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HIGHER EDUCATION COMPETENCE MODEL FOR SUSTAINABLE DEVELOPMENT

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Abstract

An important goal of higher education is to shape the behavior of future citizens by influencing conscious students.The work is aimed at presenting the methodology for assessing "competencies in the field of sustainable development" acquired during university studies in non-formal and informal learning contexts. Given the absence of a framework, but following the criteria established by the "Council Recommendation of 20th December 2012 on the validation of non-formal and informal learning" (2012/C 398/01), a model called "Higher Education for Sustainability Competencies" (HE4SC) has been developed. Starting from the 17 Sustainable Development Goals by United Nations, the model allows evaluating the theoretical and practical knowledge achieved by students through their university educational path and environment. The main idea of the proposed model is to translate the Sustainable Development Goals into "sustainability competences" of individuals, developed in non-formal and informal learning contexts. In defining the model, it is important to single out a "sponsor" of sustainability, that will guarantee the activities that can support the acquisition of competencies by students; identify the Sustainable Development Goals more appropriate for the specific analysis; make classification of "competencies in the field of sustainable development" for the chosen goals; determine the level that is considered acceptable for each "competence in sustainable development" in accordance with the scheme of the European Qualifications Framework. While underestimating the contribution of the university environment and ways to improve the transfer of knowledge, skills and competencies, a balance between "sustainability competencies" can be achieved through the HE4SC model.

1. Introduction

"The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future" (Sustainable Development, 2020).

The 17 Sustainable Development Goals (SDGs) are shown in the Figure 01.

Figure 1. The 17 Sustainable Development Goals (SDGs) (Source: UN)

In the Sustainable Development Outlook 2020, the United Nations Department of the Economic and Social Affairs (UN DESA) has exanimated the repercussions of COVID-19 on the achievement of the above 17 SDGs, starting from the 2019 Global Sustainable Development Report (I Independent Group of Scientists appointed by the Secretary General, 2019; United Nations Department of the Economic and Social Affairs, 2020). That Report considered the distance from reaching the target by 2030 before COVID-19 (Figure 2).

Due to COVID-19, many countries took various emergency measures to strengthen their healthcare, social protection, and overall governance systems to deal with the crisis, with repercussions on the post-COVID-19 scenario. According to the above analysis the post-COVID-19 scenario depends on how each Country will: (i) minimize the damage caused by COVID-19; (ii) recover quickly from the damages; (iii) hold on and build further on the positive changes introduced to its healthcare, social protection, and governance systems during the pandemic; (iv) sustain and bolster the positive gains that were made regarding the planet-related SDGs during the COVID-19 crisis; and (v) reenergize its general effort toward sustainable development. Should countries succeed at the above efforts, they will enter the optimistic scenario. The COVID-19 crisis has clearly showed that health inequality persists today and there is a robust link between income and health (Chokshi, 2018). There is strong connection between income and life expectancy, a gap of about 15 years for men and 10 years for women when comparing the

most affluent 1% of individuals with the poorest 1% (Chetty et al., 2016). However, education and in particular higher education can have an impact on that relation (Atkinson, 2015).

Figure 2. Pre-COVID assessment of progress toward SDGs (distance from reaching the target by 2030)

This work begins by considering that achieving the SDGs depends not only on policymakers' decisions, but also on the individuals' choices influenced by their lives and their environment.

The main idea behind the proposed model is to translate the Sustainable Development Goals into "sustainable development competencies" of individuals, developed in non-formal and informal learning contexts (Werquin, 2010).

2. Problem Statement

Non-formal learning is different from formal learning because it takes place outside the formal school/vocational training/university system, through planned activities (e.g. with goals and timelines) involving some forms of learning support, for example:

- programmes to impart work-skills, literacy and other basic skills for early school-leavers;
- in-company training;
- structured online learning;
- courses organised by civil society organisations for their members, their target group or the general public.

Informal learning is not organized or structured in terms of goals, time or learning. It concerns the skills acquired (sometimes unintentionally) in the course of life and work, for example:

- project-management or IT skills acquired at work,
- languages and intercultural skills acquired during a stay abroad,
- IT skills acquired outside work,
- skills acquired through volunteering, cultural activities, sports, youth work and through activities at home (e.g. taking care of a child).

