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Sustainable development in the design of online degree programmes for national cross-studies

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Abstract

This study examines the integration of sustainable development in the holistic design of higher education online degree programmes for national cross-studies in Finland. The methodology adopted is design-based research. The literature combines works from the fields of online degree programme design and sustainable development. The empirical data is collected from an Online Degree Working Group representing various online degree expertise in applied higher education.

The results of this study highlight the importance of national level collaboration in efforts to reach sustainable development goals in online degree programmes for national cross-studies in higher education. Key sustainability competencies are combined into online degree programme design to reveal new considerations for sustainable development in the online degree education context. The results can be utilised by managers, administrators, and educators of online degree programmes in higher education organisations who are interested in implementing sustainable development in the design phase of the online degree programmes.

Key words: *higher education, online degree programme, sustainable development, design*

Introduction

Digitalisation of education has been accelerated by the recent global pandemic, and preparedness for digital transformation in education is needed for effective and planned utilisation of technologies in digital education. The sudden move to digital learning has led to differing levels of digital competence, implementation, and learning outcomes (European Commission, 2020), and the focus has been on digital platforms rather than pedagogical models for online teaching (Adedoyin & Soykan, 2020). Higher education institutions (HEI) worldwide are likely to expand their degree education offering from traditional to online degree modes (OECD, 2021), which has created a need for further research in e-learning and fully online higher education degrees (Ghanem, 2020), where less attention has been placed on holistic design of online programmes (Kumar, 2014).

Design of online degree programmes (ODP) supports the sustainable educational goals (United Nations, 2015; The Rectors' Conference of Finnish Universities of Applied Sciences Arene [Arene], 2020; Universities Finland UNIFI [UNIFI], 2020) of life-long learning and equal access to quality education. HEIs are the leaders in creating a sustainable society to various stakeholders (Cortese, 2003; Koehn & Uitto, 2014; Leal Filho et al., 2020) and need to reorient their education towards inclusion of sustainable development (SD) in order to create graduates who have the competence to resolve challenges and improve sustainability (Wiek et al., 2016). There are many sustainability-focused and sustainability-oriented programs, but it is not clear how they support the sustainability competence of the students (Brundiers et al., 2020). Holistic and whole institution approaches in terms of impact of SD activities in HEIs are also lacking (Findler et al., 2019).

There is an urgent need to move from research to action in terms of SD integration to curriculum (Lozano et al., 2017). Sustainability should be more than an add-on to curriculum (Tilbury, 2019) and investment in education for SD (ESD) should be made to foster institutional SD (Leal Filho et al., 2020). ESD requires transformative, action-oriented pedagogies that need to be integrated in a comprehensive manner into curricula and can be enhanced by emerging technologies (González-Salamanca et al., 2020).

The need for this study arose from the recently presented sustainable educational goals for applied higher education (Arene, 2020) where one goal is to integrate SD in all degree programmes and to produce graduates with basic SD competence. This study aims to fill the research gap of integration of SD into holistic ODP design by examining how to integrate SD in the holistic design of ODPs for national cross-studies. The results can offer new insights into previous research of ODP design and SD in education by adding SD in the holistic ODP design. It can also reveal how SD competences can be supported by including SD in the design of ODPs. This paper does not attempt to create new definitions for SD competences, nor does it result in the creation of a new sustainability-oriented degree programme. Instead, it is a theoretically oriented evaluation to gain an understanding of how elements from various SD frameworks could be integrated into ODP design.

The methodology adopted in this paper is design-based research (DBR) (Collins et al., 2004; Wang & Hannafin, 2005) for holistic design of online degree programmes in HE. This study discusses the results of Cycle 4 and methods from the field of service design are utilised. The empirical data is collected from a national Online Degree Working Group representing various expertise in Finnish applied HE online degree education. The theoretical frameworks utilised for SD are Rohweder & Virtanen (2009), Wiek et al. (2011), Lozano et al. (2017) and Brundiers et al. (2020) which are compared against the context of the ODP design elements from DBR Cycles 1-3. The results of this study are used to further develop the holistic design of ODPs.

The results can be utilised by managers, administrators, and educators of online degree programmes in HEIs who are interested in implementing SD approach in the design phase of the ODP.

Context of the study

The research started as part of a Ministry of Education funded national project eAMK during 2017-2020 (n.d., a), the aim of which was to develop an offering of year-round digital studies through cooperation of all universities of applied sciences (UAS) in Finland. The working group was set up to investigate how an online degree could be offered as part of national online cross-studies to be offered on the national digital platform CampusOnline and how that process could be supported through pedagogical planning in terms of studying, teaching and tutoring. National digital cross-studies were developed as part of eAMK project through funding from Ministry of Education in Finland with the aim of creating a platform for offering year-round digital studies for students from all universities of applied sciences. The online studies are currently offered on the joint national platform CampusOnline (CampusOnline, n.d.).

All 24 universities of applied sciences in Finland have committed to the principles for national cross-studying, which were approved in a meeting of the Rectors' Conference of Finnish Universities of Applied Sciences (Arene) (eAMK, 2017), including enabling students' free mobility across all universities of applied sciences in Finland and giving them a chance to complete degree studies from a national course offering of digital cross-studies free of charge.

In addition, through a common framework, all universities of applied sciences in Finland have committed to a common goal of reducing the footprint and increasing the handprint with the impact of education, research, development and innovation activities that support the efforts for a more sustainable future (Arene, 2020). A similar context can be found in the science universities in Finland, where they have shared theses on sustainable development and responsibility (UNIFI, 2020) and joint online course offering is through a joint platform DigiCampus (DigiCampus, n.d.). However, these are not in the scope of this study and therefore are excluded from the study context.

