Key Competencies for Sustainability in University of Iceland Curriculum

Auður Pálsdóttir 1,* and Lára Jóhannsdóttir 2

1 Department of Subject Teacher Education, School of Education, University of Iceland, Stakkahlið, IS105 Reykjavík, Iceland
2 Environment and Natural Resources, Faculty of Business Administration, University of Iceland, Gimli v/Semundargötu, IS102 Reykjavík, Iceland; laraj@hi.is

Abstract: Sustainable development is growingly being developed in universities around the world. The United Nations presented eight Sustainability Key Competencies (SKCs) that represent cross-cutting competencies crucial to advance sustainable development and achieve Sustainable Development Goals. The aim of this research is to know to what extent the University of Iceland courses seem to include the emphasis of the SKCs, either in the course description text or the learning outcomes. Data collection took place in early 2020 and included analysing every single university’s course description text and learning outcomes using a curriculum analysis key for SKCs. Results show that proportionally, most signs of SKCs were found for SKC 3 (Normative competency) in 53% of courses in the university, and SKC 6 (Critical thinking competency) in 46% of the university’s courses. For individual schools of the university, the far highest proportion of signs of SKC was found for the School of Education (5.0 signs per course) and the relatively fewest for the School of Humanities (1.1 sign per course). The results are discussed both in relation to identified competencies needed for the pressing sustainability problems humanity faces, and in the light of a discrepancy appearing between the university’s ranking according to Times Higher Education University Ranking by citations, research, and teaching, and the proportional signs of individual SKCs within the University of Iceland.

Keywords: key competencies; sustainable development goals; curriculum; university; higher education; learning outcome

1. Introduction

The need of modern society to solve complex challenges has never been more pressing. Universities play a key role in fostering sustainable development [1], and it is considered the fundamental responsibility of universities to engage in the realisation of the SDGs [2], including moral imperatives ensuring the success of the SDGs as part of their social missions and core functions [3,4].

1.1. United Nations Sustainable Development Goals and Their Implementation in Universities

Recent research in higher education shows how integration of sustainable development in Higher Education Institutions (HEIs) is developing and how they are attempting to take responsibility as agents in promoting sustainable development principles [5–7]. In the United Nations (UN) Agenda for Sustainable Development, 17 Sustainable Development Goals (SDGs) are presented that describe major development challenges crucial for the survival of humanity [8]. For the goals to be reached, humans require a profound transformation of how to think and act. To be able to do so, people need to require the knowledge, skills, values, and attitudes that empower them to contribute to sustainable development. Thus, it is stated that education is crucial for the achievement of sustainable development. “However, not all kinds of education support sustainable development. The
well-established and researched approach of Education for Sustainable Development (ESD) empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability, and a just society for present and future generations” [9] (p. 7).

1.2. Implementing Qualification Frameworks in Universities

European universities started over 20 years ago a higher education reform through the Bologna Process. Today, this includes an intergovernmental higher education reform process of 49 European countries and several European organisations. The main purpose of the Bologna Process is to enhance the quality and recognition of European higher education systems and to improve the conditions for exchange and collaboration within Europe, as well as internationally [10,11].

As part of this international process, there is growing development and application of level descriptors as an integral part of the qualifications framework, e.g., the use of learning outcomes [12]. Learning outcomes are statements of what a learner should know and be able to do at the end of a learning experience, i.e., what competencies one is to possess as a result of one’s learning. Within the context of universities, the learning outcomes are meant to guide the development of curriculum and the work of teachers in delivering curriculum. They should also be aligned with pedagogical and assessment methods, to ensure the core aspects of the educational experience being geared toward the same outcomes and student learning [13].

1.3. University of Iceland—The Context of the Research

The University of Iceland is a state university located in Reykjavík, the capital city. Internationally, it is known for progressive research and offers of more than 400 programmes within its five schools: School of Education (SoEd), School of Engineering and Natural Sciences (SoEN), School of Health Sciences (SoHS), School of Humanities (SoHu), and School of Social Sciences (SoSS) [14]. For some years the University has been ranked in the group of the best universities in the world, i.e., in the 401–500th place in overall ranking, and in 301–400th for impact, according to THE World University Rankings [15]. The University of Iceland is on a total of 14 lists of the world’s leading schools in specific fields of study, according to the Shanghai Global Ranking of Academic Subjects for the year 2021, for instance, ranked 10 in remote sensing [16]. Other studies are uniquely Icelandic and relate to the Icelandic Sagas and manuscripts, language, literature, ethnography, folklore, and cultural heritage [17]. Other unique Icelandic data include “complete genealogical data, and climatological, glaciological, seismic, and geothermal records” [14]. In 2019, the number of registered students was about thirteen thousand, and the number of employees, including administrative staff and academics, was close to seventeen hundred [18].

