
Education indicator evaluation of UI Green Metric of campus sustainability of Faculty of Engineering Universitas Negeri Semarang

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Abstract: Education is one of the categories and indicators of sustainable campus assessment used in UI Green Metric World University Ranking. This research aimed to evaluate the education indicator in Faculty of Engineering Universitas Negeri Semarang toward the ranking in UI Green Metric. Mixed assessment is carried out to identify curriculum, study implementation plans, and sustainable research. The requirements assessment collected in each department then screened through terminology scan as preliminary assessment. Then sustainability linkages were analysed to henceforth calculate. The result showed that Faculty of Engineering Universitas Negeri Semarang has 53.79% sustainability ratio of education indicator. This evaluation contributes as a reference to increase the value of sustainability in education indicators especially the curriculum and study implementation plans.

Keywords: campus sustainability; UI Green Metric; curriculum; study implementation plans; research.

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1 Introduction

Education's inclusion is one of the 17 goals of the Sustainable Development Agenda in 2030. The future of educational achievement designed more qualitative and transformational approach in several important international education initiatives including the Sustainable Development Goal on Education (SDG4), the Education 2030 Agenda and Framework for Action, the Global Action Program (GAP) on Education for Sustainable Development (ESD) (Ofei-Manu and Didham, 2018). In recent years, there have been sustainability assessment tools with different criteria for higher education toward green university and green education. The concept of 'green university' and 'green education' is becoming a trend and is being promoted by including environmental education, environmental protection and sustainable development to all disciplines both natural and social sciences, as well as all aspects of campus life (Barth and Rieckmann, 2012).

Creighton in Xiong et al. (2013) defined 'green education' as "the process of reducing the multitude of on- and off-site environmental impacts resulting from campus decisions and activities, as well as raising environmental awareness within the human communities of a higher education or university". Then it must be integrated into all higher education programs in all disciplines and fields of study (Wemmenhove and de Groot, 2001). Building and implementing a 'green curriculum' are the main and most important part in raising students' awareness of the environment and developing 'green universities' (Boks and Diehl, 2006). This due to the level of 'green curriculum' has a direct influence on the level of 'green education', and sustainability in social and economic development (Nejati and Nejati, 2013). So, determining the campus sustainability must be done through the assessment of several aspects needed.

Furthermore, the topic of sustainability assessment is concern in different references (Ceulemans et al., 2011) for example, as in Shiel et al. (2015) which specifically discusses Assessment and Evaluation in Higher Education. Study of the integration of sustainability into the functions of education, research, operations, and community involvement in higher education into the sustainability assessment (Fischer et al., 2015). In the field of education, curriculum assessment examines the existence of the theme of sustainability in the curriculum. The curriculum assessment provides insight into the

sustainability of the program which can be used as a reference for the starting point for a higher education change (Lozano and Young, 2013).

The determination of green campus and sustainability campus uses UI Green Metric as a standard. UI Green Metric is an initiative of Universitas Indonesia which is being launched in 2010 to provide ranking of the result of online survey towards current condition and policies in regard to Green campus and sustainability in the universities. Ranking is based on Setting and Infrastructure, Energy and Climate Change, Waste Water, Transportation, and Education and Research. Since the first ranking was held in 2010, then obtained from the official website of UI Green Metric, Universitas Negeri Semarang is ranked 35 out of 95 universities with 5,975.21 total score, and then in 2018 it was ranked 85 out of 719 universities in the world with 6925 total score. In 2016 to 2017, Universitas Negeri Semarang up the rank from 95 to 85. Main factor that increase the rank is Energy and Climate change and transportation, it was increase significantly, while education and research has drops. Education and research have 18% contribution of the total score. This criterion has seven indicators; one of them is the ratio of sustainability (RS) courses towards total courses/subjects. More widely, the sustainability courses related to green education and green universities in education indicator. Based on that, focus of this study discuss about green education.