To develop a model for assessing competencies, a reference structure is needed (Robinson et al., 2007), but the criteria dictated by the Council Recommendation of 20 December 2012 on the validation of non-formal and informal learning (2012 / C 398/01) can be followed (Council of The European Union, 2012). In general, the model is applicable to different types of competencies, both manual / operational / craft and organizational / managerial / intellectual, but also soft-transverse and hard-technical. Soft skills are personal attributes that enhance an individual's interactions, job performance, and career prospects. Unlike hard skills, which are the technical requirements of a job and many other activities, soft skills relate to a person's ability to interact effectively with others and are broadly applicable both in and outside the workplace (Westerhuis, 2011). Referring to "sustainability competences", we can consider them as a combination of theoretical knowledge and practical skills, sometimes technical and related to a specific issue and often transversal and useful in different contexts, able to guide the behaviour of an individual in the life actions and interactions, at work and at home, according to the concept of the continuum of *lifelong and life wide learning* (European Commission, 2000).

3. Research Questions

The competence measurement process has always attracted the attention of researchers and many projects for the assessment in different domains were developed, in particular in educational field (Leutner et al., 2017). It is a complex process, used often in the field of HR development and empowerment (Russo, 2016). In the recent literature, many models were developed to improve performance. The model can also be useful for comparing the available and required competencies of individuals or organizations, starting with related behavior. It is necessary to use special dictionaries or create individual, as well as identification and verification tools (surveys, interviews, focus groups, etc.).These models are useful for exploring competencies throughout life, young or adult, citizen or employee, student or teacher (Mashinchi et al., 2017).

Competence is a structured set of knowledge (to know) and skills (to know how) that can be used independently in work or study situations, as well as in professional and personal development. Therefore, exploring a set of competencies means confirming knowledge, skills, or "the ability to use knowledge and skills independently in real life conditions" (competence).

The assessment process requires three different aspects to be examined:

- theoretical concepts acquisition (knowledge);
- practical ability acquisition (skill);
- the joint acquisition of theoretical concepts and practical abilities, knowing how to use independently in work situations (competence).

The main difficulty in competence assessment is the definition of competency indicators (an element or a set of elements that can communicate or provide information about the property of a certain competence).

The set of indicators attributed to a competence defines the distinctive and identifiable criteria that make the acquisition of competence evident with reference to the application context.

Each evaluation process takes place through the following three steps:

- Identification: the first phase aims to identify and define the competence amenable to a particular field;
- Documentation: the second phase aims to point out the competence possession;
- Evaluation: the third phase aims to verify the competence possession (according to criteria and indicators referring to predefined standards) and to evaluate the achieved level.

After the above three steps, it might be possible to certificate the competence possession, according to defined rules.

Given the absence of a framework to evaluate the acquired competences, in particular for sustainability ones, it becomes essential to involve qualified experts able to evaluate the actual acquisition of competences (Dreyfus & Dreyfus, 1980). Only "an authorised body confirms that an individual has acquired learning outcomes (knowledge, skills and competences) measured against a relevant standard" (UNESCO, 2011).

4. Purpose of the Study

The 17 Sustainable Development Goals or SDGs are (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (9) Industry, Innovation and Infrastructure, (10) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the Goals. Even if they were fixed by world leaders in 2015, their achievement depends on the today contribution of all persons, in order to create a better world by 2030, by ending poverty, fighting inequality, and addressing the urgency of climate change.

The University path and environment contribute to shaping the thoughts and actions of students, many of whom are future leaders. Therefore it is interesting to understand how they can influence the achievement of the SDGs through informal or informal activities. For the previous objective, it is important to create a supporter within the organization, in particular the Committee on Sustainable Development: a group of experts with documented qualifications, able to motivate students to achieve the SDGs through constant concrete actions. In accordance with the aforementioned actions, the members of the above Committee will help to determine indicators for assessing the "sustainable development

competencies" that students have, before and after the actions implemented within the organization, in particular the University (balance of competencies and the measure of their development).

The role of the experts of the Committee for Sustainable Development is crucial. For their qualifications, one can refer to the European Social Fund reporting guidelines for 2007–2013, which distinguishes between three levels:

- **Group A:** requires at least ten years of experience and includes university professors, senior researchers (research managers, researchers), business executives, entrepreneurs, industry experts and professionals;
- **Group B:** requires a minimum of three years of experience and includes university researchers, industry experts and professionals;
- **Group C:** includes university researchers, industry experts and professionals with less than three years of experience.

