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Aya M. Mostafa AMM
Business Information Systems, Faculty of Commerce and Business Administration, Helwan University, Egypt, aya.m@commerce.helwan.edu.eg

yehia M. Helmy YMH
Business Information Systems, Faculty of Commerce and Business Administration, Helwan University, Egypt, ymhelmy@commerce.helwan.edu.eg

Amira M. Idrees AMI
Faculty of Computers and Information Technology, Future University in Egypt, Egypt, amira.mohamed@fue.edu.eg

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Business Information Systems, Faculty of Commerce and Business Administration, Helwan University, Egypt, ymhelmy@commerce.helwan.edu.eg

Amira M. Idrees AMI
Faculty of Computers and Information Technology, Future University in Egypt, Egypt, amira.mohamed@fue.edu.eg

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A CONFIGURABLE MINING APPROACH FOR LEARNING SERVICES CUSTOMIZATION

Aya M. Mostafa[1, a], Yehia M. Helmy[1, b], Amira M. Idrees[2, c]

[1] Business Information Systems, Faculty of Commerce and Business Administration, Helwan University, Egypt

[2] Faculty of Computers and Information Technology, Future University in Egypt, Egypt

[a] aya.m@commerce.helwan.edu.eg, [b] ymhelmy@commerce.helwan.edu.eg, [c] amira.mohamed@fue.edu.eg

ABSTRACT

There is no doubt that this age is the age of data and technology. Moreover, there is tremendous development in all fields. The personalized material is a good approach in the different fields. It provides a fit material that matches the styles of readers. It supports readers in various reading domains. This research paper aims to support students in the educational system. Additionally, the research paper designs to increase education values for students. Furthermore, the research paper builds the smart appropriate materials through Egyptian Knowledge Banking (EKB) based on the learner question. The Egyptian Knowledge Bank (EKB) is a rich platform for data. The research paper is implemented in the faculty of Commerce and Business Administration, Business Information System program (BIS) at Helwan University, Egypt.

Keywords: Egyptian Knowledge Bank (EKB); Intended Learning Outcomes (ILOs); Text Mining (TM); E-Learning (EL); Similarity Techniques (ST).

1. INTRODUCTION

The Egyptian Knowledge Bank (EKB) is one of the largest digital libraries and online knowledge hubs all over the world, which intends to give all Egyptians access to free education and scientific publications in different parts of knowledge. The Egyptian Knowledge Bank (EKB) website is easy to use and available for all Egyptians all over Egypt. The Egyptian Knowledge Bank includes four main portals to fit all users' categories, they are Students and Teachers Portal, Kids Portal, Researchers Portal, and Readers Portal. More than twenty -five of the world's elite publishers have participated in the Egyptian Knowledge Bank by providing videos, articles, images, audio files, interactive materials, and learning guides to create a rich library of valuable educational resources estimated in the millions. The publisher list is replete with notable entities such as Britannica, Elsevier, National Geographic, Springer, Willey, Oxford University Press, and Mebooksg [1] [2]. This research paper focuses on one dimension for the Egyptian

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Knowledge Bank (EKB), which is learning objectives which are covered the contents of books. The Intended Learning Outcomes (ILOs) is a significant strategy to build a suitable courses' material at any higher education
institution. Additionally, it represents the frame of persist enhancing and analysis in higher education institutions [3].

On the other hand, Text mining utilizes different techniques of various fields [4] such as machine learning, visualization, case-based reasoning, text analysis, database technology statistics, knowledge management, natural language processing, and information retrieval [5].

Text mining is utilized to extract concealed significant information from semi-structured or unstructured data [6]. The volume of data is growing in this age, which is generally in an unstructured template [7]. Consequently, it is fundamental to elicit helpful data via the support of Text Mining techniques. Several techniques are accessible in text mining, for example, information extraction [8], clustering [9], classification [10], and summarization [11] [12].

Similarity technique is a fundamental activity in different text mining tasks [13]. Most of the similarity measures judge the similarity between two documents based on the term weights and the information content that two documents share in like manner [14].

This research paper is classified as follows: Section 2 introduces the related studies for the different methods in the mining approach, section 3 describes the proposed Content Generation Approach (PCGP) to improve the educational process, section 4 explains the applying tool, section 5 describes the implementation of this approach using a case study from the real-world environment. Finally, in section 6, the conclusions and future work are discussed.

