Male respondents account for 68.1% and female 30.3%. As for age range, the majority of the participants aged from 31 to 40 which accounted for 39.5%, following by the age group who were between 41 and 55 years old (31.9%). Concerning leadership experience, respondents who had less than 5 years of leadership experience made up the majority with 74.1%, followed by MOOC learners who had 6–10 years of experience. The sociodemographic characteristics of the participants can be found in Table 1.

Instrument

In the current study, a questionnaire was developed using mostly validated scales from existing studies with the wording adapted to suit the online learning context of adult learners. The socio-demographics of the participants included gender, age, and leadership experience. Motivation to take part in the training course has been measured with the following scales: personal interest and practical enhancement, occupational enhancement, social contact, and external reasons, which were adopted from Kao et al. (2011). Interaction quality and course content were taken from Diep et al. (2016) and Hone and El Said (2016) respectively. Satisfaction, perceived knowledge and skills obtained in the current study were adapted from the literature for satisfaction and perceived learning (Davis et al. 2014; Kirkpatrick and Kirkpatrick 2006).

After the draft questionnaire was developed, two experts were invited to review all of the items. To collect evidence on the validity and reliability of the modified instrument, a pilot study using a small sub-set of survey participants was

Table 1 Sociodemographic characteristics of the participants ($N = 185$)

	Frequency	Percentage (%)
Gender		
Male	126	68.1
Female	56	30.3
Missing	3	1.6
Age ($M = 36.14$, SD = 9.14)		
22–30	53	28.6
31–40	73	39.5
41–55	59	31.9
Leadership experience ($M = 3.97$, SD = 5.25)		
< 5 years	137	74.1
6–10 years	25	13.5
> 10 years	18	9.7
Missing	5	2.7
Group cohort		
The first edition (starting in February 2019)	16	8.6
The second edition (starting in September 2019)	50	27
The third edition (starting in February 2020)	119	64.4

implemented. Based on the analysis of reliability and validity, the final survey for the main study consisted of 43 questions which covered background information of the respondents and the main measured constructs. Appendix 1 illustrates the constructs with the corresponding number of measured items and sample items. The whole questionnaire can be found in Appendix 2.

Analysis method

Confirmatory Factor Analysis (CFA) was utilized to perform measurement validation. Afterward, a sum of rating scores for each scale was calculated. Subsequently, the average scores were used in hierarchical multiple regression analysis. The advantage of using hierarchical multiple regression is that it allowed the researchers to measure which potential predictor variables have the most predictive power. Lavaan package in R developed by Russeel (2011) was utilized to perform the analyses.

Results

Measurement validation

The instrument validity was tested using CFA as the subscales had been validated and tested by previous studies alongside the pilot study. The findings shows that the measurement model with nine factors is distinctive and appropriate: the χ^2 value of the model equals 984.152 with 629 degrees of freedom, with this value having a p value smaller than 0.001. However, the χ^2 test is known to be sensitive to normality assumptions, so we have preferred to use alternative indices to evaluate the overall model fit. The RMSEA (0.02) falls well below the common boundary of 0.05 (Browne and Cudeck 1992); CFI (0.99) indicates a good model fit while TLI is also above the acceptable fit (0.99) (Hu and Bentler 1999). This leads to the conclusion that the overall fit of this CFA is acceptable. The factor loadings are also above the cut-off values (Truong and McColl 2011; Hulland 1999), which means that the indicators have measured the latent concepts adequately. All of the items passing the CFA were then tested for internal consistency. The Cronbach's alpha for each subscale was also satisfactory, ranging from 0.73 to 0.94.

As the valid responses were collected from three editions of the MOOC course on leadership development, ANOVA was performed to evaluate whether perceived learning outcomes were different among the three cohorts. The results of this ANOVA demonstrated that there were nonsignificant differences among the three groups regarding satisfaction, perceived knowledge and skills obtained ($F = 1.41$, $p = 0.16$; $F = 0.91$, $p = 0.55$; $F = 1.04$, $p = 0.41$ respectively).