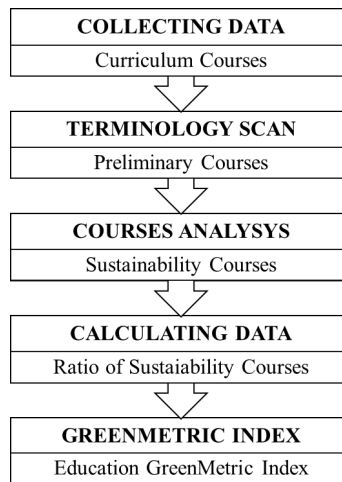
In this study, the definitions of 'green universities' and 'sustainable universities' follow relevant references (Velazquez et al., 2006; Lozano et al., 2013; Xiong et al., 2013). The 'green curriculum' referred as curriculum that includes environmental protection, nature conservation, savings and utilisation of resources, and environmentally friendly policies as the content and main objectives of teaching. Aimed to define green curriculum, the number of courses/subjects whose contents are related to sustainability offered at your university. Some universities have already tracked on how many courses/subjects available for this. The definition of the extent to which a course can be stated to be related to sustainability (environment, social, economic) or both, can be defined according to your university's situation. If a course/subject contributes in more than a minor or passing way to increasing awareness, knowledge, or action related to sustainability, then it counts. The number of courses/subjects can be counted by specifying related sustainability keywords used in the subjects.

In this situation, the keyword search method was adopted to carry out this research. Through Lee et al. (2013) who developed a list of 14 key words related to sustainability. Then for deeper analysis for sustainability, several related keywords were also adopted. Keywords must possess several requirements such as closely related to the environment, ecology and resources, and can express ideas of sustainability and are environmentally friendly in all contexts (Xiong et al., 2013). Keywords and combinations are used in data collection. Although this keyword cannot represent the entire curriculum, at least it contains the importance of 'green education' and continuing education and 'green curriculum'. Another approach is used to determine a green and sustainable curriculum. Many courses at each university are provided to teach professional knowledge and technical skills for better student prospects (Lozano, 2010), and the number of all programs provided by the institution is numerous and varied depending on the relevant university or university. In this study we are concerned about courses in all study programs in each department in the Faculty of Engineering Universitas Negeri Semarang and then the obtained data can be use as a reference to evaluate and increase the value of sustainability in education indicators.

2 Method

In case to identify the sustainability courses, modification methods are applied through different approaches to assess the presence of sustainability themes in course content will be used to categorise ‘courses that include sustainability’. Curriculum mapping using two methods by Stough et al. (2017): a terminology scan of course files and an analysis of course files developed specifically for the program. Terminology courses scan has been utilised on sustainability curriculum assessments by Ceulemans et al. (2011). Based on that, method and evaluation were done as shown on Figure 1.

Figure 1 Method to determine sustainable course



All courses included in the 2014 curriculum from all study programs each department in Faculty of Engineering were collected as a initial data. The department are Mechanical Engineering Department (include study programs Automotive Engineering Education, Mechanical Engineering Education, Mechanical Engineering), Chemical Engineering Department (include study program Chemical Engineering), Civil Engineering Department (include study programs Architectural Engineering, Building Engineering Education, Civil Engineering), Home Economics Education Department (include study programs Culinary Education, Fashion Education, Beauty Education, Home Economics Education), and Electrical Engineering Department (include study programs Electrical Engineering Education, Computer and Information Engineering Education, Electrical Engineering). Then it filtered using terminology scan as preliminary analysis to determine sustainable courses. The terminology scan assessed sustainability on courses contents towards sustainability keywords.

From limited terminology, courses will be expanded to be more holistic scan. To verify the explicit presence of sustainability in the program, this research adopts and modifies themes from Stough et al. (2017). Following themes are generated as preliminary reviews:

- 1 Sustainability (include sustainability, sustainable development).
- 2 Responsibility (responsibility, corporate social responsibility, CSR).

- 3 Ethics [ethic(s), ethical and green ethic(s)]. Based on preliminary reviews of the courses, terminology was further expanded to encompass additional sustainability-related topics from the courses themselves, organised into additional sustainability-related themes:
- 4 Environment-related terms (ecology, environment, and planet, green).
- 5 Society-related terms (socio-economic, society, social welfare, human rights, labour [in the context of labour rights], (un)employment, (in)equality, diversity).

