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An Information System for Converting of 'Merdeka Belajar Kampus Merdeka' Programs

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Abstract−Merdeka Belajar Kampus Merdeka (MBKM) program enables universities to convert independently the programs into department courses hence those can be considered as its course credits. MBKM program guideline requires universities, specifically departments, to carefully convert MBKM program since they have to consider Program Learning Outcomes (PLO) and relevancy of courses in the conversion process. To follow the guideline, departments must explore learning outcomes of each courses and learning outcome of the programs. The job is certainly time and resource consuming. Therefore it needs to be supported by a reliable strategy and system to manage efficiently and effectively relational data between MBKM program, PLO and courses. Through these data, departments then enable to identify quickly related courses with those programs. This paper introduces a model to represent the conversion strategy. We then developed in-house application called e-OBE to implement the model to enable the departments to map PLO, MBKM program and course data efficiently and effectively. The mapping data can be used to retrieve department courses quickly in which their PLO are linked with MBKM program PLO. Finally, a recommendation based on text similarity from courses and MBKM program can be generated automatically to support department decision in the conversion process.

Keywords: Conversion; Courses; e-OBE; Independent Learning Independent Campus; Information Systems

1. INTRODUCTION

MBKM program is a program that enables university students in Indonesia to choose individually learning programs which are hosted by other institutions or industries outside their university as their learning activities. To recognize the programs as learning credits in university, the grades of the programs need to be inputted into student transcripts. In some cases, to be able to insert into academic information system, the program grades need to be converted alternatively into department course credits because departments who input the grades sometimes do not provide specific courses for those programs or their academic information system does not support such inputting system. In another case, they want to convert intentionally the programs into their courses for specific reasons.

Conversion is considered as an alternative solution to solve those problems. According to a guideline book [1] published by Indonesia Ministry of Education and Culture, if a department wants to convert the programs into department courses, the conversion task needs to consider learning outcomes since the programs are provided to supply additional competencies for students which are related to Program Learning Outcome (PLO). To adapt such guideline, a department needs to measure similarity of learning outcomes between courses and MBKM programs. A department has to explore learning outcomes of each courses and learning outcome of the programs. This manual conversion task is time and resource consuming. Moreover, this manual conversion tends to lead departments to not properly convert the programs because some PLO or similarities could be easily missed.

In educational world, there is a term called Educational Data Mining (EDM) to refer methods or tools used to obtain information from variety of educational sources, for example, exam results, curricula, learning resources or online logs e-learning [2]. EDM focuses on developing methods and techniques to explore data in educational environment to understand comprehensively their students or their environments [3], [4]. Utilizing EDM methods in education recently is studied by many researchers. Recent years, for improving quality of learning in higher education, some studies [5]–[8] propose using technological approach to manage syllabus or curricula. To support learning process, a study [9] used a text mining based EDM method to create a decision support system to examine or evaluate student works. In the study [3] , the same method also has been employed to analyse student activities to support collaborative learning. Natural Language Processing (NLP) is also employed to process human works in variety fields such as psychology [10] , nursing [11] , work safety [12] and bio-medics [13], [14]. NLP focuses on processing natural language produced by humans using specific algorithms. NLP also can be used in Information Retrieval [15] . NLP in this study [16] was used to calculate similarity between student works.

We designed a conversion strategy and implemented the strategy by designing and developing an in-house application named e-OBE [17] which allows a department to manage PLO, courses and MBKM programs and integrated those data based on their PLO similarity. This application employed EDM method which was NLP to measure similarity between the text programs and the text courses. By using this similarity, the system was enable to find related courses and calculate its content similarity towards the programs quickly. Therefore. the system

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was able to recommend equivalence courses for conversion to departments based on their linked PLO and content similarity

2. RESEARCH METHODOLOGY

We used design and creation research strategy focusing on developing IT artifacts [18] combined with NLP method. We followed the design and creation research strategy to construct model and then implement the model to produce computer-based system. For many IT-related projects, especially in information system, the research involves analyzing, designing and developing a computer-based product such as a web-based application, support system application or computer animation. These projects find and present the possibilities of digital technology to solve certain issues. We employed NLP method to process data inside the IT product to measure similarity between texts inside the database.