Background literature

In this study, an online programme refers to a HE study programme where a student completes all study credits fully online and the institution offers the required support services fully online (Sener, 2015). In Finnish UAS context, the term 'Online Degree' is used to describe a HE degree that is completed online, has interactive elements, synchronous online meetings and guided study (Joshi et al., 2020).

Digitalisation and globalisation have been major forces in changing education, but sustainable development has not received the required attention in discussions (Konst & Scheinin, 2020), and new forms of pedagogy can prepare graduates for the changing world of work (Tynjälä & Gijbels, 2012). Strategic planning is one of the key elements for the design of successful online programmes (Rovai & Downey, 2010). According to Eteokleous & Neophytou (2019), pedagogical frameworks created for design of new online programmes can be helpful in successful design, implementation and delivery of the programmes. Design of sustainable online programmes include rational use of resources, focus on social perspectives, integrating the environment of the programme to wider educational ecosystem and equal study opportunities (Suhonen & Sutinen, 2014).

Sustainable development work should be approached holistically (Sterling, 2005) in terms of management, learning environments, teaching and learning and collaboration with internal and external stakeholders (OKKA Foundation, 2020; Lainen et al., 2006; Lainen, 2008; Rohweder & Virtanen, 2009). Sterling (2003, p. 46) suggests that "Ecological thinking is essentially holistic but not all holistic thinking is ecological", a statement adopted also in this study.

According to Rohweder et al. (2008), a suitable approach for developing SD in education is through inquiry-based learning, where the learning process is seen as interaction between construction of information and learning (Hakkarainen, 2003; Hakkarainen et al., 2004). In their framework, the critical factors of ESD are categorised into contextual factors as a framework, mental aspects as changes

in the learning process for sustainability and activity related aspects as realizations of educational practices for sustainability. An essential element is the interconnected nature of the SD where all dimensions are linked and form a holistic entity that shows in both curriculum and course level and requires HE teachers to understand the multidisciplinary approach required to improve the quality of SD education. According to them, multiple solutions for teaching SD are needed, and this study contextualises their work in the area of ODP.

Wiek et al. (2011) state that sustainability education should focus on preparing for problem-solving of future sustainability challenges, and their framework can be used to guide the design of academic programs, evaluation of teaching and learning as well as training of staff. They present the competencies as a layered set where academic sustainability education competencies (systems thinking, anticipatory, normative, strategic and interpersonal competence) are linked to basic competencies and key competencies in sustainability. They call for experiments on teaching and learning settings to ensure high quality SD education, and this study explores its applicability in an ODP context.

Lozano et al. (2017) propose a more holistic and systemic sustainability education by combining pedagogical approaches and competences to deliver education for sustainable development (ESD) in HE. They found that there is not a single pedagogical approach that alone reliably covers all competences, although some pedagogical approaches may be better suited to support the development of certain SD competences. They propose a framework where the competences are connected with pedagogical approaches in the course delivery to provide a more holistic approach. They suggest the framework be tested in different contexts and whilst this research does not put the framework into action, it is one attempt at utilising the framework in the context of ODP design.

Findler et al. (2019) expand the holistic view of how HEIs interact with the surrounding environment and society. They consider the impacts of HEIs on sustainability education as something that a HEI has as an organisation and the activities it conducts. These impacts can be short- or long-term, which can be difficult to observe due to complex nature of the causal pathways. Their framework further clarifies the direct and indirect impacts that an organisation or individual may have on SD impact areas of economy, societal challenges, natural environment, policies, culture, and demographics. They recommend that a whole institution approach could be used to identify the comprehensive impact and stakeholder groups of HEIs on SD, which in this present study is considered to be the ODPs.

Leal Filho et al. (2020) suggest that universities as leaders of transformation need leadership to create strategies to connect people, communities and key areas in promoting SD. They found that some HEIs are taking a more critical and serious approach on leadership on SD, which could be relevant for this study, as HEIs in Finland have committed to the realization of their SD goals (Arene, 2020; UNIFI, 2020). For universities of applied sciences, the handprint of education is to educate experts who have basic competence in SD and promote SD in their work. In addition, the goal is to integrate SD in all degree programmes and promote lifelong learning and accessibility to HE for sustainable change and expertise (Arene, 2020).

Brundiers et al. (2020) present a framework for key competencies in sustainability by adding intrapersonal competency and implementation competency to previous competency frameworks drawn from literature. Their study supports program and curriculum development and proposes that competencies need to be developed actively for both students and staff. They identify the existence of cultural limitations in their study, but as the present study represents European context, it does not add to the cultural aspects welcomed by them. As their framework is applicable for program implementation and evaluation worldwide, it offers good insights into current sustainability competencies students should achieve for better employability as graduates.

Design framework

This is a qualitative design-based research (DBR) study, where the purpose is to examine theoretical questions in real-life contexts (Collins et al., 2004) and where the researcher is an active involved party in the research process (Design-Based Research Collective, 2003). Design-based research is an iterative process of design, evaluation, reflection and redesign, where the theoretical contributions are implemented in the local authentic context and the researcher takes an active part in the process (Design-Based Research Collective, 2003; Wang & Hannafin, 2005).

The DBR process for holistic design of ODPs comprises four cycles (Figure 1) completed during years 2017-2021. Cycle 1 was a thematic literature search conducted to find principles, models, guides and process descriptions for designing ODPs in a HE organisation where the entire organisation follows a specific pedagogical strategy, resulting in the initial holistic ODP design. Cycle 2 included a focus group discussion with those ODP teaching staff who were involved in the design phase of the three ODPs of different study fields and their views were used to develop the design further. Cycle 3 was a mixed methods study that investigated how ODP students experience HE education in an international and multicultural context. The answers were used to create design principles for intercultural context and further develop the holistic design of online DPs in HE. The current study presents DBR Cycle 4, which investigates which elements to include in the design of ODPs for national cross-studies and how to integrate SD into the design.