Present and previous policies of the University of Iceland have had an emphasis on present-time challenges and implementing sustainability into learning and teaching, governance and management, research, and outreach [19–21]. Today, this is being realised by the university’s participation in the Aurora Universities Network which is a network of well-respected European universities founded in 2016. Nine of these universities received a grant from the Erasmus+ Programme of the European Union, but within the Aurora Alliance the aim is to “develop European graduate students who are willing and able to tackle the most challenging issues that society face” [22]. This is done by emphasising themes that reflect areas of teaching, research and outreach that are “linked to the grand societal challenges and therefore multidisciplinary and problem-oriented in nature”, cutting across “dimensions of the matching of academic excellence with societal relevance”. The themes Aurora emphasises are (1) diversity and inclusion, (2) societal impact and relevance of research, (3) students, (4) innovation of teaching and learning, internationalisation, and sustainability [23]. Aurora also emphasises its ranking according to the Times Higher Education Impact Rankings, where it appears in high position in terms of SDGs ranking and excels in numerous SDGs [24].
Table 1 shows the ranking of the University of Iceland according to THE World University Rankings by subjects and by citations, research, and teaching [15,25]. Here, two facts are of interest. First is that the University of Iceland is ranked highest in the field of Life Sciences, Engineering and Technology and Physical Sciences, and second, the score for teaching is always lower than the score for research (for all fields of studies).

Table 1. Ranking for subjects in THE World University Rankings for University of Iceland [15,25].

| Subject Area               | Ranking  | Overall  | Citations | Research | Teaching |
|----------------------------|----------|----------|-----------|----------|----------|
| Art and humanities         | 251–300  | 27.3–30.4| 71.6      | 17.5     | 13.3     |
| Business & economics       | 401–500  | 27.2–30.8| 55.2      | 21.0     | 10.9     |
| Clinical, pre-clinical & health | 401–500 | 30.5–33.4| 50.3      | 15.8     | 13.8     |
| Education                  | 251–300  | 31.9–34.4| 59.7      | 18.7     | 18.2     |
| Engineering & technology   | 201–250  | 41.7–44.9| 98.2      | 19.8     | 12.5     |
| Life sciences              | 151–175  | 51.5–53.0| 98.7      | 20.1     | 16.2     |
| Physical sciences          | 201–250  | 47.1–50.0| 84.9      | 19.4     | 17.2     |
| Psychology                 | 251–300  | 35.0–38.0| 63.0      | 18.6     | 16.0     |
| Social sciences            | 251–300  | 35.3–37.8| 69.2      | 22.3     | 16.3     |

1.4. The Sustainability Key Competencies and SDGs Learning Outcomes

The main aim of ESD, put forward by the UN, is for developing competencies that empower individuals to reflect on their own actions, considering their current and future social, cultural, economic, and environmental impacts, from a local and a global perspective [9]. This means that individuals should also be empowered to act in complex situations in a sustainable manner, i.e., be sustainability citizens. This may require them to strike out in new directions and to participate in socio-political processes, moving their societies towards sustainable development. That requires rethinking the learning content and outcomes, pedagogy, and the learning environment, e.g., within universities. Thus, ESD not only integrates content such as climate change, poverty, and sustainable consumption into the curriculum; it also creates interactive, learner-centred teaching and learning settings [9,26]. Therefore, what ESD requires is a shift from teaching to learning, towards focusing on the learning outcomes students are to possess as a result of their learning. It asks for an action-oriented, transformative pedagogy, which supports self-directed learning, participation and collaboration, problem-orientation and inter- and transdisciplinarity. Only such pedagogical approaches make possible the development of the key competencies needed for promoting sustainable development [9].

Analysing key competencies in sustainability, Wiek et al. point out that despite some criticism, there has been convergence in the educational literature about the critical role of defining key competencies and specific learning outcomes to successfully design and teach in academic programmes [27]. They argue that key competencies provide an explicit and commonly shared framework for developing distinct and recognisable profiles of the academic field. Moreover, they state, key competencies provide the reference scheme for transparently evaluating student learning and teaching effectiveness. This is in line with research on the link between teaching approaches and assessment emphasising the importance of applying engaged pedagogies that address all the competencies [28].

