TACKLING CURRICULA REFORMS AS DESIGN PROBLEMS: A REVIEW OF DESIGN CURRICULA PERSPECTIVES

Lore BROSENS[1,2]**, Annelies RAES**[3,4]**, Johannna Renny OCTAVIA**[5] **and Marina EMMANOUIL**[1,2]
[1]Department of Industrial Systems Engineering and Product Design, Ghent University, Kortrijk, Belgium
[2]Design.Nexus, Ghent University, Kortrijk, Belgium
[3]KU Leuven, Faculty of Psychology and Educational Sciences, Centre for Instructional Psychology & Technology
[4]KU Leuven, imec research group itec
[5]Department of Industrial Engineering, Parahyangan Catholic University, Bandung, Indonesia

ABSTRACT

In recent years, the responsibilities of designers have drastically shifted as the world we live in becomes increasingly more complex. Correspondingly, educators advocate for an adaptation of design education in relation to the shifting economy, technological and societal advances. The question therefore is how to design the future of design education in a way that it corresponds better to these shifts. Traditionally, university curricula are updated on a department level together with faculty members. Under this localized practice, programs update one course at a time. During this routine hardly any other stakeholders are involved. By reviewing universities' practices around the world towards reforming their curricula, it was found that design programs can benefit from shifting towards a systemic, design-based, and research-through-design approach, specifically, by using design research methodologies, namely, co-creation, stakeholder involvement, questionnaires, trend analysis, benchmarking, focus groups, interviews, prototyping and the application of an iterative mindset. In agreement with Cross (1982), the authors call for a more *designerly* way of thinking in order to update design curricula. By re-considering conventional approaches regarding curricula reform practices, this paper presents recommendations for designing design education to define future university study programs.

Keywords: Design education, curriculum reform, design learning, design pedagogy, future perspectives, designerly ways

1 INTRODUCTION

It is undeniable that product design and engineering education is currently at a tipping point. Many claim that it must transform, primarily, because the world we live in, inclusive of man-made products and services we create, consume and use, is becoming increasingly more complex [1]. Specific examples that underline this call for change in our education include the in-flux economic landscape, which requires a higher level of problem-solving skills [2], and the important ongoing racism and privilege issues, which requires design engineers to be more aware of their role in society [3]. Moreover, Duy Tan University in Vietnam found that their education should respond better to the technological advances of industry 4.0 [4]. Other examples from higher education institutions too show an agreement on the need to prepare next generation designers for future technological, economical, and societal advances.

As the field of product design and engineering education comes to a shared understanding that the redesign of its curricula is much needed, questions arise on the way curriculum reforms should be executed. In most cases it is the department of a university that is responsible for determining the learning objectives, teaching and learning activities, as well as, assessment means [5]. Similarly, at our university, we are currently in the midst to reform the Bachelor and Master's curricula in Industrial

Design Engineering at Ghent university. However, in setting out to do so, we found there to be a fundamental requirement for employing a methodological approach to curriculum reforming.

Therefore, this paper will report on our search to develop such a reform methodology. First, institutions reform strategies around the world were benchmarked. These institutions might not have found the ideal solution either, as there is not yet a consensus on the best way to address the current need for a reform. Looking at previous tipping points, we might see that the current need for a radical revolution in design education resembles the period around a hundred years ago in the 1920s when Bauhaus disrupted the way we taught design [1]. From Bauhaus, design research established itself as a discipline, creating tools that we can now use to refine our curricula. A critical view of this paper will be to analyse benchmarks, and report on the extent to which they incorporate design research tools by looking into research articles published in Web of Science (WoS) ranked journals. Put differently, how rigid, scientific, and *designerly* are the curriculum reform methods of institutes around the world. What can be learned from past reforms for design departments that want to take actions towards curriculum reforms in the future?