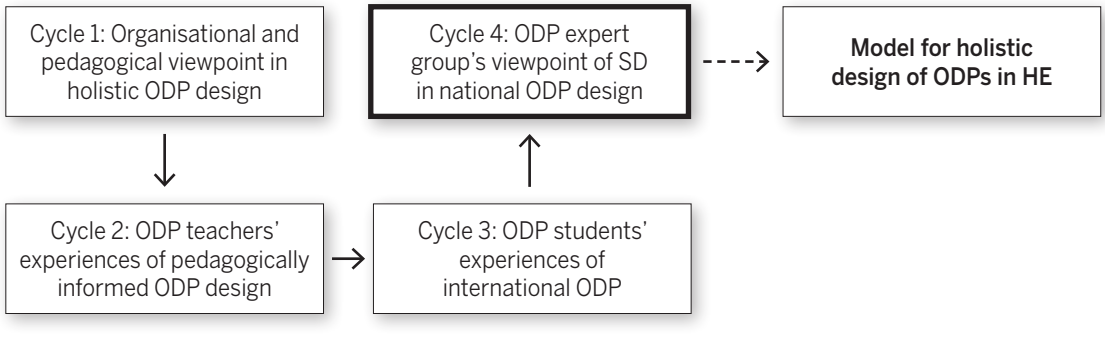

Figure 1. Design-based research process cycles in holistic design of online degree programmes

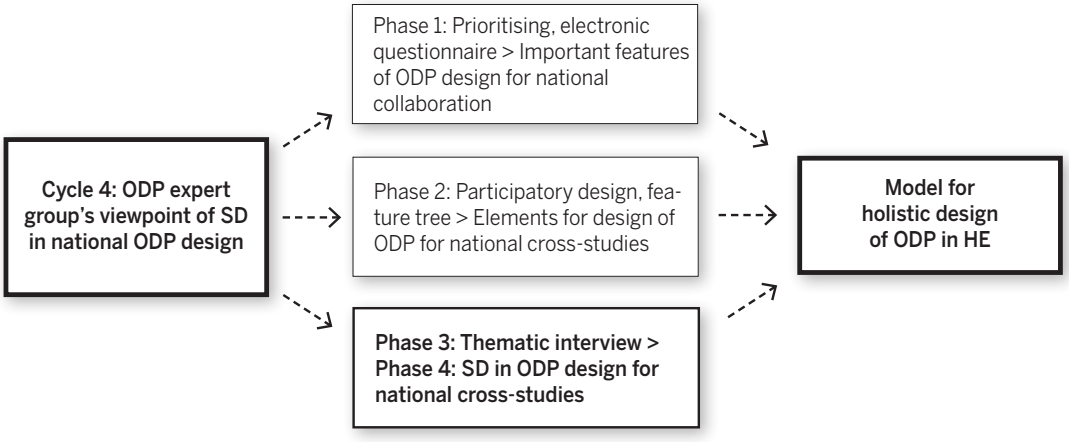

Figure 2. Cycle 4 in holistic design of online degree programmes

Cycle 4 (Figure 2) comprises four phases with results from an electronic questionnaire, participatory design and thematic interview. The results from Cycle 4 Phase 3 are used to examine how sustainability could be integrated in the design of ODPs for national cross-studies (Phase 4) to further develop the model for design of ODPs created in the previous cycles of DBR.

This study focuses on the process of integrating SD in the holistic design of ODPs for national cross-studies, and therefore does not present the implementation of SD in the actual ODPs.

Data and methods

Data protection regulation was followed in collecting data and informed consent was gained from the data subjects (European Commission, 2018). All empirical data in Phases 1-4 in Cycle 4 of DBR process was collected between 2020-2021 from the national Online Degree Working Group (ODWG) consisting of seven universities of applied sciences (UAS) out of a total of 24 in Finland.

Description of data subjects

The ODWG was selected as the data subjects in this study as they represent various ODP expertise, including pedagogical, technical and instructional. During 2019-2020, the ODWG created national recommendations for the use of ODP definition, held a webinar series detailing ODP design process and good practices (eAMK, n.d., b), as well as released a publication (Joshi et al., 2020) as a guide for those planning to set up new ODPs.

The ODWG participants work in their organisations as experts and developers of online pedagogy and guidance; mentors and trainers for online teachers; experts in pedagogical use of educational technology and environments; and in research related to online pedagogy. Moreover, the ODWG represents universities of applied sciences that offer different types of ODP implementation in different study fields, including health, information technology and business, and the universities represent different geographical regions as well as size in terms of number of students and staff. Therefore, the working group can be considered representative of the ODP de-

velopment needs in Finnish applied HE context, and their views can be considered valid for this present study.

In the design of a qualitative study, components of an integrative model may affect and be affected by one another (Maxwell, 2008, p. 215). Various integrative methods (Wang & Hannafin, 2005) were used to collect the data during Cycle 4 to gain a wide expert view from the participants (Table 1). Each phase had a different focus, with all three contributing to the design of higher education online degree programmes (ODPs) for national cross-studies.

Phase 1

The purpose of Phase 1 of Cycle 4 was to investigate what elements of the initial ODP design model created in Cycle 1-3 of DBR process would be considered important by the national ODWG for ODPs completed as cross-studies through national collaboration. The participants were sent an electronic questionnaire through Webropol electronic survey tool in January 2020 in Finnish. This method was selected to gain an objective view from all participants.

The participants were informed the questionnaire was anonymous, all data would be handled as group data instead of individual answers and the results would be used for designing national ODPs for cross-studies and the holistic design of ODPs in the DBR process.