However, within the educational literature on competencies in general, and competencies in sustainability in particular, it entails a great deal of terminological ambiguity, associating the term “competencies” with skills, abilities, capabilities, capacities, qualification and other concepts [27] (p. 203). Wiek et al. differentiate competencies from learning outcomes—the former being fairly abstract and therefore in need of translation into specific learning outcomes to be operational (e.g., for curriculum development) [27]. Moreover, they differentiate competencies from key competencies, the latter being critically important for sustainability efforts, distinguishing them from those of other professions and academic programs. This distinction does not imply that “regular” competencies, such as critical...
thinking and basic communication skills, are not important for sustainability professions and academic programs. Rather, it emphasises the competencies considered essential for sustainability that have not been the focus of traditional education and therefore require special attention (p. 204). Keeping these in mind, Wiek et al. define five key competencies for sustainability, i.e., systems-thinking competence, anticipatory competence, normative competence, strategic competence, and interpersonal competence [27], adding the sixth one, problem-solving competency, later [29].

Rieckmann explains that there is general agreement that sustainability citizens need to have certain key competencies that allow them to engage constructively and responsibly with today’s world [30]. However, which key competencies are most important in the context of higher education varies, although general trends are clear [31]. Rieckmann [31] and Brundiers et al. [32] also explain how different approaches for the selection of sustainability key competencies have been developed, asking which individual key competencies are crucial for understanding central challenges facing the world society and for facilitating its development towards a more sustainable future [30–32]. The aim of this research was to identify competencies that should be fostered through university teaching and learning. Rieckmann’s results show that twelve key competencies are assessed to be crucial for sustainable development; the most relevant ones are three, those for systemic thinking, anticipatory thinking, and critical thinking.

In a practice-based research project conducted in 15 HEIs in 12 countries, an insight was gained into how sustainability is incorporated in curricula, i.e., on one hand which competencies are being developed and on the other which pedagogical approaches are being used to develop the competencies. In addition, they researched how these two relate to each other [6]. The research is based on each course teacher responding to a survey including 40 criteria in six sections; background questions, self-assessment of sustainability criteria taught, pedagogical approaches used, competences covered in the course, types of learning and open-ended question about the incorporation of sustainability in courses. Response rate was 9.8%, and thus generalisability is not strong. However, the results give valuable information on how sustainability competencies can be better developed in class, and how to better develop all the sustainability competencies as defined in provided literature [5]. No particular focus seemed to be on if the UN SDGs were present in either the HEIs curriculum and thus the policy of the institution, or if the institutions emphasise the inclusion of the SDGs as part of their policy.

Following the international agreement on the SDGs, UNESCO decided to provide a collective guide for education professionals in all education levels on the use of ESD in learning for the SDGs [9]. The guide identifies indicative learning objectives and suggests topics and learning activities for each of the 17 SDGs. It also presents implementation methods at different levels, from course design to national strategies. In this guide, competencies describe the specific attributes that individuals need for action and self-organisation in various complex contexts and situations. They include cognitive, affective, volitional, and motivational elements; hence, they are an interplay of knowledge, capacities and skills, motives, and affective dispositions. Particularly, it is emphasised that competencies cannot be taught but must be developed by the learners themselves. Thus, they are acquired during action, based on experience and reflection [9].

Based on wide research, UNESCO presents eight key competencies that “represent cross-cutting competencies that are necessary for all learners of all ages worldwide (developed at different age-appropriate levels) and serve as an explicit and commonly shared reference framework. Here, the concept of key competencies is understood as transversal, multifunctional and context independent. They do not replace specific competencies necessary for successful action in certain situations and contexts, but they encompass these and are more broadly focused” [9] (p. 10).

Below are the eight key competencies that are generally seen as crucial to advance sustainable development by UNESCO and are in this paper called Sustainability Key Competencies (abbreviated as SKCs). These are [9] (p. 10):
1. Systems thinking competency: The ability to recognise and understand relationships; to analyse complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty;

2. Anticipatory competency: The ability to understand and evaluate multiple futures—possible, probable, and desirable; to create one’s own visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes;

3. Normative competency: The ability to understand and reflect on the norms and values that underlie one’s actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions;

4. Strategic competency: The ability to collectively develop and implement innovative actions that further sustainability at the local level and farther afield;

5. Collaboration competency: The ability to learn from others; to understand and respect the needs, perspectives, and actions of others (empathy); to understand, relate to and be sensitive to others (empathic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem solving;

6. Critical thinking competency: The ability to question norms, practices, and opinions; to reflect on one’s values, perceptions, and actions; and to take a position in the sustainability discourse;

7. Self-awareness competency: The ability to reflect on one’s own role in the local community and (global) society; to continually evaluate and further motivate one’s actions; and to deal with one’s feelings and desires;

8. Integrated problem-solving competency: The overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive, and equitable solution options that promote sustainable development, integrating the above-mentioned competencies.