2 TOWARDS STUDENT-CENTERED DESIGN EDUCATION

Through refining the motivations behind the call for reforms of engineering design education, it becomes clear that solely including more domain-specific knowledge will not suffice. Recently, multiple journal articles, have questioned the traditional master-apprentice relationship of product design education as it is a teacher-centred approach [6]–[8]. Although design education relies on this way of teaching to transfer tacit knowledge, it has been argued that traditional modes of teaching lack to assist students in deeper knowledge building. The recommended shift is to move away from teacher-centred towards learner-centred design education. Some claim that the transition to putting the student at the centre of design education will lead to a lower value of complexity in design education. However, this is opposed by the argument that we need to redesign our learning experiences as well. In a student-centred way of teaching, students learn to deal with complexity triggered by personal learning experiences and students themselves need to make sense of real-time changes alongside high-stakes risks [9]. Design engineering is a field in which critical questioning is highly valued, especially when challenging assumptions about the way things are routinely done [10]. Particularly within the interdisciplinary field of engineering product design where a wicked approach of design problems requires a more holistic approach. The recent developments force us to look inside and see that we have failed to include the main stakeholders in the development of our curricula [9]. In order to redesign our curricula for the challenges ahead and reform them following a student-centred way of teaching, we need to co-create the design education of the future together with students, industry, university academics, and society as a whole [10].

3 METHOD

In our search for a common ground to develop future curricula, we found there to be a need for a comprehensive overview of recent curricula reforms. Since a focus on product design schools and industrial design engineering school reforms yields too little results, this research chooses to incorporate design education reforms in within the whole field of design education. This means that reforms within the fields like industrial design, interaction design, transportation design, and furniture design, strategic design were also considered. Although these fields are different from product design and engineering design, they share the same teaching and learning activities (e.g., studio teaching, tutorial sessions, project- and problem based learning), and the same urgency for a reform triggered by the technological, societal, and economic changes discussed. Therefore, a systematic literature review of WoS-ranked research articles was conducted using a two-fold search strategy. First, the WoS database was searched (search strings can be found in figure 1). It was found that although the search-string was refined, many of the returned results did not discuss any field within design education. Second, a similar search-string was used in journals, ranked in the WoS database, specific to the field of design, which led to more qualitative results. Figure 1 shows a schematic overview of the search-strings used and results returned. The returned results were refined based on inclusion and exclusion criteria. Only research that reported on curriculum reforms in higher education was included, and articles focusing on primary and secondary education were excluded. We did exclude results that only focused on art education, however, when they mentioned findings related to any field in design education, we included that research paper. This means that we did not distinguish between fields, such as, textile design, product design, graphic design, or others. It was chosen to only include results from the last 20 years since the turn of the century was also a turning point for new technologies similar to where we find ourselves now. Only articles that

report on the reform of a curriculum as a whole were included, as a consequence, literature on reforms on a course level were excluded. Lastly, duplicate articles were removed. The resulting papers were analysed and clustered together based on themes that arose. Due to the added value of not only discussing these papers on a quantitative level but adding a qualitative analysis to the discussion, the results are combined with the discussion.
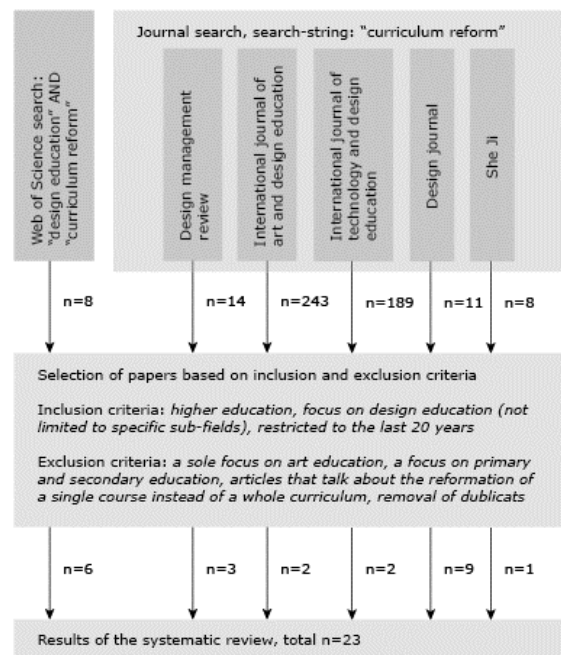