2.1 Model

We represents the strategy using an activity diagram to model actions taken by departments and lecturers in converting MBKM programs into department courses. Figure 1 shows an activity diagram in the conversion activity. The first action was to map PLO to MBKM program and PLO to department courses as well. This activity produced mapping data which contain matrices that contain relationship between PLO, MBKM program and course data. These data were stored in database and required for the next activity. In the second activity, lecturers who teach the course were asked to update their course information i.e. learning topics or body of knowledge based on PLO distributed on this course. This information was required for calculating content similarity between the course and MBKM program. The third, specific courses in which their PLO were related to MBKM programs retrieved. Hence, now we have related courses and total numbers of linked PLO. After related courses retrieved, content-similarity was calculated between MBKM program and the course. In this step, text mining method was employed to measure its similarity. Finally, departments selected recommended courses provided by the system according to the numbers of PLO related and similarity percentage. Therefore, these chosen courses were considered as equivalence courses for conversion.

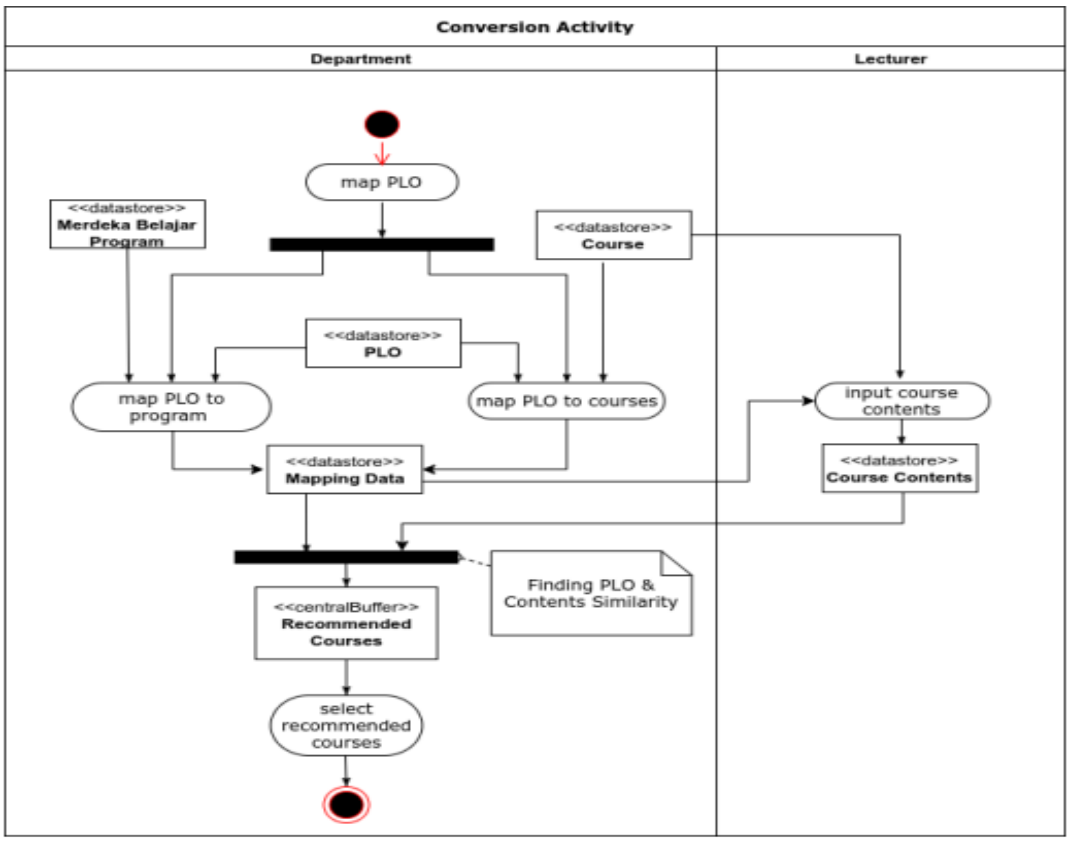

Figure 1. Activity Diagram Converting MBKM Programs into Courses

2.2 Method

We designed a method for a guidance on the model to solve the similarity problems in the form of an algorithm calculating text of MBKM and courses. In this study, we employed Natural Language Processing (NLP) task to

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obtain texts from both MBKM program contents and course contents. Texts from both MBKM program and related courses were textracted into tokens through preprocessing method in NLP.