The eight SKCs expound what sustainability citizens need to possess to be able to deal with today’s complex challenges. They are assessed to be relevant to all SDGs and enable individuals to relate the different SDGs to each other, i.e., to see “the big picture” of the UN 2030 Agenda for Sustainable Development [9]. With these SKCs in mind, the aim of this research is to know to what extent the University of Iceland courses seem to include the emphasis of the Sustainability Key Competencies, generally seen as crucial to advance sustainable development, either in the course description text or its learning outcomes.

2. Method

This study is based on an analysis of course descriptions (being 4–6 lines describing the content) and learning outcomes for all courses listed in the course catalogue of the University of Iceland for the school year 2019–2020. Since many courses are taught every second year, the whole list of courses was analysed whether the courses were taught that academic year or not. Information about all the courses is accessible on the University website [33], both in Icelandic and English.

The work was approached in four phases, see Figure 1. In the first phase, the preparation phase, the project leaders who are the authors of this article created an SKC curriculum analysis key and a data recording sheet (see Table 2). Then, the authors formed a list of keywords relevant to each of the SKCs using United Nations sources [9]. For example, for SKC 1 (Systems thinking competency), the list of keywords (including explanations about these keywords) included, e.g., relationships, complex systems, how systems are embedded, and uncertainty [9]. When the data analysis was executed, these concepts and explanations were utilised.
Table 2. Data recording sheet for the research project.

| Research Project: The SDGs and Study Offering of the University of Iceland | Language | Sustainability Key Competencies |
|---|---|---|
| Name of courses | ECTS | Icelandic | English |
| 1. Systems thinking competency | 2. Anticipatory competency | 3. Normative competency | 4. Strategic competency |
| 5. Collaboration competency | 6. Critical thinking competency | 7. Self-awareness competency | 8. Integrated problem-solving competency |

In the second phase, the pilot phase, the aim was to ensure the quality of the data collection. The master students (selected from a list of applicants) with the project leaders formed a collective working group that met regularly during the academic year 2019–2020. The purpose was to share information and pilot-test the analysis key developed for the research, compare, and discuss results of the piloting to ensure the quality, reliability, comparability, and consistency of the data collection and analysis, to the best level. Many perspectives and terms for validating findings of qualitative research exist. Wittemore, Chase, and Mandle [34] have according to Creswell [35] put forward 29 procedures for validating quality of qualitative work. He (p. 209) suggests that “qualitative researchers engage in at least two of them in any given study”. Procedures that are relevant to this research are: Triangulation, peer review, and debriefing established through benchmarks between researchers, under supervision of the research leaders, as described above.

The third phase was the execution phase, when all data were collected, which took place in February and March 2020.

In the fourth phase, the final phase, the writing of theses was finished, the results were summed up, and collective data were prepared for presentations and writing of papers.

Figure 1. Diagram of the research process.

An example of how the data were recorded can be seen in Table 2. For example, for each course where a sign of each SKC was found in course descriptions or the learning outcomes, the value 1 was recorded. Thus, each course could get the value 1 only once for
each SKC, but each course could get a score for more than one SKC. This approach was used to facilitate descriptive quantitative analysis of the results.

3. Results

The results are presented in three sections, first for the University of Iceland as a whole, then for each school of the University, and finally for each Sustainability Key Competency (SKC).

3.1. Overall Results for the University of Iceland

In total, 3239 courses were analysed, including course description texts and learning outcomes. In total, 7652 signs of SKCs were found in curricula the University of Iceland presented in the course catalogue for the school year 2019–2020. That counts for 2.4 signs on average per course in the university (see Table 3).

Table 3. Number of courses analysed and number of signs of Sustainability Key Competencies.

| Schools | Number of Courses Analysed | Number of Sign of Key Competencies per Course | Average Signs of Key Competencies per Course |
|---------|-----------------------------|-----------------------------------------------|-----------------------------------------------|
| SoEd    | 463                         | 2336                                          | 5.0                                           |
| SoEN    | 689                         | 1382                                          | 2.0                                           |
| SoHS    | 642                         | 1517                                          | 2.4                                           |
| SoHu    | 770                         | 848                                           | 1.1                                           |
| SoSS    | 675                         | 1569                                          | 2.3                                           |
| TOTAL   | 3239                        | 7652                                          | 2.4                                           |

The highest number of courses analysed was in the School of Humanities (SoHu), in total 770, and the fewest was in the School of Education (SoEd), in total 463 courses. The number of SKC signs found differs among the five schools. The fewest signs were found for the School of Humanities (848 signs), and the highest number was for the School of Education (2336 signs). The average number of SKC signs per course within each of the schools at the University of Iceland ranged from 1.1 (SoHu) to 5.0 (SoEd). The maximum number of signs per course could be eight, i.e., one per each SKC.

