RESEARCH IN PROGRESS

INTEGRATION OF THE SUSTAINABLE DEVELOPMENT GOALS IN PROJECT-BASED IT EDUCATION

JORIS GRESNIGT,[1] MARLIES VAN STEENBERGEN[2]

[1] HU University of Applied Sciences Utrecht, Institute for ICT, Utrecht, Netherland
joris.gresnigt@hu.nl
[2] HU University of Applied Sciences Utrecht, Research Group Digital Ethics, Utrecht, Netherland
marlies.vansteenbergen@hu.nl

Higher education institutions play a significant role in reaching the Sustainable Development Goals (SDGs). There is however a gap between the abstract nature of SDGs and the need to integrate these in the day-to-day educational environment. This paper presents an ongoing study that reports preliminary findings regarding the integration of insights from Value Sensitive Design into frequently employed artifacts within a project-based IT educational context, with the aim of translating abstract Sustainable Development Goals into teaching practice.

Keywords:
sustainable development goals, SDGs, values, sustainability, ethics, information technology, IT, ICT, higher education

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1 Introduction

The adoption of the 2030 Agenda for Sustainable Development by United Nations Member States in 2015 set forth a comprehensive framework for achieving global sustainable development through 17 interrelated Sustainable Development Goals (SDGs). These goals target social, economic, and ecological sustainability and seek to promote universal values, such as health, equality, and social justice (UN, 2015; UN, 2017). In this paper we use the term value in the sense of 'what is important to living things, with a focus on ethics and morality', expanding the Friedman and Hendry (2019) definition referring to humans, in order to prevent an anthropocentric focus as indicated by Borthwick et al. (2022).

Higher education institutions have a significant role in contributing to these global efforts (Žalėnienė & Pereira, 2021). Literature on sustainable education highlights the importance of integrating sustainability across the entire curriculum to develop truly competent students on the SDGs (Robinson et al., 2022; Wu & Shen, 2016). However, operationalizing this integration presents a challenge. While research and international policy documents focus on sustainable competences (Dias, 2022; Peet et al., 2004; Wiek et al., 2015; Sinakou et al., 2019; UNESCO, 2017; UNECE, 2011; Bianchi et al., 2022), they do not address the integration of the SDGs in the methods, models and theories of a specific domain. In light of the abstract nature of the SDGs and their contextual dependency within specific domains (Leal et al., 2019), there is a need for an approach that can translate these abstract goals into practical applications within a particular educational setting. In this ongoing study we explore such a translation in the context of project-based IT education, a form of education that mirrors working practice and is increasingly employed in higher education (Chen & Yang, 2019). The research question we address is: *How can the SDGs be integrated in project-based IT education*?

In this study we focus on the design phase of IT projects since it entails the primary decisions on embedding values in IT products, as well as determining product functionality and non-functional characteristics (Becker et al., 2015; Friedman & Hendry, 2019; Lago et al., 2015; Shapira et al., 2017). Consistent with Umbrello et al. (2021), we utilize insights from the Value Sensitive Design (VSD) approach (Friedman et al., 2006) as a bridge between the values in the SDGs and IT projects. VSD is an approach to integrate values into technological design (Friedman et al.,

2006). We use insights from VSD to incorporate values into the artifacts that students deliver in the design phase of their IT projects, such as a stakeholder analysis, persona descriptions or a prototype. Our aim is to adapt existing artifact formats to contain value dimensions by default, which we expect will lead to easier adoption among students, University staff and project clients than when we introduce completely new artifacts. We expect that these adapted artifacts will consequently lead to IT products that better incorporate SDG values. Two examples of this translation from SDG values to artifact formats are presented in the preliminary results section.

In the next section, we present the theoretical background on integrating sustainable development in the artifacts of project-based IT education. Section 3 discusses our research method. In section 4 we present preliminary results. We end with conclusions and further research in section 5.

2 Theoretical background

The Sustainable Development Goals (SDGs) embody specific values, as identified by Keitsch (2018), Muñoz et al. (2022), and Umbrello et al. (2021). The SDGs list ecological values, such as harmony with nature (SDG 12) and clean air (SDG 3), social values, including justice (SDG 16) and equality (SDG 5), as well as economic values, such as inclusive sustainable growth (SDG 8) and productivity (SDG 2) (UN, 2017).

Value Sensitive Design (VSD) is an approach to integrate values into technological design (Friedman et al., 2006). It is characterized by assessing the impact a new design may have on stakeholders' values. The values of different stakeholders may not always align and value tensions may be created. VSD aims to make values and value tensions explicit and carefully weigh them in making design choices. VSD offers a wide range of methods to do so, such as value dams and flows, value scenarios, and envisioning cards, and encourages to rework other existing methods and instruments to include a value perspective (Friedman & Hendry, 2019). VSD can be used to operationalize values mentioned in the SDGs using norms, leading to specific design criteria or requirements (Friedman & Hendry, 2019; Umbrella et al., 2021). The exact choice of which values and corresponding norms and design criteria are used depends on the interplay between the different stakeholders.

