Impact assessment methods for teaching activities on sustainable development goals

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ABSTRACT

This study aims to explore various approaches for assessing the impact of teaching activities on Sustainable Development Goals (SDGs). In addition to the well-known keyword search method, the study also introduces innovative methods utilizing text similarity algorithms, specifically Jaccard and Cosine algorithms. The performances of the traditional keyword search method and the proposed text similarity algorithms are then compared with the results obtained from a self-identification study conducted among the academic staff within the context of the case study. The strengths and weaknesses of each method are also discussed, aiming to contribute to a comprehensive understanding of impact assessment methodologies in the context of SDGs in education.

CCS CONCEPTS

• General and reference → Surveys and overviews; • Social and professional topics → Sustainability;

KEYWORDS

sustainable development goals, keyword search, text similarity, data mining, higher education, impact assessment

1 Introduction

By transferring knowledge and skills to individuals, teaching activities play a crucial influence in determining how society will develop in the future. With the increased attention being paid to sustainable development on a global scale, educators have a special opportunity to help achieve the SDGs.

Through their regular activities, without any additional effort, universities naturally contribute to achieving the SDGs. It is essential and valuable to adopt a well-structured approach to implementing the SDGs to ensure comprehensive engagement and maximize the impact of the university outputs. The engagement process of universities with the SDGs starts with the ‘recognition.’ Recognition step aims to map the ongoing activities and their contributions to SDGs. Following this step, the ‘opportunities’ are analyzed considering the current situation clarified by the recognition step. Finally, ‘organizing principle’ focuses on the integration and implementation of identified targets [1]. As part of the ‘recognition’ step, mapping of the university contributions to SDGs plays a crucial role in further discussions and ongoing efforts related to the SDGs by assessing strengths and weaknesses, building capacity, and facilitating reporting and communication. There are three main approaches mostly implemented to measure the impact of the activities on SDGs: desktop assessment, self-identification, and keyword searches [1].

In this study, the primary objective is to assess the extent to which the curricula at the chosen institution (IUS) align with the principles of the UN SDGs. Recognizing the limitations of keyword search method, an alternative approach is also employed. Instead of relying solely on keywords, text similarity algorithms are implemented that consider the semantic understanding of the content in the UN-recommended learning objectives for SDG education [2].

2 Methodology

The primary objective of this research is to examine and quantify the impact of teaching activities on the SDGs by utilizing different approaches and comparing their performances. Since the primary focus of this work is teaching activities, the data set to be used contains course learning outcomes. The first step is a thorough process that includes web scraping to extract learning outcomes of the courses offered by all academic programs under six faculties. After extracting the data from the web, keyword search was implemented. The keywords used for this study are the merged dataset of SDG keywords offered by the University of Toronto [3] and the data set proposed by Monash University [4]. The next approach is the text similarity analysis that compares the learning outcomes of the selected university and the UN-recommended learning objectives. In this approach, two different algorithms are implemented: Jaccard and Cosine text similarity algorithms. To compare the performances of these different assessment methods, a survey was conducted among the academic staff who are responsible for each program at IUS (self-identification). The
results of this survey were then used for comparison, and the correlation between the results of the algorithms and the survey, along with their significance, was investigated.

3 Results and discussion

This section provides the results obtained from the three methods implemented in all courses offered at IUS. The aim is to compare the results and to see if these three methods provide consistent results. Later their results were compared with the survey (self-identification) results.

The first implemented method is the traditional keyword search. Using the combined dataset, the learning outcomes of all courses offered in IUS are scanned, and keyword frequencies are reported (Figure 1). The second method implemented to assess the impact of teaching activities on SDGs is the text similarity algorithms. In addition to the automated approaches, a survey was also utilized to collect input from the academic staff at IUS.

For the comparison of the performances of different approaches, we define our hypothesis for methods, Keyword Search, Jaccard Similarity, and Cosine Similarity as follows:

\[ H_{0,i}: \text{There is no significant linear relationship between the values generated by method } i \text{ and observed data} \]

\[ H_{1,i}: \text{There is a significant linear relationship between the values generated by method } i \text{ and observed data} \]

where \( i \in \{ KS, JS, CS \} \), for methods, Keyword Search, Jaccard Similarity, and Cosine Similarity, respectively.

Table 1 summarizes the results of the Pearson correlation coefficient and p-values for these 3 methods highlighting the statistically significant results (p < 0.05).

<table>
<thead>
<tr>
<th>Method i</th>
<th>Pearson correlation coefficient</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyword Search (KS)</td>
<td>0.164</td>
<td>0.529</td>
</tr>
<tr>
<td>Jaccard Similarity (JS)</td>
<td>0.441</td>
<td>0.076</td>
</tr>
<tr>
<td>Cosine Similarity (CS)</td>
<td>0.792</td>
<td>0.000</td>
</tr>
</tbody>
</table>

The only method with a statistically significant relationship with the reference values, namely the number of manually matched courses for each SDG, is the Cosine Similarity method.

4 Conclusion

Using these text similarity algorithms, the practitioners can quickly scan the courses and see the potential areas of improvement and the strengths of the existing system. One of the drawbacks of these algorithms is the requirement of a reference dataset, such as UN learning objectives, for this case. With the introduction of more enhanced and comprehensive learning outcome datasets, the performance of these similarity algorithms can be further improved. The use of AI tools to generate these initial datasets can serve as an effective implementation to improve the performance of these text similarity algorithms.

REFERENCES