Table 4 shows the number of signs of SKC by the five schools at the University of Iceland. The highest number of signs was found of SKC 3, normative competency (1705 signs), SKC 6, critical thinking competency (1496 signs), SKC 4, strategic competency (1207 signs), and SKC 1, systems thinking competency (1028 signs). By far, the fewest signs found were SKC 7, self-awareness competency (243 signs), and SKC 8, integrated problem-solving competency (321 signs).
Table 4. Total number of signs of Sustainability Key Competencies for the five schools at the University of Iceland.

| Competency | SoEd | SoEN | SoHS | SoHu | SoSS | TOTAL |
|------------|------|------|------|------|------|-------|
| 1. Systems thinking competency | 228  | 195  | 144  | 277  | 184  | 1028  |
| 2. Anticipatory competency      | 190  | 140  | 218  | 5     | 107  | 660   |
| 3. Normative competency         | 408  | 602  | 483  | 123  | 89   | 1705  |
| 4. Strategic competency         | 392  | 185  | 163  | 6     | 89   | 1207  |
| 5. Collaboration competency     | 348  | 103  | 224  | 175  | 461  | 992   |
| 6. Critical thinking competency | 450  | 74   | 188  | 233  | 142  | 1496  |
| 7. Self-awareness competency    | 165  | 1    | 26   | 29   | 551  | 243   |
| 8. Integrated problem-solving competency | 155 | 82   | 71   | 0    | 13   | 321   |

Figure 2 shows the proportion of SKCs by the total number of courses analysed (3239) for the University of Iceland as a whole. In 53% of courses at the University of Iceland, signs of SKC 3 were found. Signs of SKC 6 were found in 46% of the courses, followed by SKC 4 (37%), SKC 1 (32%) and SKC 5 (31%). Signs of SKC 7 and 8 were found in 10% or less of the courses within the University of Iceland.

3.2. Signs of Sustainability Key Competencies for Each School of the University of Iceland

The results for the School of Education are shown in Figure 3. In total, 2336 signs of SKC were found in the 463 courses analysed, resulting in 5.0 average signs per course.
In Figure 3, the percentage of the SKC by the total number of courses of the School of Education is presented. Signs of SKC 6, 3, 4 and 5 were most evident, found in 75–97% of the courses. Fewest signs were found for SKC 7 (in 36%) and 8 (in 33%) of the courses of the School of Education.

Figure 3. Percentage of Sustainability Key Competencies by number of analysed courses for School of Education.

Figure 4 shows the results for the School of Engineering and Natural Sciences. In total, 1382 signs were found in the 689 courses analysed, resulting in 2.0 average signs of SKC per course. The highest proportion of signs was found for SKC 3, i.e., in 87% of the total number of courses. Signs of SKC 1 were found in 28% of the courses, and signs of SKC 4 were found in 27% of the courses. No signs were found for SKC 7 at the School of Engineering and Natural Sciences.

Figure 4. Percentage of Sustainability Key Competencies by number of analysed courses for School of Engineering and Natural Sciences.

Figure 5 shows the results for the School of Health Sciences. In total, 1517 signs were found in the 642 courses analysed, resulting in 2.4 average signs of SKC per course. The highest proportion of signs was found for SKC 3 (in 75% of the courses). In second place...
is SKC 5 (in 35% of the courses), followed by SKC 2 (in 34% of the courses). The lowest number of signs was found for SKC 7 (in 4% of courses) for the School of Health Sciences.

Figure 5. Percentage of Sustainability Key Competencies by number of analysed courses for School of Health Sciences.

Figure 6 shows the results for the School of Humanities. In total, 848 signs were found in 770 courses analysed, resulting in 1.1 average signs of SKC per course. Three signs are clear in more than 20% of the courses in the School of Humanities. These are SKC 1 (in 36% of courses), SKC 6 (in 30% of courses), and SKC 5 (in 23% of courses). Signs for SKC 2 and 4 were found in 1% of the courses, but no signs were found for SKC 8 in the courses of the School of Humanities.

Figure 6. Percentage of Sustainability key competencies by number of analysed courses for School of Humanities.