The filtered sustainable courses are calculated based on guideline of UI Green Metric (2018) to determine RS courses using following equation:

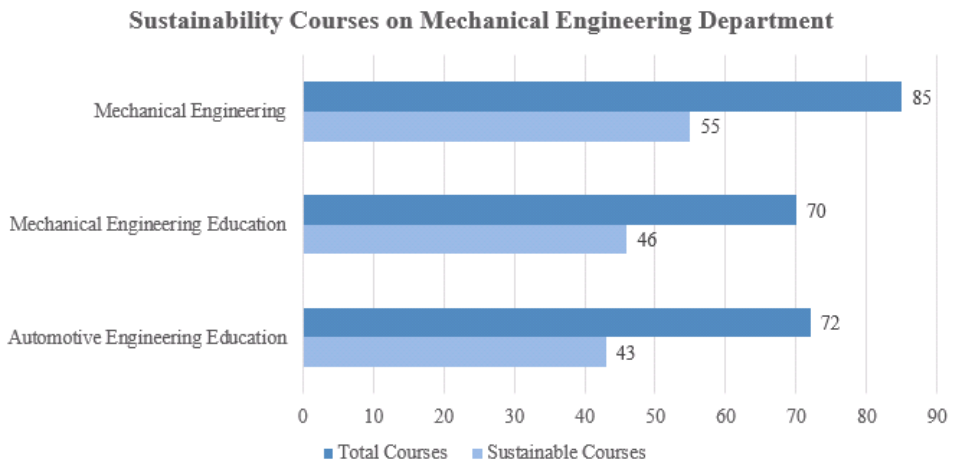
$$RS = \frac{\text{Total number of courses}}{\text{Number of sustainable courses}}$$

where RS courses written in percentage unit. Then data were analysed using descriptive and inferential technique.

3 Result

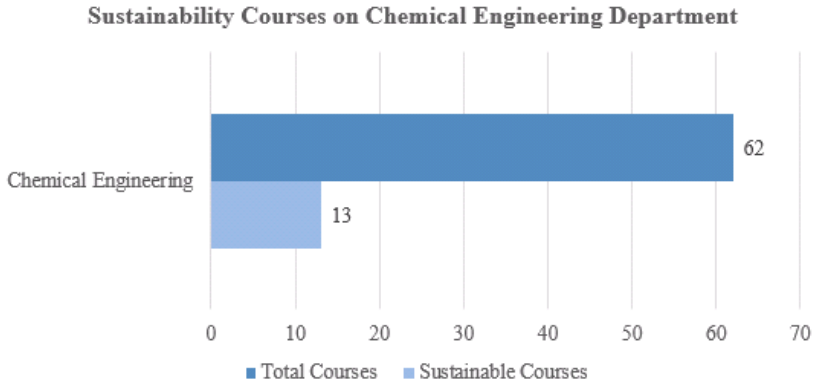
Referenced courses-based sustainability themes in the course content are categorised as courses that include sustainability. Results are displayed in each department. Using formula (1) in method, the data will be converted into RS courses. Mechanical Engineering Department has three study programs. Based on Figure 2, it can be concluded that RS courses in each study programs are; 59.72% for automotive engineering education with 43 sustainability courses, 65.71% for mechanical engineering education with 46 sustainability courses, and 64.71% for mechanical engineering with 55 sustainability courses.

Figure 2 Sustainability courses in Mechanical Engineering Department (see online version for colours)