2. RELATED WORK

Many researches have focused on the text analysis [15], education field [16], and customer satisfaction [17] [18] [19].

The research in [20], discussed the students' history in the university Learning Management System (LMS) data. They utilized classification techniques to create an educational paradigm according to predict the student's behaviour. They built a prediction paradigm utilizing the J48 decision tree algorithm and multiple linear regressions.

Another the research in [21], utilized a qualitative case study research plan that purposively tested the first-year undergraduate students who are enrolled at the University of Fort Hare.

They found the interplay of personal, social, and learning identities that format first-year students' experiences. First-year students formed positive or negative identities that are built and remade after some time.

Moreover, Ahmad and his colleague in [22], suggested a manner by which the user's character can be anticipated through data planning accessible to the general population on their own Twitter utilizing DISC (Dominance, Influence, Compliance, and Steadiness) appraisal. The user character is anticipated by dissecting the Twitter tweets by utilizing DISC structure.

Tlili and his colleagues in [23], discussed how character contrasts inside students can influence Computer-Based Learning (CBL). The Myers - Briggs Type Indicator (MBTI) paradigm is the most preferred model in the literature for recognizing the student's personality in Computer-Based Learning (CBL).

More recently, [24], constructed a forecasting framework that can naturally anticipate user characters dependent on their actions on Facebook. Big Five Personality Model (BFPM) utilizing conventional machine learning and deep learning to assort character features. (BFPM) comprises of Openness,

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Conscientiousness, Extraversion, Agreeableness, and Neuroticism. For customary machine learning, they utilized five algorithms. They were Naive Bayes, Support Vector Machine (SVM), Logistic Regression, Gradient Boosting, and Linear Discriminant Analysis (LDA).

More lately, [25], investigated students' behaviour and interaction styles in various kinds of online test-based actions inside Learning Management Systems (LMS). They used a process-oriented methodology, researching viewpoints on utilizing measure mining techniques with regards to internet learning and evaluation. They explained down students' interactions in many online tests from various courses and in various environments.

An earlier research in [26], introduced the techniques for text mining to deal with ten academic libraries from top worldwide colleges to depict their utilization of Twitter, and to explain their tweet text. The outcomes indicated that a text-analytics approach can be embraced in the investigation of scholarly libraries' online media data. This methodology is vital to information revelation and can upgrade the libraries' resources and services.

Uddin et al. in [27], displayed a structure to execute a recommender system to enhance the scholastic choice task for novel learners. The system depends on anticipating Educational Relevance for an Efficient Classification of Skill (PERFECT Algorithm Engine), which uses stochastic likelihood distribution depend on modelling. They apply an algorithm and math build to help their task alongside giving graphical outcomes for different parameters that support the suggestion and choice task for people.

3. THE PROPOSED CONTENT GENERATION APPROACH (PCGP)

The research paper provides vital information to build improvements in the educational process [28] [29]. The objective of the proposed Content Generation approach (PCGP) is to introduce the suitable courses' materials according to the trusty data source for students [30] [31]. It consists of four basic stages. The first stage is about gathering content data. The second stage involves extracting the keywords from two different sources (Egyptian Knowledge Bank (EKB) and Business Information System program (BIS)) [32]. The third stage includes selecting the suitable techniques to measure document similarity to generate a smart material [3]. In the finally, the student materials are displayed in different formats.

3.1 Stage 1: Determining the Data Sources

Original data is collected from two different sources. The first one is an online truth resource the Egyptian Knowledge Bank (EKB) and the second is an offline resource educational course For the BIS program.

3.1.1 Egyptian Knowledge Banking (EKB)

The Egyptian Knowledge Bank (EKB) contains various resources for educational, cultural, and research videos, books, and articles from different local and international publishers. Following many researches that were applied in Egyptian universities such as in [33] [34] [35],the scope of this research paper covers the books which enhance the educational courses in the faculty of Commerce and Business Administration, Business Information System program (BIS) at Helwan University, Egypt. The learning objectives which cover the extracted chapters, are a critical factor to detect the suitable materials for BIS program courses.

3.1.2 Business Information System (BIS) Program.

In the business information Program (BIS), the course description is a very important academic factor that should be considered when applying the proposed Content Generation approach (PCGP) in higher educational institutions. Especially, Intend Learning Outcomes (ILOs) for the course syllabus. The Intend Learning Outcomes (ILOs) of the BIS Program has four main

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components. First, (A) Knowledge and Understanding Skills (25%). Second, (B) Intellectual Skills (25%). Third, (C) Professional and Practical Skills (35%). Finally, (D) General and Transferable Skills (15%) as shown in figure 1.