Data : MBKM, course
Result : similarity percentage
percent = 0
x = ”
y = ”
foreach MBKM data **do**
  foreach course data **do**
    if MBKM’s PLO == course’s PLO **then**
      x ← tokenize(MBKM text)
      y ← tokenize(course text)
      percent ← similarity(x, y)
    end
  end
end

Figure 2. Calculating similarity of MBKM and course algorithm

Figure 1 shows the steps to calculate similarity between MBKM program and courses. First, we extracted tokens from MBKM learning topics and related course learning topics in which their PLO are similar. Then, the tokens from both sources were compared and calculated using NLP method to measure their similarity percentage. In this strategy, we recommend to use NLP method that can handle small data since the data sometimes have only limited tokens.

3. RESULT AND DISCUSSION

3.1 Implementation of Model

The designed model was instantiated to produce a working system that demonstrates that model to solve the problem. The conversion strategy model was implemented using e-OBE. Course and program data were imported from e-OBE database. In e-OBE application, department is facilitated to manage relationship between courses and PLO. Figure 2 shows an interface from e-OBE application where a department is enable to distribute and connect PLO to courses in order to make relations between department courses and PLO. These relational data are useful to find similar PLO connected by MBKM programs and department courses.

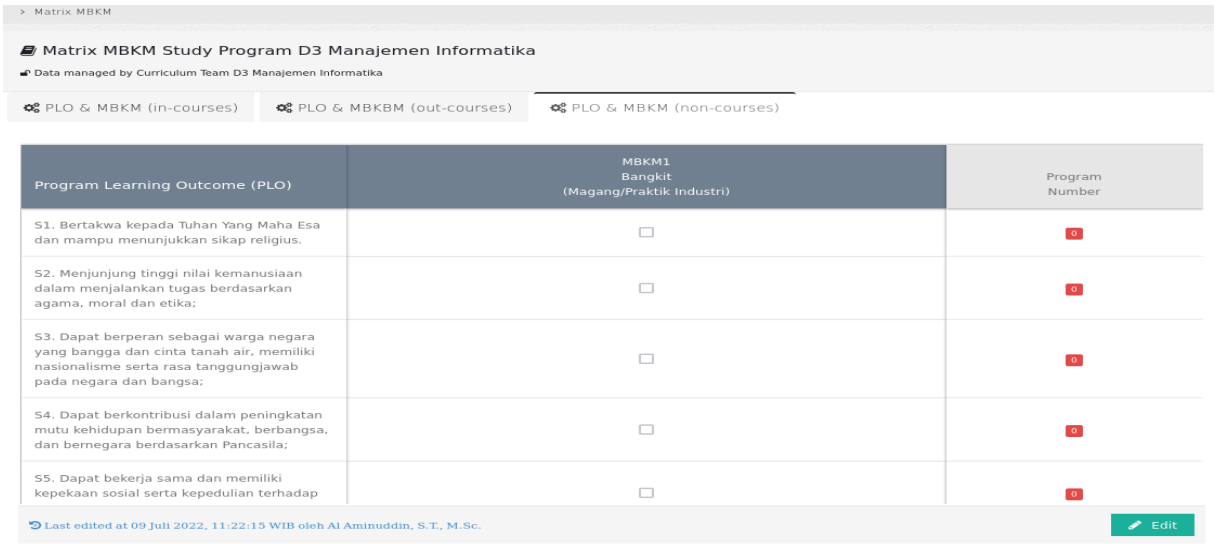

Figure 3. A web interface in e-OBE to connect courses and PLO

Figure 3 shows an interface for managing MBKM detail data including their learning topics in e-OBE application. Departments are facilitated to input the MBKM data throughout this interface. These learning topic data were then later preprocessed and counted in order to measure its similarity with learning topic of department courses. The more detail data are inserted by departments describing MBKM learning topic program, the more data can be used to compare similarity between learning topics in courses. The process of calculating similarity between MBKM programs and courses was dependent with these data. The system would give zero similarity if the data were empty.