The University will ensure that experts have the necessary technical and professional requirements, according to the above groups A, B or C. The presence of such expert figures will lead to actions within the organization that are adequate to develop the SDGs and support the assessment of "sustainable development competencies", be it theoretical/practical (*knowledge/ability*) or cross-cutting/technical (*soft/hard skills*).

5. Research Methods

The main object of the proposed model is not the evaluation of a single individual, but the capacity of developing "sustainability competences" in the entire population belonging to the same organization, in particular university students: from individuals to the whole organization performances. To reach the above objective, it is not the depth of the competences assessment that is important, but its width in order to collect much reliable data in a quick way. It is necessary to use a survey tool (questionnaire, test, interview, practice test etc.), opportunely defined.

In particular, the HE4SC model suggests using a questionnaire with closed answers, defined as follows:
- Each question with three answers: one definitely wrong, one wrong, only one correct;
- Questions prepared by the experts of the Committee for sustainable development, also responsible of concrete supporting actions inside the organization, non-formal and informal activities;
- Characteristics of each question:
  - Valence: theoretical / practical (assessment of knowledge or ability, respectively);
  - Nature: transversal / technical (assessment of soft or hard competences, respectively).
- For every competence (soft or hard), eight questions are required: four theoretical (knowledge) and four practical (ability).

The questions structure is important; in fact, theoretical questions are more based on memories and information; whereas practical ones are more based on choices and situations (Falcone et al., 2014). The criteria that must be met to demonstrate proficiency in a competency will be implicitly determined by the content of the questions. Obviously, they should be related to activities carried out within the organization. The structure of the question can be as shown in Table 1.

Table 1. Question Scheme

1 question with 3 answers (one definitely wrong, one wrong, only one correct)	Question	Valence	Nature
	Answer 1 Answer 2 Answer 3	☐ Theoretical (knowledge) ☐ Practical (ability)	☐ Transversal (soft skill) ☐ Technical (hard skill)

Question Examples

The question scheme doesn't change when investigating theoretical or practical, transversal or technical aspects. In the following Tables 2, 3, 4 and 5, some examples are shown.

The choice of the questions allows defining the region of competence under study, the particular group of SDGs; then, by analysing the answers given, it will be possible to value the possessed levels and the performances, as explained previously.

Table 2. Example of question for assessing competence in sustainable development: *Theoretical-Transversal*

1 question with 3 answers (one definitely wrong, one wrong, only one correct)	Question	Valence	Nature
	How many new people are pushed into extreme poverty in 2020? About 7 ML About 70 ML About 700 ML	X Theoretical (*knowledge*) ☐ Practical (*ability*)	X Transversal (*soft skill*) ☐ Technical (*hard skill*)

Notes: *NSGD focus: 1–End poverty in all its forms everywhere*
Sustainability competence: Poor people support

Table 3. Example of question for assessing competence in sustainable development: *Practical-Transversal*

1 question with 3 answers (one definitely wrong, one wrong, only one correct)	Question	Valence	Nature
	What is better to donate to a mendicant? Books Money Food	☐ Theoretical (*knowledge*) X Practical (*ability*)	X Transversal (*soft skill*) ☐ Technical (*hard skill*)

Note: *SGD focus: 1–End poverty in all its forms everywhere*
Sustainability competence: Poor people support

Table 4. Example of question for assessing competence in sustainable development: *Theoretical-Technical*

1 question with 3 answers (one definitely wrong, one wrong, only one correct)	Question	Valence	Nature
	What is the power consumption of an average tablet?	X Theoretical (*knowledge*) ☐ Practical (*ability*)	☐ Transversal (*soft skill*) X Technical (*hard skill*)
	15 watts		
	150 watts		
	1.500 watts		

Note: *SGD focus: 12–Ensure sustainable consumption and production patterns*
Sustainability competence: Resource consumption reduction

Table 5. Example of question for assessing competence in sustainable development: *Practical-Technical*

1 question with 3 answers (one definitely wrong, one wrong, only one correct)	Question	Valence	Nature
	What do you use to storage some important information?	☐ Theoretical (*knowledge*) X Practical (*ability*)	☐ Transversal (*soft skill*) X Technical (*hard skill*)
	A print copy		
	A digital copy		
	Both		

Note: *SGD focus: 12–Ensure sustainable consumption and production patterns*
Sustainability competence: Resource consumption reduction

6. Findings

The proposed model suggests referring to the descriptors of the European Qualifications Framework for Lifelong Learning (EQF) to select proficiency levels (European Commission, 2008a; European Commission, 2008b). In accordance with this structure, eight levels of knowledge, skills, and competencies are described. The suggested rating scale-levels are listed below:

- Level 8: demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research.
- Level 7: manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams.
- Level 6: manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups.
- Level 5: exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others.
- Level 4: exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities.