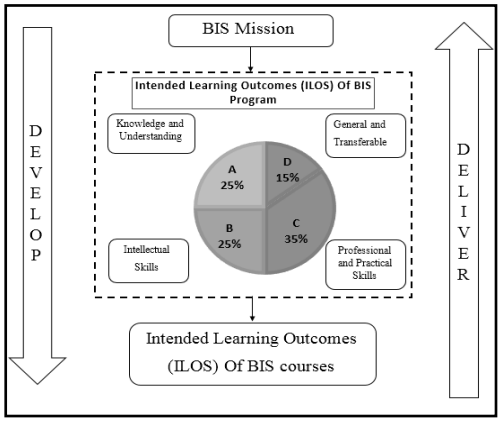

Figure 1: Intended Learning Outcomes (ILOs) of BIS Program

3.2 Stage 2: Extracting the keywords

In this phase, there are a set of tasks to extract the keywords from two different data sources (Egyptian Knowledge Banking (EKB) and Business Information System (BIS) program) which can be described as follows:

3.2.1 Tokenization

Tokenization is the mechanism of splitting or fragmenting the sentences and words to its possible smallest morpheme called a token. A morpheme is the smallest possible word after which it cannot be broken further. As the tokenization is the initial phase and as well very crucial phase of Part-Of-Speech (POS) tagging in Natural Language Processing (NLP). The token serves as an atomic unit that embeds the contextual information of text, defining a token plays a decisive role in the performance of a model [36] [37].

3.2.2 Stop Words Removal

Stop words removal are common words occurring in most documents, such as “the,” “and,” “from,” “are,” “to,” “an,” “in,” “a,” “is,” “her,” “of,” “with,” “about,” “what,” “when,” etc. They are required to apply this processing because these stop words cannot decide the category of the document [38] [39].

3.2.3 Transform Case

Transforming case transforms all characters in a document to either lower case or upper case.

3.2.4 Filter Token (By Length)

Filter token (by length) task, filters tokens based on their length (the number of characters which contain it). tokens with a length less than the minimum length will be removed. There are two parameters are chosen.

- The first parameter is called min chars, is the minimal number of characters that a token must contain to be considered.
- The second parameter is called max chars, is the maximal number of characters that a token must contain to be considered [40].

3.2.5 Stemming

Stemming refers to the process of identifying the root of a certain word. Stemming reduces the length of the words to the minimum length [41]. Many words in the English language can be reduced to their base form or stem such as Agreed, agreeing, disagree, agreement and disagreement belong to agree.

3.3 Stage 3: Generating Course’ Material

The third stage can be divided into three major steps, to detect the learning materials match with student learning. The first step is the Intended Learning Outcomes (ILOs) which matches with the learning objectives of chapters. The second step extracts the content material. Finally represents student materials with a different format.

3.3.1 ILOs / Objectives Materials.

In this step, there are two important indicators and the main question. The first indicator includes an Intended Learning Outcomes (ILOs) course syllabus for Business Information System (BIS) Program. the second indicator involves

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chapters' Learning objectives that extract from the Egyptian Knowledge Bank (EKB). The main question in this step, how many learning objectives can match with ILO for the course syllabus? To answer this question, we utilize the similarity technique to compare the similarities and differences between ILO and Learning Objectives for chapters. The output of this step is a very important indicator that should be considered when extracting content materials.

3.3.2 Extracting Content Materials.

The major key for extracting the contents from books to generate suitable materials is identifying the relationship between two factors Learning objectives for chapters and headers. The main question in this step, how many learning objectives for the chapter can match with headers for the chapter in the book? To answer this question, we utilize the similarity technique to compare the similarities and differences between headers for the chapter and Learning Objectives for the chapter. After identifying this relationship, we extract the book's content, which covers the learning objective that matches Intend Learning Outcome (ILO). Then gathering the contents and building the learning materials fit learning studying.

4. EXPERIMENTAL STUDY

This section includes the explanation for implementation tool which are used for applying the Proposed Content Generation Approach (PCGP) and the experiment outcomes performed to build smart learning courses' materials.