Figure 7 shows the results for the School of Social Sciences. In total, 1569 signs were found in the 675 courses analysed, resulting in 2.3 average signs of SKC per course. Two SKCs stand out in terms of identified signs. These are SKC 6 (in 82% of courses) and 4 (in 68% of courses). The fewest signs were found for SKC 7 (in 3% of courses) and 8 (in 2% of courses) for the School of Social Sciences.

Figure 7 shows the results for the School of Social Sciences. In total, 1569 signs were found in the 675 courses analysed, resulting in 2.3 average signs of SKC per course. Two SKCs stand out in terms of identified signs. These are SKC 6 (in 82% of courses) and 4 (in 68% of courses). The fewest signs were found for SKC 7 (in 3% of courses) and 8 (in 2% of courses) for the School of Social Sciences.
3.3. Signs of Sustainability Key Competencies—Comparison among the Five Schools of the University of Iceland

In sum, proportionally most signs of Sustainability Key Competencies were found for SKC 3 (Normative competency) and SKC 6 (Critical thinking competency). Three other competencies were clearly identified in courses at the University of Iceland, i.e., SKC 1 (Systems thinking competency), SKC 4 (Strategic competency) and SKC 5 (Collaboration competency) that were found in 30–40% of the analysed courses of the university.

Looking at the individual schools of the University of Iceland, the far highest proportion of signs of the Sustainability Key Competencies was found within the courses of School of Education (5.0 signs per course) and fewest for the School of Humanities (1.1 sign per course).

Results of identified SKCs by the five schools at the University of Iceland are presented in Figures 8 and 9 below. The proportion of signs for Sustainability Key Competencies 1–4 by the number of courses in each of the five schools at the University of Iceland is presented in Figure 8.

The SKC 1 indicates systems thinking competency, which was identified within all schools of the University of Iceland, for the most part within the School of Education (in 49% of courses in SoEd). The signs of SKC 1 for the other four schools were between 22–36%.

The SKC 2 indicates anticipatory competency, which was identified for the most part within the School of Education (in 41% of courses in SoEd), and then for the School of Health Sciences (in 34% of courses in SoHS). The far fewest signs of SKC 2 were identified for the School of Humanities (in 1% of courses in SoHu).

The SKC 3 indicates normative competency, which was clearly identified for three of the schools, the School of Education (in 88% of courses in SoEd), the School of Engineering and Natural Sciences (87% of courses in SoEN), and the School of Health Sciences (in 75% of courses in SoHS). Signs of SKC 3 were identified in relatively fewer courses in the School of Humanities (in 16% of courses in SoHu) and the School of Social Sciences (in 13% of courses of SoSS).

The SKC 4 indicates strategic competency, which was identified for the most part within the School of Education (in 85% of courses in SoEd) and then for the School of Social Sciences (in 68% of courses in SoSS). Signs of SKC 4 were found for around one-fourth of courses in the School of Engineering and Natural Sciences and the School of Health Sciences (87% of courses in SoEN), and the School of Health Sciences (in 75% of courses in SoHS). Signs of SKC 4 were identified for the School of Social Sciences (in 68% of courses in SoSS), and the School of Humanities (in 16% of courses in SoHu).

Figure 7. Percentage of Sustainability Key Competencies by number of analysed courses for School of Social Sciences.
Sustainability. Proportionally, the far fewest signs of SKC 4 were identified for the School of Humanities (in 1% of courses in SoHu).

Figure 8. Proportion of signs for Sustainability Key Competencies 1–4 by number of courses in each of the five schools at University of Iceland.

The proportion of signs for Sustainability Key Competencies 5–8 by the number of courses in each of the five schools at the University of Iceland is presented in Figure 9.

![Figure 9](image-url)

Figure 9. Proportion of signs for Sustainability Key competencies 5–8 by number of courses in each of the five schools at University of Iceland.

The SKC 5 indicates collaboration competency, which was identified within all schools of the University of Iceland, for the most part within the School of Education (in 75% of courses in SoEd). In second place is proportion of signs for the School of Health Sciences (in 35% of courses in SoHS), followed by the School of Humanities (in 23% of courses in SoHu) and the School of Social Sciences (in 21% of courses of SoSS). The relatively fewest signs were identified for the School of Engineering and Natural Sciences (in 15% of courses in SoEN).

The SKC 6 indicates critical thinking competency, which was identified for the most part within the School of Education (in 97% of courses in SoEd), followed by the School of Social Sciences (in 82% of courses of SoSS). The proportion of signs of SKC 6 for the School
of Health Sciences and the School of Humanities was around 30% in their courses, and the far lowest proportion of signs was identified for the School of Engineering and Natural Sciences (in 11% of courses of SoEN).