- Level 3: take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems.
- Level 2: work or study under supervision with some autonomy.
- Level 1: work or study under direct supervision in a structured context.

In line with European Qualifications Framework (EQF), all Member States are in the process of developing National Qualification Frameworks (NQFs), which describe qualifications in terms of learning outcomes (CEDEFOP, 2013; Coles, 2007).

Mathematical Formulation

We agree with many authors, in particular with Van de Snepscheut (1984): "In theory, there is no difference between practice and theory. In practice, there is".

Consequently, a person could be skilful, competent in practice, even if lacking the necessary theoretical knowledge in a particular field (Weiss & Kittikhoun, 2011). Therefore, the competence is not the simple sum of knowledge and ability, but needs something linked to responsibility and autonomy, more depending on practice then theory. The proposed formulation to value the level of competence possession, the same for hard and soft competences, giving more weight to ability than knowledge, is:

$$\text{Competence level} = ((\text{Knowledge level} + \text{Ability level} \times 2)/3) \times 2 \qquad (1)$$

or in a compact form

$$C = ((K + A \times 2)/3) \times 2$$

Thestructure of the questionnaire required 8 questions for every analyzed competence, 4 theoretical (knowledge) and 4 practical (ability);consequently, the total range of the competence level is 1–8, as evaluated thanks to the above formulation (1), compliant with the eight levels of EQF. The scale of judgment becomes:

- Excellent (score 8): critical and in-depth knowledge of the topics, commendable competence level.
- Outstanding (score 7): extensive knowledge of the topics, very good competence level.
- Good (score 6): satisfactory knowledge of the topics, discrete / good competence level.
- Average (score 5): essential knowledge of the topics, just enough competence level.
- Mediocre (score 4): fragmentary knowledge of the topics, modest competence level.
- Insufficient (score 3): incomplete knowledge of the topics, level of competence not sufficient.
- Poor (score 2): very sketchy knowledge of the topics, grossly inadequate competence level.
- Null (score 0–1): no knowledge of the subjects, competence level very low or nil.

Sensitivity Analysis

A sensitivity analysis has been realized to determinate how the different values of the two independent variables (**K** and **A**) affect the dependent variable (**C**) under the given assumptions. The summary is presented in the Table 6.

Table 6.   Competence level = f(Knowledge level; Ability level)