Findings

In the current study, hierarchical multiple regression was exploited to investigate the impacts of sociodemographic variables, motivation scales, interaction quality, and

the course content on learners' satisfaction and perceived learning outcomes. Socio-demographic factors including gender, age, and leadership experience were entered into the first block; motivation, which includes four sub-scales, was entered into Block 2, while interaction quality was entered into Block 3, and the course content was entered into Block 4. This results in four models in each of the multiple regression analyses. A model is chosen when it significantly adds a greater explained variance to the former model, demonstrated by a significant R-squared change (ΔR^2). Table 2 interprets the findings of the four hierarchical multiple regressions analyses for three dependent variables including satisfaction, perceived knowledge, and the potential skills obtained.

According to Table 2, three predictors of the socio-demographic group were entered into the first model: gender, age, and leadership experience. This model explained the variance in satisfaction, perceived knowledge, and potential skills with $R^2 = 0.01$, $R^2 = 0.02$, and $R^2 = 0.01$ respectively. Following the entry of the four scales of motivation in step 2, the total variance explained by the model as a whole was 46% for satisfaction, 39% for perceived knowledge, and 35% for potential skills. The introduction of different sources of motivation explained an additional 45% variance in satisfaction, 37% in perceived knowledge, and 34% in potential skills after controlling for socio-demographic variables. In step 3, interaction quality was entered into the model; by adding this new variable, the new model significantly explained an additional 3% variance in satisfaction, 4% in perceived knowledge, and 7% in potential skills after controlling for socio-demographic variables and motivation. In the final adjusted model, the course content variable was added to the block, with the results indicating that the total variance explained by the model as a whole was 69% for satisfaction, 75% for perceived knowledge, and 60% for potential skills. Figure 3 depicts the main findings of the study. Of this, the variables in dotted squares and circles illustrate nonsignificant effects.

RQ1 *How do the learners' socio-demographic variables affect the perceived effectiveness of the MOOC-based leadership program?*

As can be seen in Table 2, model 1 summarizes the association between gender, age, and leadership experience and three dependent variables. As can be seen, all socio-demographic predictors did not make a significant contribution to the variance of the three outcome variables.

RQ2 *How do different sources of motivation affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic variables?*

Model 2 introduced different sources of learning motivation to the block. The results presented a significant ΔR^2 across the three aspects of perceived effectiveness as found in Table 2. Only personal interests and practical enhancement were identified as being significant predictors to the three components of perceived learning effectiveness, $\beta = 0.85, p < 0.001$ for satisfaction, $\beta = 0.57, p < 0.001$ for

Table 2 Coefficients from Hierarchical multiple regression analysis of perceived learning effectiveness (satisfaction, perceived knowledge and potential skills obtained)

	Coefficients			
	Model 1	Model 2	Model 3	Model 4
Satisfaction				
Gender (female)	− 0.01	0.07	0.07	0.04
Age				
31–40 vs 18–30	− 0.05	− 0.03	0.01	0.01
41–55 vs 18–30	− 0.13	0.05	0.06	0.05
Academic leadership experience				
6–10 years vs 0–5 years	0.06	− 0.06	− 0.08	− 0.11
More than 10 years vs 0–5 years	0.23	− 0.05	− 0.10	− 0.16
Motivation patterns				
Motivation: PE		0.85***	0.80***	0.54***
Motivation: OP		0.01	− 0.01	− 0.04
Motivation: SC		0.04	− 0.07	− 0.09
Motivation: EE		− 0.06	− 0.04	− 0.03
Interaction quality			0.30***	0.06
Course content				0.69***
R^2	0.01	0.46***	0.49***	0.69***
Adjusted R^2	− 0.02	0.42	0.46	0.67
ΔR^2		0.45***	0.03***	0.23***
Perceived knowledge				
Gender	− 0.01	0.08	0.07	0.03
Age				
31–40 vs 18–30	− 0.07	− 0.07	− 0.03	− 0.02
41–55 vs 18–30	− 0.17	0.01	0.02	0.01
Leadership experience				
6–10 years vs 0–5 years	0.08	− 0.01	− 0.03	− 0.07
More than 10 years vs 0–5 years	0.31	0.05	− 0.01	− 0.08
Motivation patterns				
Motivation: PE		0.57***	0.51***	0.18
Motivation: OP		0.09	0.07	0.03
Motivation: SC		0.03	− 0.09	− 0.12
Motivation: EE		0.09	0.05	0.10
Interaction quality			0.34***	0.05*
Course content				0.88***
R^2	0.02	0.39***	0.43***	0.75***
Adjusted R^2	− 0.01	0.35	0.40	0.73
ΔR^2		0.37***	0.04***	0.32***
Potential skills				
Gender	− 0.02	0.05	0.06	0.02
Age				
31–40 vs 18–30	− 0.01	− 0.02	0.04	0.04

