FACTORS THAT MAY IMPACT CURRICULUM DESIGN IN HIGHER EDUCATION IN A VUCA WORLD

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ABSTRACT

Higher Educational Institutions (HEIs) have been characterized by volatility, uncertainty, complexity, and ambiguity (VUCA), with the Covid-19 pandemic being a recent example, which significantly affected higher education worldwide. The aim of this research was to better understand which components of curricula are sensitive to potential VUCA-like events, and which VUCA events one may foresee that may impact study programs and teaching. A survey was developed to gather data, and thirty-seven faculty members with experience in curriculum design from six countries participated in the survey which was carried out in 2023. To start with, we outlined the different components of a curriculum which then formed the basis for evaluating their perceived sensitivity to VUCA-like events. Based on the survey we then analyzed and summarized the factors that may potentially impact the curriculum. The components of a curriculum that are most sensitive to VUCA-like events are the ones directly related to the actual teaching and learning processes. In addition, the study findings indicated that when considering potential VUCA-like events, Artificial Intelligence (AI) was expected most likely to significantly affect educational programs, followed by events such as disinformation online, cyberattacks, disrupted online communication, as well as climate change and natural disasters. The increasing VUCA characteristics of the world are expected to affect the curriculum in general and in particular the actual teaching and learning. Therefore, HEI leaders and curriculum designers need to ensure that the HEI system is responsive to the VUCA-like events and that the system becomes resilient.

KEYWORDS

Curriculum design, curriculum sensitivity, VUCA events, CDIO Standards: 1-12.

INTRODUCTION

Most countries provide educational guidance on what to teach and the educational process at each school level; this guidance is referred to as the curriculum or curriculum standards. The curriculum is important to identify the focus of the content, describing the degree of learning appropriate for the preparation of students for the future, and to ensure the introduction of the content in relation to the goal of the education. The complexity of the modern world requires a curriculum that transcends disciplinary boundaries, and which is resilient (Ciolacu et al., 2023; Ramsaroop, 2023). Interconnected global challenges such as climate change, economic inequality, and technological innovation demand an interdisciplinary approach to education. Curriculum designers must emphasize the integration of diverse perspectives, fostering a holistic understanding of complex issues and preparing students to engage with multifaceted problems (Ciolacu et al., 2023).

In the ever-evolving landscape of higher education, educators and curriculum designers find themselves grappling with the challenges posed by the volatile, uncertain, complex and ambiguous (VUCA) nature of today´s world (Pannipa et al., 2023; Rouvrais et al., 2023), which has been characterized by pandemics, wars, and erratic weather (Rockley, 2022), and an uncertain future which may bring about further surprises. Multiple disruptions in Higher Educational Institutions (HEIs) over the years have resulted in curriculum leaders having to consider the relevance and impact of the programs that are offered. The Covid-19 pandemic was particularly disruptive for higher education as a whole (Ramsaroop, 2023), and resulted in many HEIs being pushed rapidly into much-needed technological advancement (Ciolacu et al., 2023). HEIs have to be proactive and agile to be able to respond to the multiple disruptions in the external and internal environments.

In engineering education, the principles of VUCA offer a strategic lens through which to comprehend and address the multifaceted landscape that engineers must navigate (Kamp, 2023). Furthermore, program leaders have to design and operationalize their curricula in a context of unknown changes (Ciolacu et al., 2023). Designing a curriculum involves defining and describing its components and structure (van den Akker, 2004). When ascertaining the factors that may impact the curriculum, in particular from potential VUCA-like scenarios, one way to do so is to look at the effect they may have on these components.

The authors of the paper are part of a project called DECART and are from the fields of STEM and management education. The project is an international cooperation partnership, including France, Germany, Iceland, Indonesia, Lithuania, and South Africa. The primary goal is to allow partner’s organizations to develop new practices and methods as well as sharing and confronting ideas in curriculum design, with a focus on Designing higher Education Curricula for Agility, Resilience and Transformation. Here in this paper, we focus on one aspect of the project by examining curriculum design within the context of a VUCA world.

In this paper, we present results from a survey that was carried out to better understand which components of curricula are sensitive to potential VUCA-like events, and also VUCA events one may foresee that could impact study programs and teaching in higher education. The respondents who completed the survey are mostly from STEM and management education.

LITERATURE REVIEW

Policy documents from OECD and UNESCO emphasize the need to support today's students to develop skills and attitudes to survive and succeed in a VUCA world (Hadar et al., 2020). Looking through the VUCA lens provides an opportunity to understand the dynamic forces at

play in the contemporary educational environment (Ramsaroop, 2023; Niemczyk, 2023). As industries undergo rapid technological advancements, globalization reshapes collaboration, and societal needs evolve. It becomes imperative for higher education curriculum designers to adopt an adaptive, forward-thinking approach.