The questionnaire consisted of 18 statements representing elements from the holistic ODP design created in Cycle 1-3 of DBR process. The participants were asked to mark using Likert scale 1-5 to indicate which elements they considered the most important (5) in the design of ODPs for national cross-studies and the least important (1). All seven participants from six universities of applied sciences that formed the ODWG for eAMK project during the time of the survey (eAMK, n.d., a) and were invited to participate in Phase 1 gave their response, making the response rate 100 %.

Table 1. Methods and focus of data collection in DBR Cycle 4

DBR	Method	Focus
Cycle 4		
Phase 1	Electronic questionnaire	Prioritising elements of holistic ODP design for national collaboration in ODP design
Phase 2	Online visualisation and participatory design	Identifying key elements for ODPs completed through national cross-studies
Phase 3	Online thematic focus group interview	Identifying what elements are needed in integrating SD in the design of ODPs completed through national cross-studies
Phase 4	Comparison	Comparing interview results against categorised SD key competencies and prioritised ODP design elements

Phase 2

The purpose of Phase 2 was to investigate what elements are needed in designing ODPs completed through national cross-studies. Seven participants from six universities of applied sciences that formed the ODWG for eAMK project (eAMK, n.d., a) took part in the second phase of the DBR Cycle 4.

The methods for Phase 2 were selected from the field of service design. DBR focuses on the researcher in the local context, whereas service design focuses on the user, therefore service design can be seen to support DBR processes (Keskitalo & Vuojärvi, 2018) in creating new services in higher education. Approaches of service design are used to some extent in higher education pedagogy, for example in creating new services for specified groups (Joshi & Alavaikko, 2020). Moreover, holistic design principles are also part of service design (Stickdorn et al., 2018), meaning that various actors and stakeholders in the organisation should be involved in the design process. Thus, visualisation and participatory design were selected as methods in this phase to involve the participants in the design.

The empirical material was collected as an online participatory design process using a feature tree visualisation with an electronic mindmapping tool Coggle.it in March 2020 to go through service design process of generating (Moritz, 2005) and to select features that would be the most relevant for supporting the design. The basis for the diagram was taken from DBR Cycles 1-3. The resulting multicoloured diagram was then reviewed with the participants.

The task of the ODWG participants was to participate in the design process by adding, removing or changing features of the tree, thus resulting in a revised model that would show relevant elements for supporting the design of ODP through cross-studies. The results of the feature tree were later used as a basis for a participatory workshop organised as part of the eAMK project where teachers and educators as stakeholders were given the opportunity to comment and make suggestions to the preliminary categories for future visions of ODPs in Finland. The results were analysed and categorised by the ODWG and future visions for national ODPS were created and published (Joshi et al., 2020).

Phase 3

The purpose of this phase was to investigate what elements are needed in integrating SD in designing ODPs completed through national cross-studies. Four participants from seven universities of applied sciences that formed the ODWG took part in the third phase of the DBR Cycle 4, which was held as a thematic focus group interview. The author moderated the discussion according to the set of questions sent to the group prior to the interview to stimulate the discussion (Edwards & Holland, 2013).

The participants were asked to take part in the interview via an email invitation. The invitation was sent to the entire ODWG. In total 8 participants were invited, out of which 4 accepted the invitation, 2 declined and 2 did not respond. The interview was held using Zoom (zoom.us) platform. The meeting lasted for one hour and it was recorded and later transcribed for research purposes. The participants were informed that there would be thematic analysis of data, where individual

answers or institutions would not be identified. They were explained their views would be used in further development of the holistic design of ODPs.

The interview was held in Finnish in May 2021. The interviewer led the discussion and structured the session according to questions that were shared with the participants beforehand. The questions asked were:

1. How is SD considered in the design of ODPs in your HEI?
2. How could SD be included in the future visions for national ODPs?
3. How could the SD goals of Finnish applied HEIs by Arene (2020) be implemented in the design of national ODPs in the future?

The interviewees were briefly presented the ODP design principles and future visions, and the SD goals of Finnish applied HEIs by Arene (2020) at the beginning of the interview to ensure they all understood the terms and topics as intended for the purposes of this study.

Phase 4

The purpose of Phase 4 was to compare the results of the previous phases against SD key competencies to identify which elements in integrating SD in the design of ODPs completed through national cross-studies. A key competency in sustainability according to Brundiers et al. (2020, p. 17) is:

> *"A distinctive and multifunctional competency, which is composed of several sustainability competencies that functionally relate to each other. It facilitates achieving successful performance and a positive outcome that progresses sustainability (given what is known, valued, and aspired at a given moment in time), while working on specific sustainability challenges and opportunities in a range of contexts."*

The key sustainability competences were combined from the frameworks of Rohweder & Virtanen (2009), Wiek et al. (2011), Lozano et al. (2017) and Brundiers et al. (2020). These were selected as they are frameworks that can inform academic program design to enhance the development of SD competencies in education. It should be noted that the competencies were combined according to descriptions only for the purposes of comparison in this study, and they should not be considered as new definitions or summaries of key competencies.

Results

Phase 1

The results from Phase 1 in Table 2 show that the highest importance in the design of national ODPs is placed on the use of external collaboration and support from management (M=4.9, SD=0.38 each). These two are followed in importance by quality frameworks (M=4.71, SD=0.76), with agreement on the importance of internal collaboration, continuous pedagogical and technical support for staff and continuous support for students (M=4.71, SD=0.49 each). Pedagogical training given to ODP staff (M=4.57, SD=0.53) was seen as important by most, and developing ODP curriculum, technical training for staff, creating and supporting ODP community (M=4.43, SD=0.79 each) were all seen equally important.