Table 2 (continued)

	Coefficients			
	Model 1	Model 2	Model 3	Model 4
41–55 vs 18–30	− 0.03	0.13	0.15	0.14
Leadership experience				
6–10 years vs 0–5 years	− 0.04	− 0.15	− 0.19	− 0.21
More than 10 years vs 0–5 years	0.15	− 0.07	− 0.13	− 0.1
Motivation patterns				
Motivation: PE		0.43**	0.36*	0.10
Motivation: OP		0.14	0.11	0.08
Motivation: SC		0.05	− 0.10	− 0.11
Motivation: EE		0.10	0.05	0.10
Interaction quality			0.42***	0.14**
Course content				0.67***
R^2	0.01	0.35***	0.42***	0.60***
Adjusted R^2	− 0.02	0.31	0.38	0.57
ΔR^2		0.34***	0.07***	0.18***

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

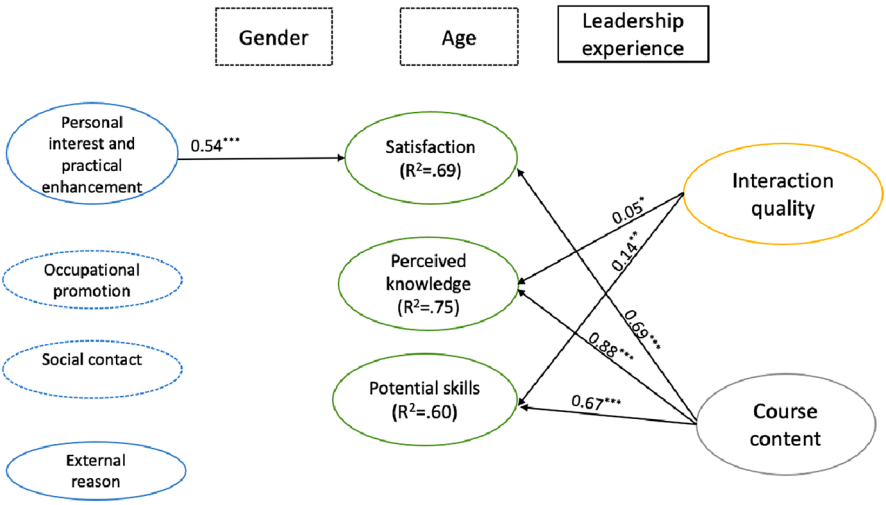

Fig. 3 The research model with standardized coefficients and explained variance (R^2). (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$)

perceived knowledge, and $\beta = 0.43, p < 0.01$ for potential skills. On the contrary, the contribution of occupational promotion, social contact, and external reasons to satisfaction, perceived knowledge and skills obtained was not statistically significant.

RQ3 *How does the interaction quality affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic characteristics and motivation?*

Including interaction quality in model 3 consistently demonstrates a significant ΔR^2 in all three of the dependent variables. The results indicated that interaction quality significantly predicts satisfaction, perceived knowledge, and potential skills with $\beta = 0.30, p < 0.001$ for satisfaction, $\beta = 0.34, p < 0.001$ for perceived knowledge, and $\beta = 0.42, p < 0.001$ for potential skills.