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No	Program Code	Program Name	Place	Learning Topics	Duration	Link Info.	MBKM Type
1	MBKM1	Bangkit Academy 2022 by Google, GoTo, Traveloka - Android Learning Path	Online / Virtual	Bahasa Inggris, Belajar Pengembangan Aplikasi Android Intermediate, Review Materi, Belajar Dasar UX Design, Simulasi Ujian Associate Android Developer, Memulai Dasar Pemrograman untuk Jadi Pengembang Software, Pembelajaran dan Tugas Soft skills, Memulai Pemrograman Dengan Kotlin, Belajar Fundamental Aplikasi Android, Refleksi Diri, Inisiatif Proakrif BErtanggung Jawab, Persiapan Karir atau Start Up, Belajar Prinsip Pemrograman SOLID, Pengenalan ke Logika Pemrograman, Belajar Dasar Git dengan Github, Capstone Project/Proyek Akhir	5 months	link	Studi/Proyek Independen

Figure 4. An interface in e-OBE for managing MBKM program data

Figure 4 shows that matrix interface was provided to help department managing matrices to connect MBKM program to PLO. These connected data were required in finding PLO similarity with courses. Therefore departments had to make sure the program has at least one PLO connected. Finding PLO and content similarity was done in a background process to avoid disturbing transactional processes in the application.