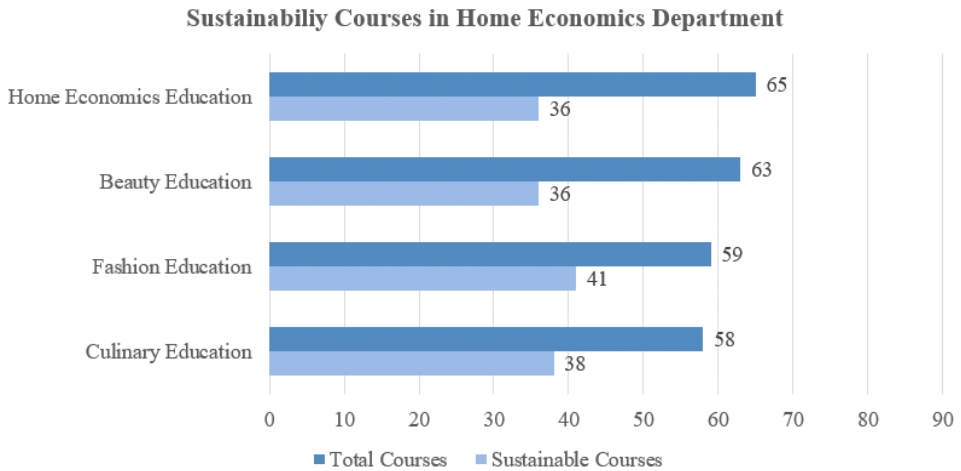
RS courses in Chemical Engineering Department based on Figure 3 is 20.97% with 13 sustainability courses.

Figure 3 Sustainability courses in Chemical Engineering Department (see online version for colours)



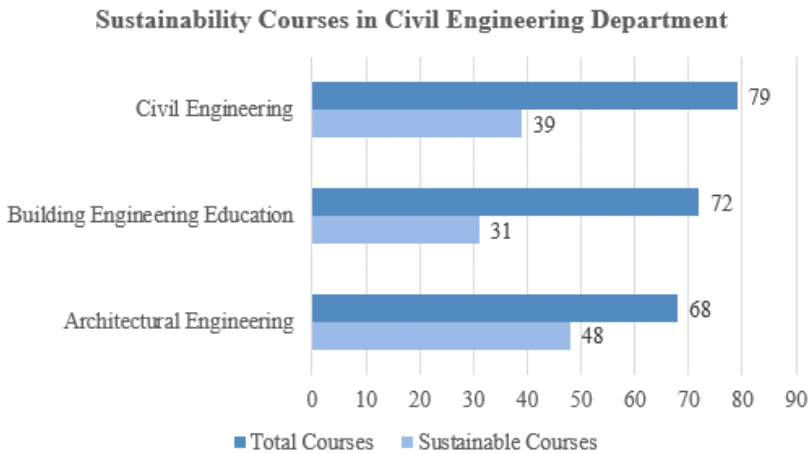
In department of home economics education, RS based on Figure 4 included; 65.52% for culinary education with 38 sustainability courses, 69.49% for fashion education with 41 sustainability courses, 57.14% for beauty education with 36 sustainability courses, and 55.38% for home economics education with 36 sustainability courses.

Figure 4 Sustainability courses in Home Economics Department (see online version for colours)



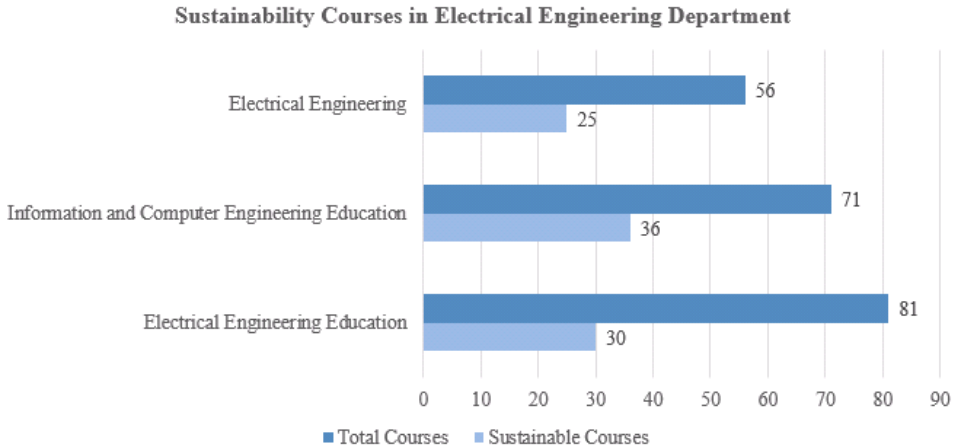
Then, RS courses in Civil Engineering Department are; 70.59% for architectural engineering with 48 sustainability courses, 43.06% for building engineering education with 31 sustainability courses, and 49.37% for civil engineering with 39 sustainability courses.