In the abbreviation VUCA, volatility refers to the frequent, rapid, and unpredictable changes that characterize today's world (Bennett & Lemoine, 2014). It is critical to understand the opportunities and threats which are present in the situation, and to embrace agility to deal with the volatility. Uncertainty acknowledges the lack of predictability and the prevalence of unknowns, and essentially relates to the lack of adequate information (Bennett & Lemoine, 2014). Complexity recognizes the intricate interconnections that shape educational contexts, with a complex situation being defined by many interconnected parts (Bennett & Lemoine, 2014). Ambiguity acknowledges the haziness of situations where cause-and-effect relationships are unclear, and where there is little precedent to enable predictions to be made (Bennett & Lemoine, 2014). In the realm of curriculum design, embracing VUCA is not merely a response to these VUCA challenges, but an opportunity to foster resilience, innovation, and lifelong learning skills among students.

Prideaux (2003) argues that “The curriculum represents the expression of educational ideas in practice. The word curriculum has its roots in the Latin word for track or race course. From there it came to mean course of study or syllabus. Today the definition is much wider and includes all the planned learning experiences of a school or educational institution”. Curriculum furthermore refers to the formal requirements for the degree or syllabus, and is usually composed of contents and topics relating to lectures, reading lists, and content knowledge (Annala & Mäkinen, 2011). The more holistic definition of the higher education curriculum provided refers to “an intentional and dynamic process, which reveals the values and principles in relation to learning, knowledge and disciplines, and cultural and political purposes of HE” (Annala & Mäkinen, 2011, p. 4).

RESEARCH METHODOLOGY

To achieve the aim of this research, as stated in the Introduction section, we developed an online survey. As is evident from the above review of the literature, a curriculum may have varied meanings and different structures, so we started out by analyzing the structure of actual curricula used in STEM and management education for the purpose of this research. Firstly, the curriculum is designed within the overarching external constraints, which may include national policies, stakeholders, and accreditation bodies. Secondly, curriculum is often presented as a set of components (e.g. van den Akker, 2004; Jonnaert et al., 2021).

In this research, we used actual examples of curricula presented by all six partners in the DECART project and based on an analysis of them, we developed a harmonized curriculum model consisting of nine components. This model is in general agreement with conventional curriculum models (e.g. van den Akker, 2004), with some components being basically the same, but there are additional components which include stating explicitly entry requirements (#2), on interpersonal skills (#6), language (#8) and ethno- and sociographic aspects (#9). As the model is based on actual curriculum, it may reflect more the current situation concerning programs in higher education. The components of this harmonized curriculum model, and which are used as the basis in the main survey, are:

1. Main goals and learning outcomes of the program, including its objectives.
2. Entry requirements for students entering the program.
3. Structure and content of the program, including the sequence of courses, content and learning activities and length of program.
4. Teaching methods and learning in the program, including the role of the teacher and teaching material.
5. Location of teaching and learning in the program, including being on campus or not, or a hybrid combination.
6. Teaching and learning of interpersonal skills in the program, including communication and teamwork.
7. Assessment methods in the program.
8. Language of instruction in the program.
9. Ethno- and sociographic aspects of the program, including diversity and equity.

A survey was conducted; a preliminary version of the survey which was developed initially focused only on VUCA events and then it was later finalized and constitutes the main survey. The preliminary survey was conducted in June of 2023 with a small subset of the respondents that participated in the main survey which was conducted in October and November of 2023. The main survey was sent to several faculty members at six different institutions of higher education, all of which are involved in the DECART project. At each institution, one person was responsible for sending the survey to faculty members that were either directly involved in curriculum design or responsible for running educational programs. These members received a link to the survey which was conducted online.

In the survey, the faculty were asked to consider which components of the harmonized curriculum model might be affected by some VUCA-like events, and also which potential VUCA scenarios they foresee might happen in the future and affect current educational programs. The purpose was to evaluate the sensitivity of different components of the curriculum to unexpected VUCA-like scenarios. The survey was composed of four parts. The first part presented three background questions, i.e. on involvement or experience with STEM, management or other education, on expertise in curriculum design, and the country where one is based. This was followed by nine questions directly related to the different components of the curriculum model as outlined above. The third part presented six general questions on specific potential VUCA-like scenarios. The fourth part was to allow respondents to make open remarks on potential VUCA-like scenarios that may impact the program, as well as on the survey in general. As VUCA is not a common term and perhaps not understood in the same way by all, in the survey we used the phrase ”unexpected and forceful event”. The scale used for the responses were based on the five-point Likert scale, with “Totally disagree” and “Totally agree” at the ends of the scale.

When asked to rate their expertise of program curriculum design, 35 out of 37 respondents indicated expertise, and only two out of the 37 indicated that they had little or no expertise. Table 1 shows the total number of respondents.

Table 1. Number of respondents, field of education and countries.