RQ4 *How does the course content variable affect the perceived effectiveness of the MOOC-based leadership program after controlling for socio-demographic characteristics, motivation, and interaction quality?*

The last model added the course content variable to examine its effect on satisfaction, perceived knowledge, and potential skills obtained after the courses had concluded while controlling for socio-demographic characteristics, different motivators for taking the course, and interaction quality. The results indicate that course content significantly predict the three aspects of learning outcomes ($\beta = 0.69, p < 0.001$ for satisfaction, $\beta = 0.75, p < 0.001$ for perceived knowledge, and $\beta = 0.67, p < 0.001$ for potential skills).

RQ5 *What are the strongest predicting contributors to the perceived effectiveness of the MOOC-based leadership program?*

As presented in Table 2, among the nine predicting variables, the most important predictor of perceived learning was motivation, which uniquely explained 45% of the variation in satisfaction, 37% of that in perceived knowledge and 34% in potential skills.

When all of the predictors were included in stage four of the three regression models, the adjusted models significantly contributed to explaining the variance of perceived learning effectiveness. Together, the nine independent variables accounted for 69% of the variance in satisfaction, 75% in perceived knowledge achievement, and 60% in potential skills obtainment. As well, looking at the individual predictors (Fig. 3), the results clearly demonstrate that the course content variable was the most significant and strongest contributor to satisfaction with $\beta = 0.69, p < 0.001$, followed by a sub-scale of motivation "personal interests and practical enhancement" with $\beta = 0.54, p < 0.001$. On the contrary, socio-demographic characteristics, the last three components of motivation, and interaction quality were found to be non-significant contributor of satisfaction.

Concerning perceived knowledge, the findings indicate that course content and interaction quality were significant and strongest contributors to perceived knowledge with $\beta = 0.88, p < 0.001$ and $\beta = 0.05, p < 0.05$.

As for potential skills obtained after finishing the courses, the findings show that course content was the strongest predictor with $\beta = 0.67, p < 0.001$.

Interaction quality was also found as a strong contributor of potential skills with $= 0.14, p < 0.05$.

Discussion

The trend of using MOOC in higher education and the substantial changes caused by COVID 19 fundamentally increased the interest of using MOOC in professional development. Recent studies have been examine the feasibility and effectiveness of this type of training (Griffiths et al. 2021; Misra 2018; Truong and Murray 2019). Unraveling related factors of the MOOC based professional development to learning effectiveness using quantitative method is vital to further advance understanding of predictors that contribute to learning effectiveness. To that end, the current study was designed to identify contributing roles of design course factors to the variance on learning effectiveness of MOOC-based leadership programs. In addition, the study sought to identify the strongest predicting variables to the training effectiveness.

Socio-demographic effects

The present study endorses the view that there are no significant differences in satisfaction, perceived knowledge, and skills obtained between participants who differ in gender, age, and leadership experience. The negative correlation between age and perceived learning outcomes is in line with Ke and Kwak's findings (2013) and (Diep et al. 2016). Concerning gender, the data analysis results reveal the non-significant effect of gender on the three outcome variables. The results thus contradict Reeves and Pedulla's findings (2011), indicating the significant role of gender in predicting satisfaction with the professional training program. A possible reason for this could be the majority of learners in the MOOC-based leadership programs are male, which accounted for 68.1% of the whole sample. Concerning leadership experience, the findings indicate that there are no differences among satisfaction, perceived knowledge and potential skills obtained following the course among learners who differ in leadership experience. These findings are contradict Lacerenza et al. (2017). The possible reason for this could be due to the characteristics of the learners themselves. However, there might be a balance between trainee groups who differ by leadership experience in face-to-face learning platform but not in virtual learning environment. The current study reveals that the majority of learners were those who have less than five years of leadership experience. Further research is thus recommended to verify this assumption.

Motivation patterns

The findings endorse the view that the four subscales of motivation have different effects on learning outcomes of the online leadership program.

Regarding satisfaction, personal interests & practical enhancement represented the only motivational pattern which made a contribution to variance in learning satisfaction.