Figure 5 Sustainability courses in Civil Engineering Department (see online version for colours)



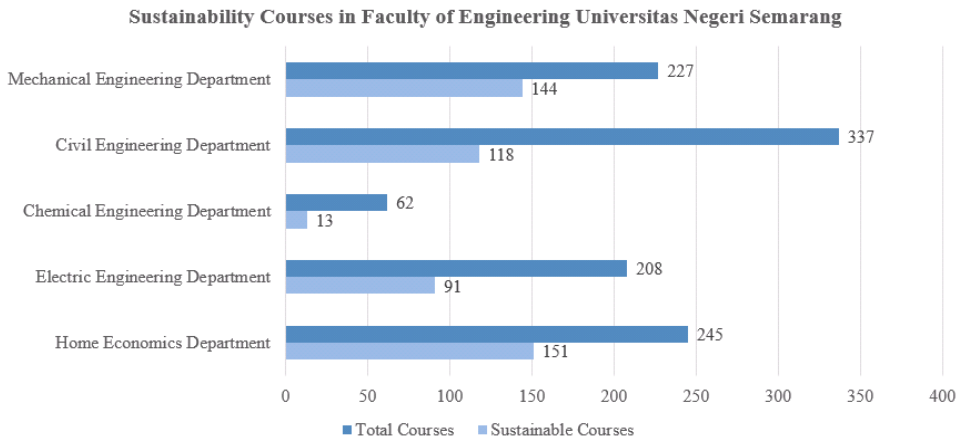
Last department, Electrical Engineering Department shown the RS courses based on Figure 6 as; 37,04% for electrical engineering education with 30 sustainability courses, 50,70% for information and computer engineering education with 36 sustainability courses, and 44,64% for electrical engineering with 25 sustainability courses.

Figure 6 Sustainability courses in Electrical Engineering Department (see online version for colours)



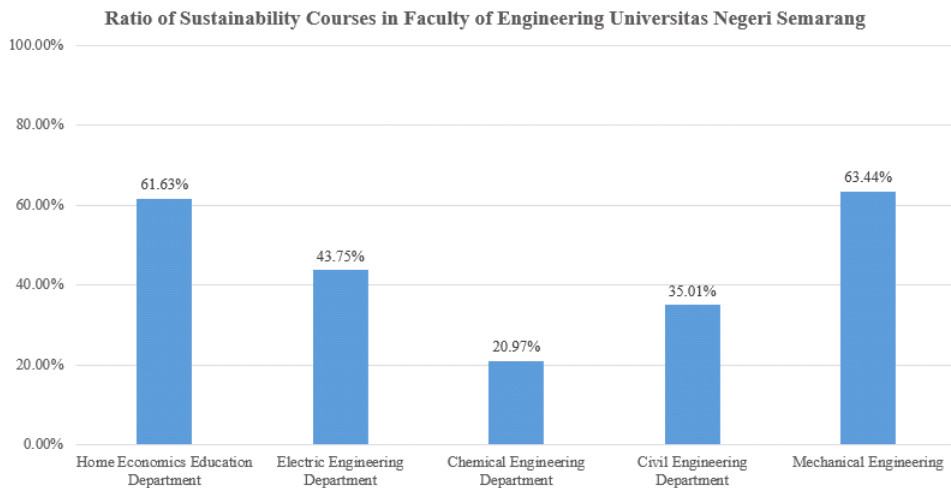
Accumulated data from each department are tabulated and given by chart on Figure 7. Where total number of courses is sum of all courses from study programs, and the number of sustainable courses is accumulated from each study programs.

Figure 7 Sustainability courses in Faculty of Engineering Universitas Negeri Semarang (see online version for colours)



The RS courses in Faculty of Engineering Universitas Negeri Semarang shown as Figure 8. The highest ratio achieved by Mechanical Engineering Department with 63,44%, in the second place is home economics department with 61, 63%, then Electrical Engineering Department in third with 43,75%, followed by Civil Engineering Department with 35,01%, and last 20,97% for Chemical Engineering Department.