The SKC 7 indicates self-awareness competency, which was identified for the most part within the School of Education (in 36% of courses in SoEd). In the other schools, fewer than 5% of the courses had identified signs for SKC 7, and none were found for the School of Engineering and Natural Sciences.

The SKC 8 indicates integrated problem-solving competency, which was identified for the most part within the School of Education (in 33% of courses in SoEd). In two schools the signs were just above 10% in their courses, i.e., in the School of Engineering and Natural Sciences (in 12% of courses in SoEN) and in the School of Health Science (in 11% of courses in SoHS). In the School of Social Sciences, the signs of SKC 8 were relatively very few (in 2% of courses in SoSS), and no signs of SKC 8 were found for the School of Humanities.

In sum, relatively most signs of all the Sustainability Key Competencies were found in the courses of the School of Education. The School of Humanities had the far fewest proportion of signs for SKC 2 (anticipatory competency) and SKC 4 (strategic competency), and no signs were identified for SKC 8 (integrated problem-solving competency) for the School of Humanities. The School of Engineering and Natural Sciences had proportionally the far fewest signs for SKC 5 (collaboration competency) and SKC 6 (critical thinking competency), and no signs for SKC 7 (self-awareness competency). The other schools had signs of different SKCs, from moderate proportion to low, except for SKC 3 (normative competency), where three schools were identified with 75% or more proportion of signs per number of courses in each school.

4. Discussion and Conclusions

The aim of this research was to know to what extent the University of Iceland courses seem to include the emphasis of the Sustainability Key Competencies, generally seen as crucial to advance sustainable development, either in the course description text or its learning outcomes. No such research had been executed for the whole University of Iceland before and thus no comparison can be done indicating progress or changes. However, some points raise questions, and some came as a surprise, but others did not.

The aim of ESD put forward by the UN is for developing competencies that empower individuals to reflect on their own actions, considering their current and future social, cultural, economic, and environmental impact, from a local and global perspective [9]. Of the five schools in the University of Iceland, the School of Education had comparatively most signs of the SKCs. The possible explanation is that within the School of Education, special focus is on educational aims and competencies, particularly within the context of Teacher Education. However, to be able to achieve the UN aims, one needs certain key competencies for understanding complexity and long-term effects of present-day actions as well as for questioning common assumptions [27,30]. Of UNESCO’s eight SKCs there are in particular two competencies that support that aim, i.e., SKC 6, the Critical thinking competency, including the ability to question norms and to reflect on one’s own values, perceptions, and actions, and SKC 7; the Self-awareness competency, including the ability to reflect on one’s own role in the local community and (global) society [9]. However, the relative signs of these two SKCs differ greatly when looking at the overall results for the University of Iceland. Signs of SKC 6 (Critical thinking competency) within the university were found on average in 46% of the university’s courses. The highest proportion was found in courses for the School of Education (in 97% of their courses), and the School of Social Sciences (in 82% of their courses). Here, the School of Engineering and Natural Sciences had proportionally the far fewest signs (in 11% of their courses). Then, signs of SKC 7 (Self-awareness competency) were only found on average in 8% of the university’s courses. The signs of SKC 7 were found in 36% of courses within the School of Education, but 0–4% of courses in the other schools. Here are clear opportunities for improvement
within the individual schools, particularly within the School of Engineering and Natural Sciences, whose courses indicated no signs of SKC 7.

Given the context of universities and the pressing nature of sustainability problems humanity faces, it was of surprise that now, in the second decade of the 21st century, there were relatively few signs found of collaboration competency within four of the schools at the University of Iceland (75% in SoEd, 35% in SoHS, but fewer than 25% in the other schools). This competency is in line with what Wiek et al. call “Interpersonal competence”, being the ability to motivate, enable, and facilitate collaborative and participatory sustainability research and problem-solving [27]. This capacity includes advanced skills in communicating, deliberating, and negotiating, collaborating, leadership, pluralistic and trans-cultural thinking, and empathy. These results raise questions about whether academic teachers in universities assume these competencies are being achieved as a “side product” to the studies, presumed to become realized, and that these competencies are so general they do not need to be particularly stated. This calls for further research since the capacity to understand, embrace, and facilitate diversity across cultures, social groups, communities, and individuals is recognised as a key component of this competence [27].