4.1 Applying Tool

The Rapid Miner Studio (Version 9.8.1) is a system interface that supports the design and documentation of an overall data mining process, text mining, and machine learning processes [42].

4.2 Finding and Analysis Results

This section describes the experiment outcomes performed to build smart learning materials which match the learning styles according to the required course for students. Here we will go through all stages of the proposed Content Generation approach (PCGP) in the faculty of Commerce and Business Administration, Business Information System program (BIS) at Helwan University, Egypt.

4.2.1 Stage 1: Determining the Data Sources

In this stage, some information is provided for the course' material (Systems Analysis and Design) in the Business Information Systems (BIS) Program and (Systems Analysis and Design) book which is extracted from the Egyptian Knowledge Bank (EKB). The (System Analysis and Design) book includes fourteen chapters; every chapter involves a set of learning objectives.

4.2.2 Stage 2: Extracting the Keywords

At this stage, involves a set of tasks to transform the dataset for the system analysis and design (Book and Course syllabus) into a particular configuration that fits analysis in the next stage. The following points clarify the keywords extraction.

The system reads the excel operator to load the dataset for the system analysis and design (Book and course syllabus) and the parameter for this operator is the location of the excel file in the repository where is stored. Then it selects the attributes operator to choose the attributes of an example set and removes the other attributes, the tokenization, removal of stop words, tokenization, stemming, and filtration operators are applied. Table 1 introduces the summary results for a sample of the rounds. Each one consists of five tasks in order to extract the keywords.

4.2.3 Stage 3: Generating Course' Material

This section discusses applying the proposed content generation via the cosine similarity technique to extract the course' material (PowerPoint and text) fit students. This section is organized as follows; Part 4.2.3.1 ILOs / Objectives Materials, Part

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4.2.3.2 Extracting Content Materials, and part 4.2.3.3 Generating .PPT / Text.

Table 1: The Result for five tasks to extract keywords.

Rounds	Tokenize	The data set after Removal	Transform Case	Filter Token (By Length)	Stem (Porter)
Round 1	230	195	193	187	161
Round 2	224	190	189	183	158
Round 3	225	191	190	184	158
Round 4	225	191	190	184	159

4.2.3.1 ILOs / Objectives Materials.

- Applying the similarity technique to match between two factors which are Intended Learning outcomes (ILOs) for the course ' materials and Learning Objectives (LO) for the book.
- On each round, we detect any ILO matching with the learning objectives according to the highest similarity value.
- After our execution of all rounds, the learning objectives for the book cover the Intended Learning Outcomes for course ' materials.
- Table 2 introduces a sample of the results of matching between two factors which are, Intended Learning outcomes (ILOs) and Learning Objectives (LO).

Table 2: A sample of matching ILOs / Objectives Materials.

Learning Objective (LO) book	Intended Learning Outcome (ILO) course
Explain the initial transition from analysis to design.	Apply different IS methodologies for analysis and design.
Be familiar with the system construction process.	Analyze system process and data requirements.
Explain the system installation process.	Analyze system process and data requirements.

4.2.3.2 Extracting Content Materials.

The following presents some of the performed steps for extracting the chapters from the book which covered the learning objectives.

- Determining the chapters which covered the learning objectives.
- Extracting the headers for chapter that are matched the ten learning objectives.
- Applying the similarity technique to match between two factors which are the headers for chapter and Learning Objectives (LO) for this chapter.
- Detect the header matching with the Learning Objective according to the highest similarity value. An example of the results is the learning objective "Explain the initial transition from analysis to design." That matched with the header "Transition from Requirements to Design". Another example is the learning objective ". Explain the initial transition from analysis to design" which matches the header "System Tests".

5. CONCLUSIONSAND FUTURE WORK

In this research, we proposed an intelligent material generation approach in the higher educational environment. The proposed approach has been implemented in the faculty of Commerce and Business Administration, Business Information System program (BIS) at Helwan University, Egypt and presents its applicability to build learning materials according to the produced outcomes. It recommends a valuable combination of course syllabus which are knowledge and understanding skills (CK), intellectual skills (CI), professional and practical skills (CP), and general and professional skills (CT) for each student. It represents the learning materials of the course syllabus (system analysis and design). Our future work involves introduce course material

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with the different format types such as voice. Due to not all the students have the same mental level. Applying the proposed model is required in other different specialties to reach a more effective and efficient decision.

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