This finding is consistent with several studies on online learning (Kao et al. 2011; Watted and Barak 2018). Conversely occupational promotion, social contact, and external reasons were found to be non-significant predictors of satisfaction when it comes to MOOC-based leadership programs. Even though McCauley and Palus (2021) stresses a vital role of networking in leadership development programs, the motivation for social contact did not have a substantial influence in the online leadership training program.

Concerning perceived learning, the study does not support the positive effects of motivation patterns on perceived knowledge and potential skills obtained after the course. The reason could be that the relationship between motivation and perceived learning may be mediated by satisfaction. Further research is thus recommended to verify the hypothesis.

Interaction quality

The findings in the current study demonstrate that interaction quality did not contribute to the variance in learning satisfaction. According to Diep et al. (2016), interaction activities over virtual learning platforms depend on several factors, such as the norm of reciprocity, or a sense of belonging. Thus, we propose including those dimensions in future research to clarify the role of interaction in the online leadership programs. Conversely, interaction quality was found to significantly predict perceived learning, including knowledge and potential skills.

Course content

These findings revealed that course content was the strongest predictor of the leadership training effectiveness in a virtual learning environment. The findings is in line with Kim et al. (2021). It means that regardless of the theoretical disciplines the course relies on (connectivist approach or constructivist approach), course content still plays the most essential role to learning satisfaction and perceived learning. The reasons could be explained in multiple ways. It is possible that participants tend to participate in the programs for the main purpose of expanding their knowledge and skill and did not opt for learning and social interaction via the course. The other possible reason could be explained by Diep et al. (2016) indicating that if the course content is considered to be more or equally effective to peer interaction, adult learners preferably opt for the former option. Further research would help to establish a greater degree of accuracy on this matter.

Conclusion and implication

The purpose of the current study was to determine the contribution of motivation patterns, interaction quality, and course content on perceived learning effectiveness of the MOOC-based leadership development programs. The findings further knowledge regarding the design and implementation of a professional training in virtual learning environment. The added value of the research lies in addressing the gaps on unveiling predicting factors on the perceived effectiveness of academic leadership development

MOOC. Based on the findings, we highly recommend that MOOC providers, when preparing online courses on leadership development, should adopt strategies to identify those learners with varying motivational orientations. A short survey of the learners' demographic backgrounds and motivations for participating in the course given at the beginning of the program is recommended in order to classify the motivational orientations of learners and facilitate interaction activities. The results of this investigation show that interaction quality does not contribute significantly to learners' satisfaction with the MOOC-based leadership courses but the perceived knowledge and skills. Thus, an online leadership program in which leaners have opportunities to interact and collaborate with their peers is recommended. Additionally, our findings make it clear that interactive collaborative learning environments for online leadership training could be established via discussion activities, peer evaluation, and networking forums The study found that in a MOOC-based design wherein learning community and practice sharing enhancement are centered, course content is still the strongest predictor of the course effectiveness, followed by interaction quality. As such, MOOC instructors or designer of online leadership program need to understand this requires and have appropriate course content more than simply providing and assigning training materials.

Limitation and recommendations for further research

Despite the significant contribution of this research to the literature, there have been certain limitations of the findings that should nevertheless be noticed. Firstly, due to the limitations caused by the sample size while striving to ensure the validity and consistency of the model, our study was limited to evaluating specific indicators which were expected to be associated with perceived effectiveness of MOOC-based leadership development course. Further research, which should encompass additional indicative factors that potentially affect on the effectiveness of such training programs, is recommended. Secondly, the sampling issue is another limitation in the current research. Sampling was based on voluntary participation. Consequently, the equality of the group sizes divided by countries, educational levels, and leadership experience were not guaranteed. Thus, future research which overcomes this limitation will assist with improving the generalizability of our findings. Thirdly, it is beyond the scope of this study to provide explanations as to why course content is the strongest predictor of the MOOC course based on connectivist discipline and whether different types of motivation affect interaction quality of the training courses. Further study on different types of MOOC is recommended to compare the results.

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Ethical statement This study was conducted under the framework of a large project under the Erasmus+ Capacity Building in Higher Education program. All participants were informed about confidentiality, the purpose, the design of the study, and the voluntary nature of the participation. Written consent was sought from the participants for data publication, and the participants were informed that they could withdraw from the study at any time.