C = f(K;A)	A=0	A=1	A=2	A=3	A=4
K=0	0	1	3	4	5
K=1	1	2	3	5	6
K=2	1	3	4	5	7
K=3	2	3	5	6	7
K=4	3	4	5	7	8

Instead, in the graph of Fig. 3, the level of competence obtained with the equation (1), is compared to the value obtained simply summing K+A; it is possible to notice that more the balance goes towards Ability, more quickly Competence increases.
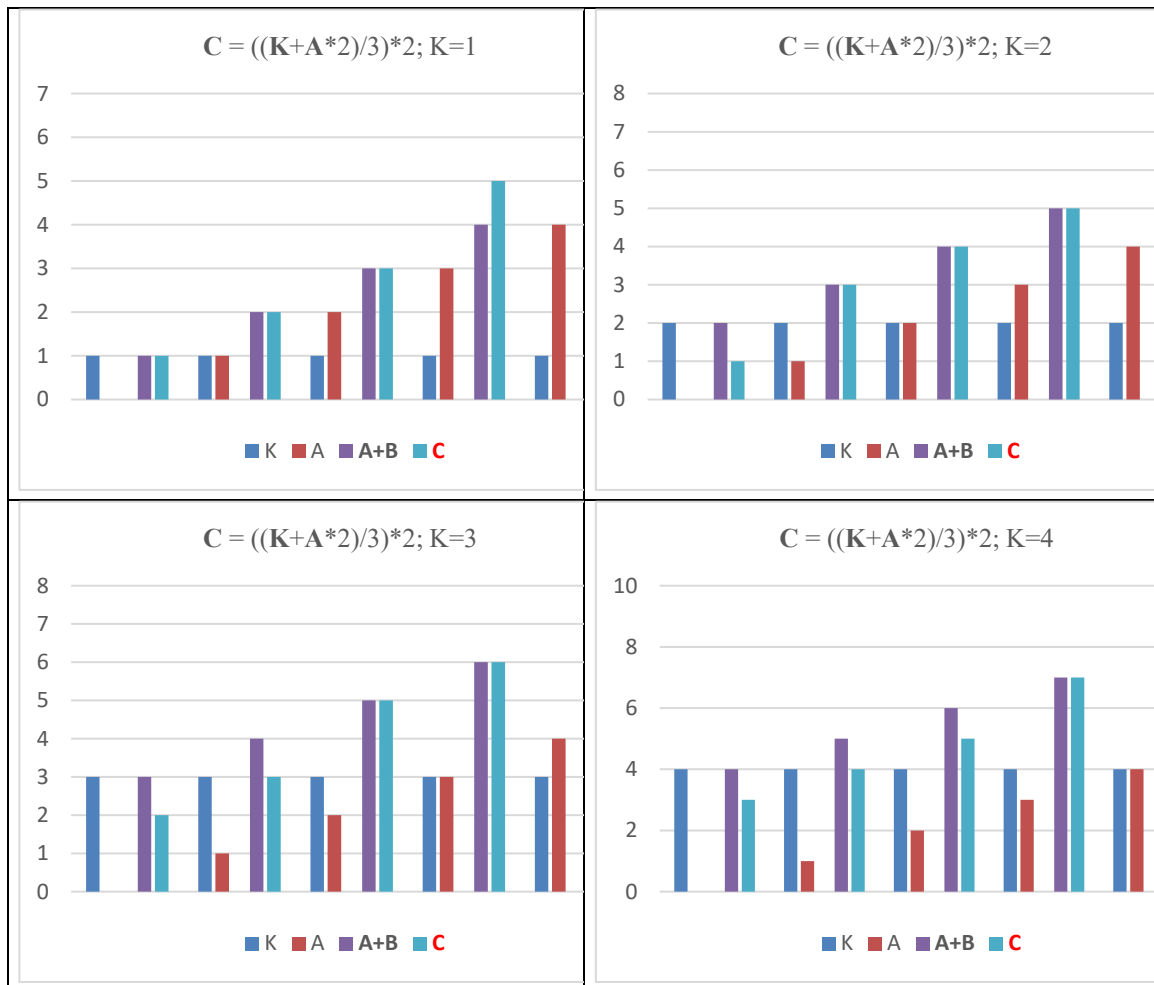

Figure 3. Competence trend

7. Conclusion

The work suggests transforming the SDGs as captured by countries into measurable "sustainable development competencies" accessible to people. The main goal of the proposed model is not to assess the individual in terms of attention to sustainability, but the ability of an entire organization to support its development and achievement (Petrillo et al., 2018). Starting with an assessment of the levels of "sustainable development competencies" achieved by people belonging to the same organization, in particular students belonging to the same university, one can try to assess the effectiveness of informal and non-formal activities carried out within the organization under the direction and under the guidance of a sustainable development committee capable of managing the entire assessment process. The developed model, after defining the set of competencies to be researched, proposes to adopt a structured questionnaire, a large-scale tool capable of assessing the level of competence (associated with a specific SDG), starting with the corresponding levels of knowledge and ability according to the eight EQF levels. The proposed analysis provides many results:

- To assess the attention to sustainability of a single individual;
- To assess the attention to sustainability of a group of individual belonging to the same organization;
- To value the capacity of a whole organization of supporting the sustainable development;
- To realize a benchmarking between different groups of the same organization;
- To realize a benchmarking between different bodies.

The authors are actually working on a questionnaire that focuses on four SDGs that are considered to be more directly related to people's everyday lives. It will be characterized by 32 questions perfectly balanced in terms of knowledge / ability, cross-cutting / technical competence. The importance of the proposed model is that a different view of higher education relates to the possibility of supporting the Sustainable Development Goals in a structured way (Nocenzi & Sannella, 2020).

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