Figure 1. Visualisation of the search strategy

4 RESULTS AND DISCUSSION

4.1 From a traditional approach to a design approach

A total of three papers (n=3) report on the add-on strategy for curriculum changes [11]–[13] which was first described by Gibbs [14] as a way to add an extra course or course-content into a curriculum. Augsten and Gekeler [13] illustrate this idea by claiming that future designers should not only possess typical craftmanship capabilities, namely, design doing and user/design research. They argue that a new design paradigm should be added onto the traditional curriculum that teaches co-creation and design facilitation skills in order to create design experts in communication and collaboration. However, Kolmos [11] claims the add-on strategy might be insufficient and a more systemic approach is needed in which new learning objectives are integrated in a holistic manner. This is achieved through an integration strategy where new knowledge is inserted into a curriculum on a systemic level that leads into a specialization sequence. Moreover, the rebuilding strategy takes this approach one step further by linking new knowledge to an interdisciplinary understanding. In her paper on the integration of more sustainability focused knowledge in a design program, she concluded that a process-oriented approach of remaking a curriculum is required and should involve external stakeholders [11].

This call for involving stakeholders into the curriculum reform process is strengthened as four (n=4) papers state some form of collaboration or co-creation especially with students, is necessary [4], [15]–[17]. More specifically, Schneorson and colleagues [16] report on the use of field observations, interviews, and informal conversations both with students, experienced designers and industry partners. Blau and Shamir-Inbal [17] highlight the use of technology to capture the 'student voice', which is a strategy to listen to and value students' perceptions on their learning experiences. They describe a process in which students are treated as equal co-creation partners for developing future design curricula. These examples suggest that design education is moving away from a traditional university approach where new knowledge is added onto the curriculum based on lecturer's beliefs of what a designer should know and be able to do. Instead design education seems to recognise curricula reforms as design problems and tackle them in such a way by making informed decisions based on co-creation and stakeholder involvement.

4.2 From a pedagogical approach to a research-through-design approach

Three studies (n=3) use the constructive alignment framework as the back-bone for their curricula reform research [18]–[20]. Constructive alignment, first described by Biggs [21], is a method originating in the pedagogical sciences that aligns learning objectives to teaching and learning activities, and to assessment. Soares et al. [18] report on the use of informal talks and linguistic analysis to develop a set of learning objectives for design students of the future. Wilson and Zamberlan [20] argue that in order to arrive at an objective, metric, and quantitative way to assess creativity, we need to involve students in identifying learning objectives. In line with the tendency of moving towards tackling curricula reforms as design problems, four papers (n=4) report on the use of design research approaches to develop learning objectives [13], [22]–[24]. Inayatullah [24] and Kaur Majithia [22] report on the use of future thinking strategies like trend analysis and long-range future-oriented design (LFD) tools. These consist of pillars which are defined as mapping, anticipation, timing, deepening, creating alternatives, and transforming. To strengthen these future thinking outcomes, both Kaur Majithia [22] and Augsten and Gekeler [13] report on the use of semi-structured interviews, informal interactions, and focus groups with design professionals in businesses, education, and industry partners. Lastly Vasconcelos [23] describes the use of design school rankings (Top University, Business Insider, Red Dots, and Domus) as a curriculum benchmarking strategy.

In order to verify their research into learning objectives, research papers (n=4) report on quickly prototyping a section of a new curriculum in order to measure differences with the old curriculum [23], [25]–[27]. Brueggemann et al. [25] report on the use of workshops, Collina et al. [26] on the incorporation of Jams (intensive design-led workshops) in a summer school, Camacho and Alexandre [27] developed a case study within a course in collaboration with industry partners. At Umeå Institute of Design (UID) in Sweden and Aalto University in Finland, this approach was used to handle their curricula reform by prototyping solutions and making future decisions based on these prototypes [5]. By quickly prototyping a new curriculum approach outside of the usual curriculum, design departments have the opportunity to refine this curriculum in iterative cycles that are much shorter then yearly or semester-long cycles.