There was also agreement on the importance of future visions (M=4.43, SD=0.53), followed by slightly more de-

Table 2. The mean scale (1-5) and standard deviation (SD) of the importance of ODP design elements for design of national ODPs for cross-studies

ELEMENT	MEAN	SD
External collaboration of UAS	4.90	0.38
Support from management	4.90	0.38
Applying a quality framework	4.71	0.76
Internal collaboration at UAS	4.71	0.49
Continuous pedagogical and technical support for ODP staff	4.71	0.49
Continuous support for ODP students	4.71	0.49
Pedagogical training to ODP staff	4.57	0.53
Developing ODP curriculum	4.43	0.79
Technical training to ODP staff	4.43	0.79
Creating and supporting ODP community	4.43	0.79
Considering future visions	4.43	0.53
Considering strategy of UAS	4.29	0.76
Applying a pedagigical framework	4.29	0.76
Marketing of the ODP to future students	4.29	0.49
Developing online learning environments	4.14	1.46
Considering international and intercultural aspects	3.86	0.69
Creating instructional templates	3.71	0.95
Creating a joint online learning environment	3.57	1.40

viated opinions on the importance of UAS strategy and pedagogical framework (M=4.29, SD=0.76), followed by the marketing of ODP (M=4.29, SD=0.49). Taking into consideration international and intercultural aspects (M=3.86, SD=0.69) was rated lower in importance. The least importance was placed on creating a joint online environment (M=3.57, SD=1.4), but deviated the most, as did developing online learning environments (M=4.14, SD=1.46). Also creating instructional templates (M=3.71, SD=0.95) was placed low in importance but showed more deviation.

Phase 2

The results from Phase 2 revealed modifications to the feature tree by the participants only in the part that focused on collaboration and combining pedagogy and technology. Other parts were felt to be relevant and covered important aspects to be considered in the ODP design for national cross-studies (Figure 3 page 23).

Phase 3

Question 1: Considering SD in the design of ODPs in HEIs

The results for question one in Phase 3 revealed that in terms of considering SD in the context of ODPs in their own HEI, accessibility was one of the most important factors mentioned, as offering ODPs can ensure access in terms of location, gender, curriculum and modes of study. SD was mentioned to be a new focus area

in HEI strategy, and whilst carbon footprints were calculated more previously, now the approach was becoming more holistic. SD was said to be included as an integrated element in many curricula.

Some HEIs offered separate SD courses for students and staff, and even entire degree programmes, although not as an ODP. Enthusiastic staff were seen by many as an important aspect of SD in HEI, and students were described to have a good understanding of ecological aspects but not so much of SD as a whole. Technical aspects of ODP were said to increase responsibility in terms of selecting and supporting the use of certain tools, also indicating better data security and protection.

Question 2: Including SD in the future visions for national ODPs

The results for question two revealed that SD could be included in the future visions for national ODPs by offering courses related to SD that could increase students' possibilities to take courses according to their own interests and thus increase competences in the field and SD. In addition, it was seen that integrating SD in ODP visions could support national collaboration and SD development in a multidisciplinary manner. International aspects were seen as an additional possibility for visions, including international virtual exchange, social entrepreneurship, and social responsibility in educating developing countries. Future signals were seen as important in order to include SD in the ODP design in the future, taking into consideration future professions, competence needs and achieving generic skills for future working life.

Another aspect mentioned in relation to future development and possibility was new types of degree studies, such as micro degrees, and more agile ways of achieving competence instead of degree studies. A positive aspect was seen to be increased possibilities for national collaboration and levelling the size differences of different UAS's, where smaller UAS's could benefit from collaboration and their students could get better access to stud-

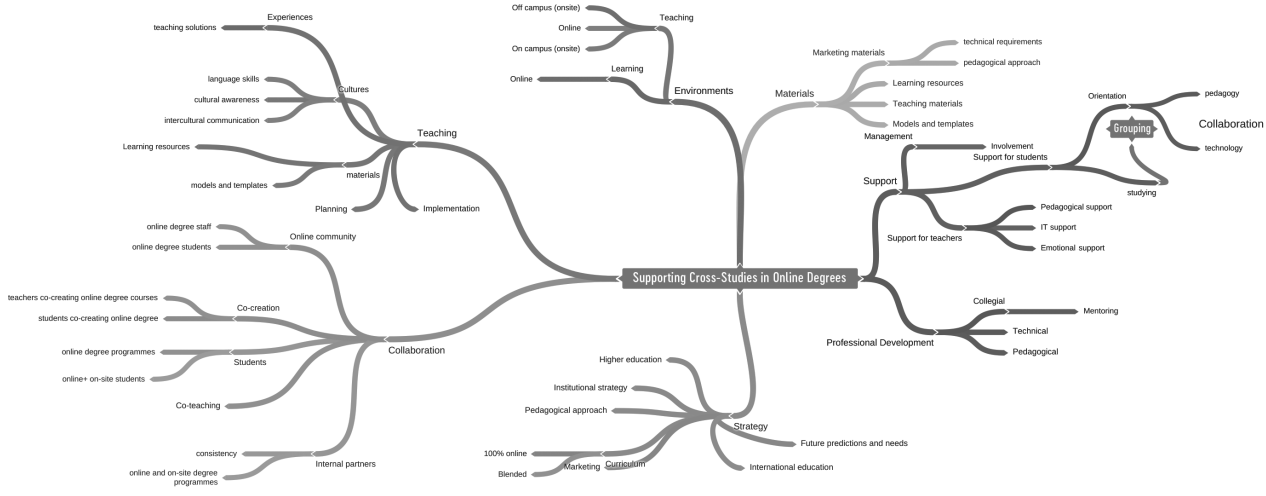

Figure 3. Feature tree of ODP elements supporting ODP design for national cross-studies

ies. Professional development and competence-based curricula were considered as an important aspect of supporting SD in future ODPs. Thesis work, participation in projects and working life collaboration were seen important in integrating SD in the future visions of ODP.