	Involved with STEM education	Involved with Management education	Other	Total
France	4	5	0	9
Germany	4	0	0	4
Iceland	8	0	0	8
Indonesia	2	1	1	4
Lithuania	4	1	1	6
South Africa	0	6	0	6
Total:	22	13	2	**37**

There are several ways to analyze the data based on the responses on the Likert-scale, including statistical methods or simple fractions. Here we want to focus on the number of respondents that agree with the given statement compared to the respondents that disagree. Therefore, to distinguish these positive agreements, we used the number of responses in categories “Strongly agree” and the one next to it (“Agree”) and compared it to the number of responses in “Strongly disagree” and the category next to it (“Disagree”) by using a simple ratio of the two. This bias ratio is labeled *R* in Tables 2 and 3. In the analysis of the data, we consider a response convincingly positive if the bias ratio *R* is two or higher and the mode is on the positive side, i.e. either “Agree” or “Strongly agree”.

RESULTS AND DISCUSSION

Sensitivity of components of the curriculum

In the survey, nine statements were focused on the sensitivity of each of the different curriculum components to VUCA-like scenarios. The components were the ones of the adapted curriculum model as presented in the Introduction section. All the statements had the same structure, i.e. “I am concerned that the *main learning outcomes* of the program, including its goal and objectives, will change significantly in the near future due to unexpected and impactful events”, and so on. The words in italics in exemplary statements above were replaced by the ones listed in Table 2. Counts of the responses are presented in Table 2.

Table 2. Sensitivity of different curriculum components. Entries represent the number of responses for each category.

	Likert scale category					
Component	Strongly disagree				Strongly agree	*R*
1. main learning outcomes	4	7	**11**	10	5	1,4
2. entry requirements	5	8	**11**	8	5	1,0
3. structure of the program	3	8	8	**11**	6	1,5
4. teaching methods	3	5	7	**15**	7	**2,8**
5. location of teaching and learning	1	9	7	**16**	4	**2,0**

6. teaching of interpersonal skills	2	7	7	**13**	7	**2,2**
7. assessment methods	3	6	8	**13**	7	**2,2**
8. language of instruction	**10**	9	7	8	3	0,6
9. ethno- and sociographic aspects	2	**13**	8	10	4	0,9

Four components have both distinctly higher *R* than the rest of the statements and modes on the agree-side, satisfying our criteria of being convincing. Therefore, there are four components of the curriculum that the respondents were concerned about that may change, and may therefore be more sensitive to unexpected and impactful events. These four components are Teaching methods (*R*=2,8), Location of teaching and learning (*R*=2,0), Teaching of interpersonal skills (*R*=2,2) and Assessment methods (*R*=2,2).

The sensitivity of Teaching of interpersonal skills (#6) may be due to shifts in the world of work, coping with studies, and perhaps this is a skill that has not received enough attention over the years. One may argue that the other three (#4, 5 and 7) of these components are considered more sensitive because of the impact of the Covid-19 pandemic, like online teaching and learning, more options in teaching methods and assessments, and the uncertain effects that AI may have on higher education. These changes will certainly affect faculty, as they have no option but to adapt, but they may not know how exactly to do so.

Potential VUCA events

The statements on six specific potential VUCA events in the main survey were based on the most frequently mentioned events in the preliminary survey. In the main survey, all six statements had the same structure, i.e. “I am concerned that *AI (Artificial Intelligence)* will significantly affect the program.”, and similar for the other five events (the words in italic were replaced in each statement by the ones in Table 3). The results are shown in Table 3.

Table 3. Number of responses regarding suggested VUCA like events.

	Likert scale category					
Event	Strongly disagree				Strongly agree	***R***
AI (Artificial Intelligence)	6	7	3	**13**	8	**1,6**
global warming	4	**11**	7	**11**	4	1,0
international conflict	7	5	8	**13**	3	1,3
local unrest or conflict	8	9	**11**	7	2	0,5
local access to electricity	**12**	11	3	8	3	0,5
too few students	6	8	**12**	6	5	0,8

Of the suggested events, only AI stands out as a major area of concern, when considering both the mode of responses and the bias ratio *R*. Local access to electricity appeared to be of least concern (on the other hand load-shedding is rather common in South Africa). The bimodal response for Global warming is intriguing and indicates that concern for it may be site dependent, and the same applies for local access to electricity. Although we use the term event, some of them may be prolonged over some time and still have the VUCA characteristics.

AI may be so prevalent in the survey because it is so topical today in daily discussions, but it is also clear that AI poses both a threat as well as creates opportunities for higher education, both in terms of teaching and learning, and in the assessment of students. How HEIs deal with AI and take advantage of it, is outside the scope of the survey and this research.