The School of Engineering and Natural Sciences seems to include the relatively fewest signs of SKC 5, 6, and 7, and the School of Humanities seems to include the relatively fewest signs of the SKC 2, 4, and 8. What could explain these results, given that the Sustainability Key Competencies are not content-specific but “represent cross-cutting competencies that are necessary for all learners of all ages worldwide and serve as an explicit and commonly shared reference framework [9] (p. 10)? It is possible that more emphasis is on the SKCs in the execution of the courses than is explicitly presented in the course description texts and learning outcomes published in the University curricula. In the preparation phase of this research and during the pilot and execution phases of this research, there appeared clear indications of urgent revision of course descriptions and learning outcomes in all the five schools for securing required information about each course. In addition, in the pilot phase, examples were revealed about courses where information in the course catalogue (the description text and learning outcomes) was not in line with the actual execution of the course. This calls for further research, possibly including case studies of selected courses, with focus on the courses’ teaching plans, and the teaching and learning as perceived by teachers and students.

Moreover, the implications of the results of this research bring forward the need for each school of the university to demarcate and scrutinise their own course offerings, asking if and how they could make the SKCs more explicit in course descriptions and learning outcomes, and particularly in the assessment. This indicates with no doubt that ahead is a lot of work within the University of Iceland, and that work is quite complex in many respects.

When looking at these results for the University of Iceland at this timepoint, the question of the usefulness of such a research is raised. How can these Sustainability Key Competencies guide the curriculum development of the University of Iceland? According to research pedagogical approaches, including more inter- and transdisciplinarity in programmes makes possible the development of the key competencies needed for promoting sustainable development [9]. These approaches should be kept in mind when decisions of what needs to change, and by whom and how are taken. However, as Rieckmann points out [30], further research is needed on the development, and even more necessary on the assessment, of Sustainability Key Competencies in higher education.

However, no research is without limitations. In the phase of data collection each course could only get the value 1 for each SKC, regardless of the number of signs appearing. In addition, each course had the same weight in the analysis regardless of the size of the course (mainly being 4–10 ECTS). These factors could influence the results. Then, two other points need to be kept in mind. First, that the data analysis was executed by five individuals who could, despite efforts of synchronising the work, present some discrepancies. Second, although some examples can be found on the university’s implementation of the SKCs in
curricula, the results do not give information for what happens in the work taking place in each course. This research was a curriculum analysis, not analysis of actual practice.

Overall, this research indicates ample opportunities for improvement for the University of Iceland in relation to the UN Sustainability Key Competencies. Not surprisingly the SKCs appeared mostly for the School of Education. But of some surprise was the obvious discrepancy between the highest scoring fields of study according to Times Higher Education University Ranking [15,25] by citations, research, and teaching, and the proportional signs of SKC. The University of Iceland ranked highest in the field of Life Sciences, Engineering and Technology and Physical Sciences, but the School of Engineering and Natural Sciences, which host these studies, seemed to include the relatively fewest signs of SKC 5, 6, and 7, competencies that aim at enhancing students’ competencies in collaboration, critical thinking, and self-awareness, indicating the ability to reflect on one’s role in a local and global context. This needs further attention and collective research for putting clearer focus on the SKCs that are generally seen as crucial to advance sustainable development by UNESCO [9]. The second issues to note in the scores presented by Times Higher Ranking according to their fields of study, is the fact that the score for teaching is always lower than the score for research and citations (for all fields of studies). This indicates less emphasis on the quality of teaching and learning than producing research results and citations, particularly in the context of UN SDGs and the advancement of specific Sustainability Key Competencies urgently needed to collectively face the complex challenges crucial for the survival of humanity.

These results indicate that the University of Iceland seems to be in similar footsteps as other universities walking the path of implementing the UN SDGs into policy and practice and turning their focus more and more to the competencies students are to achieve as a result of their learning. However, the contribution of this research does not only concern the University of Iceland. These results can serve as an indicator of what is aimed for in an international policy and how it appears in a local one. In addition, the contribution of this research is that it can serve as a benchmark for other universities, e.g., for comparison of results and for effectively creating policy and practices of universities that clearly include the UN Sustainability Key Competencies as a framework for their educational offers and assessment.

There are many more options for future research deriving from this research. One would be to carry out interviews with relevant stakeholders, academic and administration, within all five Schools of the University. This would help interpret the differences found among the Schools of the University of Iceland, and to transfer the results to some actual guidelines for the separate Schools, such as those highlighted in cited studies [6,12,13,26,28–30,32,36]. This could also serve as a lesson for other universities and higher education institutions regarding implementation of the UN SDGs into policy and practice, and how to advance specific Sustainability Key Competencies urgently needed for this purpose.

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