Question 3: Implementing SD goals of Finnish applied UAS's by Arene (2020) in the design of national ODPs in the future

The third question of how the SD goals of Finnish applied UAS's by Arene (2020) could be implemented in the design of national ODPs in the future revealed that ODPs can answer many of the SD goals by offering free and open online materials, content and tools for studying SD online. Accessibility to tools was seen as a possible challenge, as some may not have the possibility to use tools or programmes needed for the online studies. Student wellbeing and strengthening the sense of community amongst students and staff was highlighted considering the current pandemic.

An interesting suggestion was made to include online studying as one element in calculating the carbon footprint and enabling the mode and environment of study to be one element. This was seen as a possible way for ODPs to impact SD on a wider scale. In terms of global aspects, it was mentioned that SD goals differ for export of education, projects and degree

Table 3. Combined key competencies in sustainability

	Rohweder & Virtanen (2009)	**Wiek et al. (2011)**	**Lozano et al. (2017)**	**Brundiers et al. (2020)**
Future orientation	Context (time perspective)	Anticipatory competence	Anticipatory thinking; Tolerance of ambiguity	Futures-thinking competency
Normative competence	Mental aspects (Value clarification, motivation building)	Normative competence	Justice, responsibility and ethics; Empathy and change of perspective	Values-thinking competency
Systemic thinking	Mental aspects (Systemic thinking); Context (Integration; spatiality)	Systems thinking competence	Systems thinking; Assessment and evaluation	Systems-thinking competency
Co-operation and communication	Activities (Partnerships, cooperation and communication)	Interpersonal competence; Normative competence	Personal involvement; Interdisciplinary work; Communication and use of media; Interpersonal relations and collaboration	Interpersonal competency
Critical thinking	Mental aspects (critical reflection)		Critical thinking and analysis	Interpersonal competency
Strategic action	Activities (participation)	Strategic competence; Integrated problem-solving competence (Wiek et al., 2016)	Strategic action	Strategic-thinking competency, Implementation competency; Integrated problem-solving competency

studies in Finnish UAS's. Future foresight in design and integration of SD goals into ODP design as well as participation were seen as important.

Phase 4

The descriptions of the key competencies from the frameworks of Rohweder & Virtanen (2009), Wiek et al. (2011), Lozano et al. (2017) and Brundiers et al. (2020) were compared and then combined into six main categories (Table 3 page 24) to facilitate the analysis of interview results.

The key sustainability competencies and interview results were compared against Phase 1 elements of prioritised ODP design to identify how SD could be integrated in the design of ODPs (Table 4 page 26).

Discussion

This study examined how to integrate sustainable development (SD) principles in the design of higher education online degree programmes (ODPs) for national cross-studies. Three phases were used to gather data for supporting the design of ODPs for national collaboration, out of which the last phase focused on integrating SD in the design.

When looking at the results, the importance of collaboration is highlighted. This can be considered as an expected result to some extent, since the aim was to create design principles for national cross-studies which are currently offered on a national joint platform for online studies. This may support findings by Leal Filho et al. (2020) where partnerships with stakeholder organization networks are needed for successful leadership of SD initiatives. First, in Phase 1 the prioritised list of design principles showed the external collaboration between UAS's as the most important, followed by support from management, utilisation of quality framework and internal collaboration. In Phase 2, collaboration was added as an element in the feature tree, and in Phase 3, when comparing the results of the interview to the categorised key sustainability competencies, the most answers were found focusing on the category of co-operation and communication. Lozano et al. (2017) detail the appreciation of different disciplines as one principle. In this study, multidisciplinary work was seen as something that could enhance inclusion of SD in future ODPs.

Interestingly, no answers in Phase 3 interview were found for prioritised ODP element 2, support from management, or 4, internal collaboration. This could be since the focus of the research was national collaboration. Another reason might be that internal collaboration and management involvement is expected and instead, the benefits of external collaboration are highlighted, as was the case in ODP element 1. Leal Filho et al. (2020) found that leadership is needed to connect people, communities and key areas in promoting SD. The lack of specific mentions on leadership or management in Phase 3 could indicate that SD goals are seen to be integrated in the HE strategy overall. Sterling (2005) suggested that SD should be approached holistically by including management, learning environments, teaching and learning and collaboration, an important aspect also in ODP design (Kumar, 2014).

Strategic action and systemic approach were the second most commonly found category in Phase 3. Rovai & Downey

Table 4. Comparison of ODP design elements, key sustainability competences and thematic interview results Q1-Q3

Prioritised ODP design elements (Table 2)	Key sustainability competencies (Table 3)	Q1: SD in the design of ODP in HEIs	Q2: Including SD in future visions for national ODPs	Q3: Implementing Arene SD goals in future national ODPs
1. External collaboration of UAS	Co-operation and communication		• Multidisciplinary national collaboration and SD development • Wider access to studies through national collaboration for students and smaller UAS's	Partipication in the design and integration of SD goals into ODP design
2. Support from management	Co-operation and communication			
3. Applying quality framework	Systemic thinking, Strategic action			Impacting SD by including mode and environment of study (online studying) in calculating the carbon footprint
4. Internal collaboration at UAS	Co-operation and communication			
5. Continuous pedagogical and technical support for ODP staff	Co-operation and communication	Enthusiastic staff in supporting SD		
6. Continuous support for ODP students	Co-operation and communication	Developing students' understanding of SD as a whole	• Considering future professions, competence needs and achieving generic skills for future working life • Supporting SD in ODP through professional development	
7. Pedagogical training to ODP staff	Normative competence			
8, Developing ODP curriculum	Systemic thinking	Including SD in curricula, courses and DPs	• Offering courses related to SD to increase access and competences in the field and SD • Supporting SD in ODP through competence-based curricula • Integrating SD in thesis work, projects and working life collaboration • Creating new types of degree studies and more agile ways of achieving competence	
9. Technical training to ODP staff	Co-operation and communication, normative competence	Responsibility in terms of selecting and supporting the use of certain tools, indicating better data security and protection		