Figure 8 RS courses in Faculty of Engineering Universitas Negeri Semarang (see online version for colours)



Continuing to UI Green Metric standard, the result of RS courses in each department or each study program are greater than 17%. It is mean, index of education in sustainable campus is 5, the highest scale of indexation. Its mean, current status in Faculty of Engineering Universitas Negeri Semarang can be included into green campus on education indicator.

4 Discussion

The case presented two approaches to sustainability assessment of curricula, and discusses priority determining of campus sustainability especially green education contribution related to them. Regardless of the approach used, the conceptualisation of 'sustainability' during the assessment process has an impact on the extent to which sustainability is integrated in the curriculum. In this case, as many as 14 keywords that are used as benchmarks in the scan terminology are used as preliminary courses, and then extended to courses analysis by applying the themes used by each subject. By using this limited approach, then the results obtained were 517 out of 961 courses categorised as 'sustainability courses' or 53.79% of sustainable courses. Then the validation of this assessment has been done before by validating the instrument or method used against the relevant literature.

Based on the results, there are several key points are highlighted for further discussion. First is the green curriculum, where this is an important indicator of an aspect of education for the sustainability status of a higher education or university. As explained by Suwartha and Sari (2013), there are around 16 indicators for sustainable campus, one of which is education. Chen et al. (2018) also stated that indicators for sustainability campuses in Taiwan were education that was examined through fuzzy Delphi methods and hierarchical process analysis. The results of this study indicate that development still needs to be done regarding sustainable courses. This can be seen in Figure 8 which shows the number of total courses and sustainability courses, which is use in scoring of UI Green Metric. Based on the results, the sustainability keywords found on courses still have a few that have not been listed and the sustainability content contained in the courses is still not yet visible. The 53.79% of sustainable courses is a good grade even though further development must be done to improve performance towards a sustainable green campus.

Second is contribution, what is meant in this case is the contribution of education, especially the green curriculum in determining the sustainability of a higher education or university. Universitas Negeri Semarang as one of the conservation-based universities highly upholds its vision as a green and sustainable campus so that the contribution of a green education is enormous in the implementation of campus sustainability. This is because a green education and green curriculum create a green atmosphere in the academic environment, so that it will increase awareness of the environment and the concept of sustainability in every aspect of life on campus. When this is done correctly, it can be said that a green education is successful (Abdul-Wahab et al., 2003).

However, a green education greatly contributes and becomes a top priority for sustainability. In general, to determine campus sustainability the indicator is not only education. All indicators given by UI Green Metric appropriate with the previous research. Chen et al. (2018) shown that three dimensions such; policy management, building and equipment, and educational activities are importance for the implementation of sustainability campus. In other studies, relevant to campus sustainability, there is a lot of scope that must be studied for such policies, work processes, environmental architects, and other variables that have an impact on the environment (Foo, 2013; Geng, 2013; Jabbour et al., 2013; Lenzholzer and Brown, 2013; Vicente-Molina et al., 2013).

The more sustainability courses lead toward green curriculum and become green education with several addition indicators. Then the sustainability ratio of the green curriculum must still be improved through appropriate methods such as open curriculum

(Lansu et al., 2013) and internal drive (Müller-Christ et al., 2013) because the level of green education becomes an important index in an assessment of the performance of a higher education or university.

5 Conclusions

This paper presents a study focused on evaluating sustainability education Faculty of Engineering Universitas Negeri Semarang in UI Green Metric. It integrates two growing fields; curricula assessment for sustainability and priority determination for sustainable campus. Several conclusions can be made:

- 1 The results show that sustainability is being broadly integrated into the curriculum, with average about 50% of CEE courses incorporating one or more related topics to the assessment.
- 2 Contributions to sustainability from the results of the curriculum assessment show that considerable efforts have been made to incorporate sustainability into courses.

The courses in appropriate technology are examples of important interdisciplinary approaches, not only for engineering, but also for philosophy, economics, ecology, social science and business. While the engineering profession is critical to building the path to sustainable prosperity, collaboration with many disciplinary professions from other fields that can work effectively in interdisciplinary teams will be very important. To reach a higher sustainability campus; which needs to be developed according to the author to promote sustainability education including; courses, work programs, research centres, government efforts and the development of all aspects at the global level.

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