3 Research method

We adopt a design science approach in our study (Hevner & Chatterjee, 2010), since our object is to design a way to incorporate SDGs in project-based IT education. Structuring our study according to Peffers et al. (2007), we use the five steps of their design science research process: *problem identification and motivation, objectives of the solution (*as stated in the introduction*), design and development, demonstration* and *evaluation.* The research is currently in the design and development phase. Insights from VSD are used to design adaptations of existing formats commonly used in project-based IT education.

As a first step in the design and development phase we made the SDG values explicit and translated them to the IT field. This was done by finding academic articles on the relationship between the SDGs and IT and publications such as Tjoa & Tjoa (2016) of mostly UN organizations aligned with a certain SDG. E.g. the UN agricultural organization FAO publicizes about SDG 2 on hunger and IT. Analyzing these publications we created a list of positive and negative influences of IT on each of the SDGs which contain a myriad of values. IT can e.g. lead to different types of inequalities: caused by lack of access for poor people (SDG 1), for people with disabilities or caused by discrimination due to the use of racially or gender skewed data sets (SDG 10). This list is not meant to be exhaustive, but it aims to help the thought process of translating SDGs to the IT context. Having such an overview is however not enough if values are not part of the artifacts the students produce. Therefore for each of the artifacts commonly used in the IT design phase, we analyzed the gap between the artifact in use and insights from VSD on how to incorporate values and consequently adapted the artifacts to include a value dimension. For example, personas typically do not contain values and tend not to include non-typical personas, therefore we added these aspects to the persona format. Student and lecturers can use the overview of (SDG) values in IT produced in the first step as an inspiration to draw values from. To make it easier for students to produce the adapted artifacts we made formats which include worked examples of the artifact and 'how to' steps. These formats were tested with ten IT lecturers who applied the formats to a real case in a workshop setting and adapted based on the lecturers' feedback. We additionally provided supporting material such as videos and an easy-to-fill-out lay-out on an online collaborative platform, learning materials, assignments and assessment criteria, and embedded the SDGs in the learning

objectives. We are currently in the process of testing the formats with students in different years of their IT studies. The students use the formats in their projects, and we gather feedback from both lecturers and students.

4 Preliminary results

Until now we produced 11 formats to be used by students in the design phase, including formats for personas, formats for customer journeys and additional prompt questions. For example we extended the commonly used stakeholder analysis. In the regular IT design process, especially in an agile setting, the focus is on end-users. This creates IT that does not by default take into account the interests and values of a broad range of stakeholders and might create harm or fail to obtain benefits. The SDGs require including a broad group of stakeholders. VSD methods on stakeholder involvement offer insights, such as inclusion of indirect stakeholders (f.i. non-users, future generations or other cultures) and their values. The extended format aims to help students get a broader picture of stakeholders and their values so these can be taken into account as input for the design. Another example is the extension of the process of defining the problem. The typical questions used by students in defining the problem are limited in scope and tend to not contain questions that are vital for sustainable development such as looking into the relevance of the problem for future generations and relationships among various problems. VSD provides, with e.g. the envisioning cards method (Friedman et al., 2011), a whole range of added questions that can open up the students' horizon.

While testing the formats with the lecturers during the workshop they indicated that using them has definitely helped in making the abstract SDGs tangible for them. They indicated that it was easier for them to use IT specific values such as accessibility or privacy than the related more abstract SDGs *reduce inequality* or *ensure fundamental freedoms,* especially when integrated into artifact formats they were already used to. However, lecturers less familiar with the original artifacts, indicated that they felt overwhelmed by the added complexity.

The first results on the quality of the artifacts students made using the formats show a remarkable difference between students being coached by lecturers already familiar with the adapted formats and those to whom these were entirely new. Only the students with more experienced lecturers in this area were able to produce artifacts

that incorporate ethical/sustainable values in a sensible way. Students from classes with a less experienced lecturer tended not to use the provided new sustainable formats or to use them in such a way that they did not provide any valuable insights into values and value tensions. The use of the formats also created discussion between students and lecturers. Some students, especially those that were newly introduced to these sustainable demands in the later part of their study, were protesting against them, even calling them "woke", with a negative connotation.

5 Conclusion and further research

The preliminary results of this ongoing research indicate the feasibility of making the SDGs tangible for students and lecturers by enhancing existing methods with a value perspective. These methods can help to bridge the gap found in literature and in practice between SDGs and IT development. Even so, the inclusion of the value perspective adds complexity that may be overwhelming. Considering the still new, contested and volatile nature of the subject, there is clearly a need for training of lecturers, embedded in an aligned sustainable learning environment along with an ongoing open discussion among the stakeholders on SDGs and values in a specific context.

Our next steps are to complete the design and development phase by validating the usability and effect of the formats we developed with both lecturers and students. We will do so by continuing to use the formats in actual student projects throughout all years of the IT course and validating their use in focus groups. We will also conduct a comparative evaluation of the artifacts produced in various settings. Based on the outcomes we will further extend the formats with an implementation approach and supporting teaching materials. We intend to demonstrate the resulting way of integrating SDGs in project-based IT education by implementing it in other parts of the IT institute which offer project-based education.

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