Prioritised ODP design elements (Table 2)	Key sustainability competencies (Table 3)	Q1: SD in the design of ODP in HEIs	Q2: Including SD in future visions for national ODPs	Q3: Implementing Arene SD goals in future national ODPs
10. Creating and supporting ODP community	Co-operation and communication			Student wellbeing and strengthening the sense of community amongst students and staff
11. Considering future visions	Futures thinking, Strategic action		* All questions related to this element	Utilising future foresight in the design and integration of SD goals into ODP design
12. Considering strategy of UAS	Systemic thinking, Strategic action	Holistic approach to SD in strategy		Support SD goals by offering free and open online materials, content and tools for studying SD online
13. Applying pedagogical framework	Systemic thinking, Strategic action			
14. Marketing of the ODP to future students	Futures thinking			
15. Developing online learning environments	Futures thinking, Strategic action, systemic thinking			
16. Considering international and intercultural aspects	Co-operation and communication, systemic thinking	Better access in terms of location, gender, curriculum and modes of study	Possibilities for international virtual exchange, social entrepreneurship, and social responsibility in educating developing countries	Considering the differing goals for export of education, projects and degree studies
17. Creating instructional templates	Co-operation and communication, Strategic action			
18. Creating a joint learning environment	Co-operation and communication, Strategic action			

(2010) identified strategic planning as a key element for design of successful online programmes. Leal Filho et al. (2020) identified involvement of management in all levels important in overcoming SD leadership challenges. This is supported by the findings in this study, as management support and use of quality frameworks could add value to integration of SD into ODP design. What is more, utilising future foresight in the design and integration of SD goals into ODP design was seen important in implementing the joint SD goals. Systemic thinking was evident also in expansion of local to international context in SD, which according to results of this study could give better access to studies in terms of location, gender, curriculum and modes of study. Also new international aspects, such as virtual exchange, were seen as possibilities for SD given by ODP, although in Phase 1 the international and intercultural aspects were not seen the most important element in the design of ODPs for national cross-studies.

Eteokleous & Neophytou (2019) suggested that pedagogical frameworks can help the design, implementation and delivery of new online programmes. Lozano et al. (2017) found that some SD competences can be reached better by means of certain pedagogical approaches, but that no single pedagogy can cover all competences. In this study, the pedagogical framework received no mentions in Phase 3. One reason may be that currently most courses for national cross-studies are offered by a specific UAS and follow their pedagogical approach. This may vary in the case of co-created or joint courses.

The prioritized ODP elements 5, 6 and 7 from Phase 1, which were all related to pedagogical and technical support and training, were also found important in Phase 2, indicating that it is important to support and train staff in national collaboration, but surprisingly did not appear in Phase 3. Findler et al. (2019) suggest the competent working staff to be the impact of education on society. In Phase 3, the answers focused on developing students' competencies, although the importance of enthusiastic staff was mentioned. This could be related to the fact that at UAS's the focus of ESD may be more on increasing students' understanding and giving them skills for better employability, although Brundiers et al. (2020) found that ensuring the competence of staff is equally important.

It is worth noting that ODP study mode supports digital working life skills and online context creates possibilities for increased competence in SD and field, belonging to the category of communication and utilisation of ICT (Lozano et al., 2017). However, Wiek et al. (2011) rightly suggest that students may be overwhelmed to achieve all of the sustainability competencies alongside other key competencies, and much rests on the academic program's level and ability to integrate the competence-based sustainability education into practice with staff training and incentives (Wiek et al., 2016). The more teachers are aware of their own professional development, the more they give opportunities for learning to students (Nykänen & Tynjälä, 2012).

Students were also mentioned in terms of improving their wellbeing, belonging to community and increasing accessibility to courses. Wiek et al. (2011) list concepts of safety and happiness in normative competence, and concept of solidarity in interpersonal competence. In Phase 1, supporting the community followed pedagogical and technical support and training in the prioritization, and in Phase 2, community element is also linked to collaboration. Thus, in Phase 3, wellbeing and supporting the ODP community can be seen as supporting the competency of co-operation and communication.

The prioritized element 8 in Phase 1 was developing ODP curriculum, and in Phase 3 it was categorised as supporting the systemic thinking competency. Integration of SD to teaching and learning activities and curriculum work was seen as a key element by Rohweder & Virtanen (2009) and Tilbury (2019), and curriculum development (Brundiers et al, 2020) must be put into action (Lozano et al., 2017). In this study, several suggestions were made in Phase 3 to highlight how ODPs can offer possibilities for SD in curriculum development, such as focusing on competence-based curricula and creating new types of degree studies. An interesting detail was the integration of SD into thesis work, projects and working life collaboration, as working life orientation is

at the heart of competence-based learning and teaching approaches at the practically-oriented universities of applied sciences.

A perhaps surprising result was that online learning environments, marketing materials or instructional templates were not highlighted in the results, as they received no mentions in Phase 3, and in Phase 1 there was variation in the importance placed. In Phase 2, they were connected to the same part of the feature tree, which could perhaps indicate that in Phase 3 they were all mentally connected to the same topical area, too. This could also possibly show the expert group's focus on the pedagogical use of educational technology and using the tools for a purpose, as seen in Phase 3 results of increased accessibility and responsibility in the use of tools.