Appendix 1. Constructs according to the number of items measured and sample items

Constructs	No. of items	Sample items
Motivation: personal interest and practical enhancement	6	I registered for this course to enhance my self-growth in university governance and academic leadership
Motivation: occupational promotion	3	I registered this course for preparing for my career/job
Motivation: social contact	3	I registered for this course to exchange ideas about academic leadership
Motivation: external reasons	3	I registered for this course because my time for learning is flexible
Interaction quality	6	During online interactions with other learners, I shared information (references, interesting websites and projects), which I had found useful with my classmates
Course content	3	This course effectively challenges me to think
Satisfaction	5	I felt satisfied with the overall experience with MOOC being used to learn about university governance and academic leadership
Perceived knowledge gained	7	After the course, I had a better understanding of old and new challenges to higher education in different contexts
Potential skills obtained	4	After the course, I feel more confident about tackling unfamiliar problems

Appendix 2. The questionnaire

Personal interest and practical enhancement ($M = 3.36$, SD = 0.61, Cronbach's alpha = 0.91)	Loadings
Self-growth enhancement in university governance and academic leadership	0.79
Personal enquiring mind	0.62
Learn for the joy	0.81
Adapt to new academic leadership styles in the future	0.87
Learn experiences from different institutions and countries (in different contexts)	0.74
Enhance competence in university governance and academic leadership	0.82
Occupational promotion ($M = 3.18$, SD = 0.73, Cronbach's alpha = 0.86)	Loadings
Obtain better qualifications in academic leadership	0.85
Career/job preparation	0.87
Getting higher job status	0.81
Social contact ($M = 3.06$, SD = 0.77, Cronbach's alpha = 0.87)	Loadings
Exchange ideas about academic leadership	0.86
Make more friends with the same interest	0.77

Social contact ($M = 3.06$, SD = 0.77, Cronbach's alpha = 0.87)	Loadings
Learn with other leaders and academic staffs	0.82
External reasons ($M = 3.05$, SD = 0.72, Cronbach's alpha = 0.73)	Loadings
The time for learning is flexible	0.79
Limited time to join offline training courses	0.59
No training courses in academic leadership within institutions	0.55
Interaction quality ($M = 2.96$, SD = 0.70, Cronbach's alpha = 0.92)	Loadings
Sharing information (references, interesting websites and projects)	0.74
Contribute information related to the topic under discussion	0.78
Providing examples to illustrate viewpoints	0.82
Examining the information and viewpoints provided	0.89
Expressing agreement or disagreement on my peers' arguments provided	0.86
Commenting on other peers' thoughts and ideas to keep the discussion going	0.86
Course content ($M = 2.96$, SD = 0.63, Cronbach's alpha = 0.89)	Loadings
Course content challenges	0.74
Course assignments	0.78
Course content updates	0.82
Satisfaction ($M = 3.29$, SD = 0.59, Cronbach's alpha = 0.91)	Loadings
Satisfaction with the overall experience with the MOOC course	0.82
Enjoyment when learning the course	0.90
Satisfaction with what have learnt in the course	0.92
Recommending the course to other colleagues/ friends	0.76
Perceived knowledge gained ($M = 3.28$, SD = 0.54, Cronbach's alpha = 0.94)	Loadings
Perceived knowledge obtained after finishing the course	0.82
Understanding of old and challenges for higher education in different contexts	0.87
Understanding of challenges academic leaders are facing	0.87
Understanding of university structures in diverse contexts	0.79
Perceived knowledge on different leadership approaches in university governance	0.86
Perceived knowledge on university operations and governance structures	0.81
Perceived awareness of the roles of leaders for university innovation and globalization	0.72
Potential skills obtained ($M = 3.27$, SD = 0.56, Cronbach's alpha = 0.88)	Loadings
Skills in term of internalization	0.76
Skills in developing university innovation strategies	0.86
Skills in tacking unfamiliar problems	0.80
Skills in engaging colleagues to develop and achieve academic visions	0.83

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