The approach of developing a solution through iterative prototyping and gathering information cycles is called research-through-design and was first described by British educator, writer, and former rector of the Royal College of Art in London, Christopher Frayling in 1993 [28]. The curriculum reform strategies discussed above show that design education now incorporates this research-through-design strategy in developing new curricula instead of only relying on frameworks for a pedagogical sciences origin. Above all, these findings highlight that design education uses interdisciplinary knowledge from a pedagogical base (i.e., the constructive alignment framework and development of learning objectives) and adds to this knowledge by using design-based methods for information gathering (i.e., trend analysis, future analysis, stakeholder interviews, and benchmarking). Lastly, these research findings are further refined via research-through-design cycles where solutions are prototyped and tested.

4.3 From curriculum reforms at a department level towards systemic change strategies

Traditionally curriculum change is discussed by a select group of lectures within the department [5], however, as recent technological changes call for a fundamentally different way of educating [1], it is suggested that conventional approaches might not be sufficient. Four journal articles (n=4) call for a systemic method for curricula reforms on different levels [4], [19], [29], [30]. Mitchell et al. illustrate this approach through a faculty-wide curriculum change which was enabled by a top-down drive for innovation and a bottom-up support for change. They furthermore describe a method for change at the individual level (micro) and organizational level (meso) which is in line with the strategy of Kolmos and her colleagues [30] for curriculum change. They developed a conceptual framework for systemic response strategies that links back to the add-on strategy, the integration strategy, and the rebuilding strategy as well as incorporating systemic change on a micro, meso, and macro level. Two articles report on the use of Bloom's taxonomy [4], [19], of knowledge dimensions which consists of a ladder with the following cognitive levels: remember, understand, apply, analyse, evaluate, create (from the bottom to top). In their study Truong et al. [4] prototype new types of design education following this framework and make informed decisions based on the percentage of students that achieves better results, and the total time students spent on studying for the class. A similar, yet different framework, was developed

by Wells-Papanek and Pecoraro [9], who created a method for curriculum reforms in five steps: gather information, define problem, build understanding, show understanding, reflect and assess.

It could be concluded that although curriculum changes to design education are usually the responsibility of the department, most universities now recognise the need for a more systemic approach. To structure these reform strategies, multiple universities use different actions on a micro, meso and macro level. Additionally, some universities develop their own strategies based on existing methods (i.e., Bloom's taxonomy) or as an abstraction of their own designed strategies (i.e., the five step strategy from Wells-Papanek and Pecoraro).

5   CONCLUSION, LIMITATIONS AND FUTURE WORK

The results show that the current ways of transforming design curricula, is not sufficient anymore. Instead, methods to redesign design education are shifting towards including more design-based approaches, research-through-design methods, and systemic change strategies. The examples outlined in this study show that recent university wide curriculum changes already incorporate some of these actions. However, reflecting on all the results collectively, the authors argue that a more designerly way of thinking is needed when redesigning curricula. Alas, the term 'designerly' was articulated in the 1980s [31], it is still relevant today by hinting at the use of design specific ways to know things and find knowledge not simply during a design project but for reforming design curricula alike. It should be noted that the findings discussed in this paper, although systematically researched, do not only regard product design education and engineering education. However, since the learning objectives, teaching and learning activities, and assessment means are largely similar between all fields of design education, the authors hope product design and design engineering educators can benefit from this research and continue to collaborate and learn from all fields of design education. Though out of scope in this study, the field of engineering education as a whole (including mechanical engineering), can be as valuable to research in the future because it is as close related with design engineering. In addition, the authors want to point at the potential benefits of involving all relevant stakeholders into the curriculum developing process, especially students, but also industry partners and design experts. Future research should focus not only on looking for a consensus in which methods to specifically use when reforming a curriculum, but also testing these methods in order to evaluate them.

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