The results of this study can reflect the fact that the national cross-study platform is for joint course offering but does not utilise a shared online learning environment, thus suggesting that learning environments do not necessarily have to be collaboratively developed as do pedagogical approaches for supporting the SD competences. However, it is interesting that the opinions in Phase 1 deviated the most in this aspect, which could reflect that this aspect should be studied more closely.

Findler et al. (2019) expand the holistic view of SD to the surrounding environment and society. In this study, one impact that was identified was to include mode and environment of study (online studying) in calculating the carbon footprint. Using the framework of Findler et al. (2019), this could be considered as part of campus operations where the indirect impact is contribution to climate change. Thus, HEIs, students and staff could make a strategic choice in their choice of study mode to create a handprint. Another impact was found to be free and open online materials, content and tools for studying SD online, which could be categorized under education's direct impact (Findler et al., 2019).

Conclusions and recommendations

Education development takes place gradually and can support reaching the goals of sustainable future by prioritising it in education through global efforts (Konst & Kairisto-Mertanen, 2020). This study has revealed some interesting notions about how important national level collaboration is in efforts to reach SD goals in higher education in online contexts. Moreover, it has presented some new considerations in times of change where the world of education is fast becoming more digitalised than ever, and joint efforts are needed to integrate SD in future online education.

The results of this study highlight the importance of national level collaboration to support the sustainable development goals in the design of online degree programmes in higher education.

External collaboration of UAS's is considered to be the most important element in developing ODPs for national cross-studies. The national collaboration can enhance multidisciplinary work and SD development as well as allow better accessibility to studies, integration of SD goals and develop students' understanding of SD as whole. Moreover, national collaboration in the design of ODPs for national cross-studies can create competen-

cies and generic skills needed for working life and support the achievement of SD competences through professional development. Through national collaboration, creating and supporting an ODP community is important, which in turn can promote student wellbeing and create new possibilities for international collaboration and exposure. The afore-mentioned features seem to have elements to support the key sustainability competency of co-operation and communication in the design of ODPs for national cross-studies.

In addition, some new considerations for integrating SD in holistic ODP design can be shown through this research. Systemic thinking competency can be supported by the following actions. Both ODP and SD aim for quality education, where an impact of ODP as a study mode can be shown through carbon footprint calculation. Integration of SD into curriculum development is critical, as ODP can increase access in terms of location, gender and modes of study to support development of competences in SD through online course availability, integration of SD in thesis and project work as well as working life collaboration, and by offering free and open online courses, materials and tools related to SD. Future visions and foresight is needed in the design of ODPs, and a dimension of that is new types of degree studies and agile ways of achieving the needed SD competencies.

The results presented in this study can help managers, administrators, and educators of online degree programmes in higher education organisations integrate sustainable development approach in the design phase of the online degree programmes. It is recommended that national level collaboration possibilities are considered to support the co-operation and communication sustainability competency through various actions in online degree programmes, such as multidisciplinary work, professional development, curriculum development, supporting community and international exposure. It is also recommended that holistic approach is taken in integrating SD into ODP by focusing on quality, accessibility, availability, openness and agility in ODP studies that enable the achievement of SD competences for future professionals in working life.

In conclusion, this study supports the SD goal of integrating SD in all degree programmes set for universities of applied sciences (Arene, 2020). The results show that integrating SD in the design of ODPs can support the wider SD goals through the handprint of education to offer lifelong learning and access to education with the aim of creating graduates who have basic competence in SD to create a sustainable change in work and society.

Limitations and further research

This is a design-based research study to investigate how sustainable development (SD) could be integrated in the holistic design of online degree programmes (ODP) in HE. The results of this study will be used to further develop the holistic design of ODP created in previous DBR Cycles 1-3. Future testing of the improved design will be done in the local context. The research can be considered reliable and valid, and integrity of research was considered. However, the following limitations should be noted.

Due to the focus of this paper on SD, the background to ODP development and

holistic approach are presented in a concise form, although extensive research has been completed in previous design-based research (DBR) Cycles 1-3. It is also important to highlight that the reliability may have been affected by environmental factors (Maxwell, 2008) of the researcher's personal understanding, experience and pilot research phase of this study; this being the first stage in combining SD principles into ODP design, the understanding and application of the results are framed by the pedagogically informed holistic ODP design approach formed in the previous DBR cycles. The validity and reliability was established by describing the DBR process as a whole.

A limitation of this study is that the expert group is small and represents only part of the practically-oriented applied universities. Adding online degree programme experts from the science universities as well as other applied universities would strengthen the reliability of the study. As the data is collected from a limited number of participants representing only a small number of universities of applied sciences in Finland, the results should be viewed with caution and used only as indicative for possible application in the local context. However, the data can be valuable in giving direction to future research and applications. The expertise of participants enriched the data in the national context of the study, but due to the limited nature of the study, the results may not be applicable in varied local, national or international HE contexts.

The discussion presented in the study represents the situation at the time of the research and updates are needed for the validity and applicability in future cycles of the development work. Findler et al. (2019) propose that assessment and reporting are fundamental in a systematic approach to identifying and prioritising the impacts in the institutional framework, and this principle can be applied in continuous assessment of the impact for SD in an ODP context.

All in all, it is important to continue the research on the ways of integrating SD into ODP design. In the future, it would be important to include all higher education organisations in Finland to get a wider view on the practices and possibilities for the integration. Alternatively, a comparison with international HEIs could provide interesting new aspects to be considered for SD in ODP design. Moreover, it would be interesting to utilise methods of service design in the process in its entirety to better understand their suitability to educational research and design of SD in ODPs. Considering the demand for hybrid education models caused by the recent COVID-19 pandemic, it would be worth investigating how the design principles of this study would be applied in blended and hybrid degree programmes in HE.

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