Qualitative results on not foreseen and potential VUCA events

In both the preliminary and the main survey, some questions were directly related to potential VUCA events. In the preliminary survey, we asked about VUCA events in three different timeframes, i.e. events that one was not able to foresee, and then events that one may anticipate in the next three and in the next 50 years. As the events indicated for these two latter timeframes were similar and the results from the main survey were comparable, the listings from both were combined. In the main survey we asked: *"Outline the events or items that you are concerned about that may affect the program or your teaching due to an unexpected and drastic event. Up to five (5) items can be mentioned"*. This was implemented by filling in the underlined space: "I am concerned that _____ will significantly affect the program or my teaching." These potential events are summarized in Table 4, and are often rephrased for the sake of brevity.

Table 4. VUCA events that have already occurred and potential VUCA events in the future.

VUCA events that you have encountered or have already taken place, that you were not able to foresee:	Potential VUCA events in the near future that may significantly affect the program or my teaching (the first items are in order of how often they were mentioned):
• Covid-19 • software crash • no electricity • no classroom • sudden online teaching • student strikes • cancellation of classes due to low student enrolment • availability of faculty for specific courses.	• AI • disinformation online • cyberattack, disrupted online communication • climate change and sustainability megatrends • natural disasters • political instability and war • student recruitment dropping • not well enough prepared students • generation gap and different approaches • cultural mixing and adaption, including xenophobia • increasing inequality • mental health • financial cost of program • slow response of HEI to external change • not enough qualified teachers • motivation of teachers • governmental funding • governmental requirements.

It is evident that even though a particular VUCA event may be suggested (second column in Table 4), its potential effect on specific curriculum components and on operating an educational program, may not always be stated nor is it effect clear. This may reflect the fact that the effects on educational programs are ambiguous and that several different VUCA-like events and scenarios may have similar or the same effect on operating an educational program (e.g. Berthoud et al., 2021).

End-of-survey comments

At the end of the survey, space was provided for optional comments from the respondents. They were able to be classified into two groups. One was on the exact meaning of "I am concerned about …" as used in the statements on the curriculum components. The other group of comments reflected the different understanding of what constitutes a VUCA-like event among the persons responding to the survey. This was reflected in quotes such as:

"I do not really understand the "I am concerned about" language."

"... I am not concerned about most of the events in question, indeed, I am looking forward to disruptive events leading to change of, e.g. assessment methods or the usage of AI in teaching."

"... I think mainly my health and motivation may affect the program and my teaching."

"VUCA factors are not just push or pull factors like fire, flood, or even war…. simply listing the factors that will affect the curriculum is not within the scope of VUCA."

"… very good survey, push thinking and rethinking"

CONCLUSION

The aim of the study was to determine which components of a curricula are sensitive to potential VUCA-like events, and which VUCA events faculty may foresee that could impact programs and teaching in the near future. As curricula may have different structures, meaning and purpose at different educational institutions, we adapted a particular curriculum model based on actual examples from six different institutions as outlined in the Introduction section. This model has nine components, which formed the basis for evaluating the different components with respect to different VUCA-like events. Thirty-seven faculty members from six countries related to the DECART project responded to the survey, most of whom had at least some expertise in curriculum design.

Results from the survey showed that four of the nine components of the curriculum may be considered sensitive to VUCA-like events according to the perception of the respondents, i.e. teaching methods, location of teaching and learning, assessment methods and teaching of interpersonal skills. The first three are in essence how one actually conducts the teaching and facilitates the learning, and may to some degree reflect the impact that Covid-19 had on higher education and the ambivalent anticipation of AI and its effect on education. The focus on interpersonal skills may reflect the increasing need for such skills in the workplace, as well as during the learning process and perhaps it is an ongoing endeavor in higher education. Interpersonal skills are mentioned in 6 out of the 12 standards of CDIO (www.cdio.org), so the relevance is not new to the CDIO community. Therefore, one may expect that these four components are indeed on the list of topics currently under review at many HEIs or may be added to such a list. When considering potential VUCA-like events that may affect educational programs, AI was of most concern, in an ambivalent manner, followed by events like disinformation online, cyberattack, disrupted online communication, and then climate change and natural disasters. It is important to realize that VUCA-like events may indeed significantly affect curricula, and may also lead to positive developments and changes. In addition, the potential VUCA events being considered may inherently be biased towards topical issues.

Considering the perceptions that emerged from the survey, the factors that need to further examined, especially when designing curriculum, is the way in which teaching is actually conducted and learning facilitated, and specifically how AI may impact the curriculum. Due to

the few respondents, given the nature of the study, one should be careful in generalizing the results, which essentially represents exploratory indications and perceptions of the respondents at the time that the study was conducted.

The VUCA events and scenarios which were identified, are presently being further explored in the DECART project and refined through cooperative workshops with faculty and other stakeholders. Such events will allow for the development of good to best practices regarding curriculum resilience and adaptation.

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