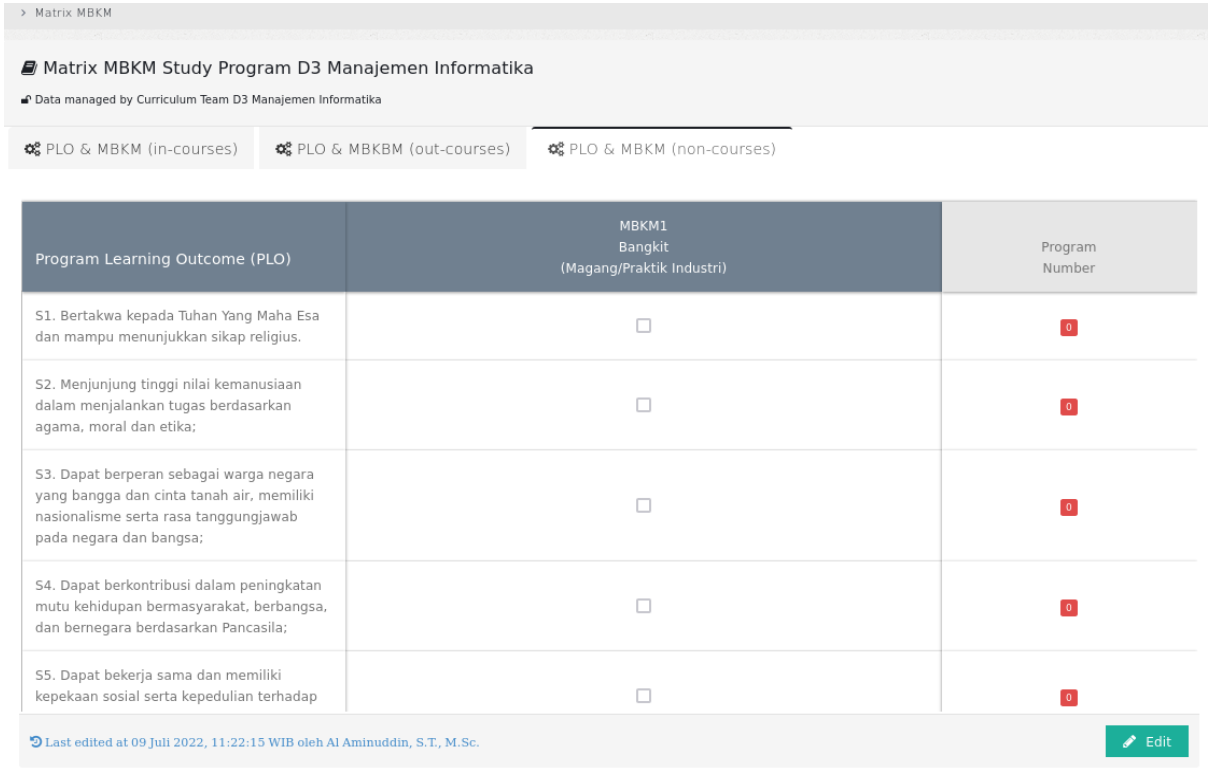

Figure 5. An interface in e-OBE to connect MBKM programs to PLO

Figure 5 shows the application interface allowed a department to view and select recommended courses derived from background calculation inside the application using Algorithm 1. The figure also explains that MBKM Program Bangkit Academy 2022 by Google, GoTo, Traveloka - Android Learning Path, for example, had several PLO which were similar to course PLO i.e KK1, KK2, KK4, KK11 and KK12. The related courses which their semester was greater than two and their PLO connected were depicted more detail in Table 1. This interface provide useful information for departments to choose related courses regarding their PLO and text similarity.

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Figure 6. Conversion interface in e-OBE

3.2 Implementation of Method

We applied the algorithm to extract and measure similarity between learning topic texts from both MBKM programs and department courses to supply information of similarity to application interface (Fig. 5). Figure 6 depicts learning topic texts from a course called Konsep Pemrograman managed by lecturers in Informatics Management Department in Universitas Riau. This learning topic texts were then extracted, preprocessed and merged becoming a bag of words or tokens as showed in Figure 7. The same preprocessed method was also applied for MBKM program data.

pengantar, konsep, pemrograman, paradigma, pemrograman, algoritma, bahasa, algoritmik, hello, world, variable, tipe, data, operator, ekspresi, percabangan, kondisi, pengulangan, looping, fungsi, method, array, string, class, object, grafik, error, handling

Figure 7. Learning topics from Konsep Pemrograman course in e-OBE application

Figure 8. Tokens extracted from course Konsep Pemrograman learning topics

In this implementation, NLP method used to calculate the similarity percentage was Smith-Waterman algorithm. As seen in Table 1, some courses such as Tugas Akhir and Kewirausahaan have zero percentage similarity since the content of both courses has not yet inputed by the lecturer or the department. Hence, it showed that the similarity between texts was dependent of both course content and MBKM program content. It also shows that similarity percentages were very small since data which were compared i.e. learning topic data from both related courses (Fig. 6) and MBKM program (Fig. 3) had limited tokens.

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Table 1. Plo And Content Similarity

Related Courses	Linked PLO	Similarity (%)
Sistem Informasi Manajemen	KK1	2.79
Algoritma dan Struktur Data	KK1, KK2, KK13	3.70
Pemrograman Visual	KK1, KK2, KK4, KK11, KK12	3.07
Pemrograman Web Lanjut	KK1, KK2, KK4, KK12	3.07
Perancangan Berorientasi Objek	KK1, KK2	6.77
Sistem Informasi Geografis	KK1, KK2, KK4, KK12	2.98
Aplikasi Mobile	KK1, KK2, KK12	4.91
Proyek Sistem Informasi	KK1, KK2, KK11, KK12	5.60
Perancangan Antar Muka	KK1, KK2, KK11, KK12	2.98
Sistem Informasi Geografis II	KK1, KK2, KK4	2.98
Keamanan Sistem Informasi	KK2	3.84
Multimedia	KK2, KK11, KK12	3.31
Administrasi Basis Data	KK4	5.52
Tugas Akhir	KK1, KK2, KK4, KK11, KK12	0
Kewirausahaan	KK12	0

For further research, the process of finding similar PLO can be improved using vector space model to enhance search results. The vector space model helps to find similarity in space degree while Boolean matching is possibly fail to find similar object when the objects have relationship. Moreover, similarity between MBKM program data and course data can be calculated with more sophisticated NLP methods to enhance similarity accuracy.

4. CONCLUSION

This study shows that proposed strategy model was able to produce a working system to display conversion information between MBKM programs and department courses through PLO and text similarity from both sources. PLO similarity enabled the system to retrieve related courses in which their PLO were linked. Text similarity was used to measure its degree of similarity between courses and MBKM programs. Implementation of the strategy using in-house application called e-OBE showed that conversion information was useful for departments to seek and select efficiently recommended courses.

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