IMPROVING THE LEARNING PROCESS FOR STUDENTS. PERSONALIZING LEARNING THROUGH SOFTWARE APPLICATIONS

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Universities often utilize the technique of enhancing educational outcomes by focusing on improving student learning. This technique has seen substantial development via the incorporation of sophisticated software tools, which provide the advantage of not only tackling intricate programming difficulties but also actively assisting students in their educational advancement. These software solutions provide a distinct benefit by facilitating customized learning experiences and enhancing study approaches in a more effective manner. This paper presents an efficient method for comprehending the significance of certain key phrases in a course: to use software that can systematically extract and analyze paragraphs that include those important terms. By prioritizing these essential topics, students may acquire profound perspectives on the subject matter, resulting in a more thorough comprehension. This article introduces a bespoke software program that has been created with the explicit purpose of improving the learning process. The system presented in this article can also deal with Romanian, where this could be a great advantage and a novelty since there is no such advantage of similar systems (to the best of our knowledge). We will showcase the potential influence of this application on student engagement and academic achievement.

Keywords: learning process, software application, educational tool, students

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1. **Introduction**

The automation process in the education system involves the use of technology to enhance and streamline various aspects of the teaching and learning process. The aim of this general approach is to boost efficiency, have a positive impact upon the personalization of the learning experiences, and, not least, to provide a valuable set of insights for educators as well as for students.

Learning management systems play a crucial role in this process of transformation with platforms like Moodle, Canvas, and Blackboard. They help with progress tracking, generate automated quizzes, manage tasks and courses in a more automated way, and also grant a more facile and smoother interaction between the students and the educators.

Carnegie Learning and DreamBox are two examples of intelligent tutoring systems that personalize the general educational experience, being adapted to every student's learning necessities. These types of systems offer aimed practice and feedback, taking into consideration the individual performances and addressing specific areas where a student may need some supplementary support.

Educational analytics tools, including platforms such as Tableau and Power BI, analyze enormous quantities of educational data to generate insights into student performance and outcomes. This method is based on facts and facilitates educators so they can make smart choices, identify at-risk students, and tailor teaching strategies in order to enhance learning outcomes.

Furthermore, Knewton and Smart Sparrow, two examples of adaptive learning technologies, represent another important layer in the process of personalization by the adjustment of the difficulty level or the content on the individual performance of every student. This process also ensures a granted customization of the learning experience for every student with the role to cater to their specific necessities and personal learning style.

In general terms, the process of integration of this type of automated tool offers an important boost to the educational field by enhancing the personalized support for the learning activities and by gathering insights in order to refine the teaching strategies and to improve the outcomes of improved learning.

More and more academic centers have become acquainted with the importance of artificial intelligence (AI) and have been leveraging it the optimization tools with the role of enhancing the overall educational experience. AI and optimization methods are used by the Georgia Institute of Technology to make the learning process more personalized. They also use flexible systems and smart teaching.

The University of Michigan is another important example. It uses AI in its online learning tools to build learning experiences for its students and keep them more interested through its advanced analytics [1]. A lot like this, the University

of California, Irvine, uses AI to make the best course schedules and keep track of their resources. This is a great way to guess how well a kid will do in school and make a more personalized education solution [2].

Some of the more advanced educational tools being made at Carnegie Mellon University use AI and optimization. These include clever teaching systems and learning platforms that change based on the student. Researchers at the university are working on these areas in order to make the learning process better [3].

Last but not least, Stanford University also uses AI in its study of educational technology. Its main goal is to make AI-driven tools that offer personalized learning and use optimization methods to improve the delivery of educational material [4].

Many people find that text extraction is very helpful for learning because it makes it easier to find information in large text files and organize it better. This important skill is more useful when working with a lot of information because it makes it easier to find the main ideas, specific meanings, or sections that students need for their studies.

Text extractors not only make work easier but they also help students learn more deeply by helping them find and focus on important information, which has a bigger effect on their ability to remember and understand. They also make it easier to combine and use knowledge from different themes or issues and help with the process of putting together information from different sources.

Overall, text extraction tools are almost indispensable to the learning process by enhancing the knowledge acquisition and its management and offering it more accessibility and efficiency.

A versatile library that is capable of text extraction from a large range of document types, Textract is used on files as PDFs, DOCXs, and JPGs or JPEGs. The article Getting Started with Textract offers a wider image about its capabilities [5]. This method is being used to implement the application presented in this paper.

These are some examples of tools used in order to provide extended support in text extraction and text processing, each of them with particular features and use cases.

2. **Related works**

Beginning in the 1970s, schools started using cassettes, compact disks, and radio broadcasts to educate. To address rising education demand and overcome time and geographical constraints [6]. E-learning, which emerged in the 1990s, proposed interactive education using online platforms [7]. Traditional schools

realized they could use digital media to improve instruction. Online classes or degree programs may increase their reach and bring more cash, they recognized.

Universities have been wary about e-learning owing to the difficulties of offering high-quality online training. Higher education institutions worldwide have discovered that using the online environment for teaching necessitates more than simply converting traditional face-to-face instruction into a digital format. It demands a complete overhaul of the teaching methodology.

The topic of teaching, including its definitions and purposes, is complex and contentious. A comprehensive analysis of this subject may be found in other sources [8].

The two primary viewpoints on teaching may be categorized as conventional and constructivist methods. The conventional method emphasizes providing the learner with crucial knowledge, pertinent processes, and an appropriate learning strategy [9]. While the constructivist method places more of an emphasis on the social and active components of learning, the other approach does not. It aims to promote collaborative discovery and construction of vital knowledge, processes, and learning techniques among students. Both the constructivist and conventional methods are used in the practical implementation of designing individual instructional activities, standards for assessment, and the use of related tools [10].

Innovation plays a significant role in supporting teaching in modern universities, particularly via the usage of virtual learning environments (VLE) like Moodle, Canvas, Blackboard, and other similar platforms. These platforms provide access to course materials and facilitate student interactions through virtual tools like discussion forums, blogs, and wikis. Generally speaking, the degree to which online technology is incorporated into the overall instructional approach is determined by a variety of variables, including the format of the educational institution (for example, distance education) as well as the capabilities, interests, and history of the instructor [11].

The introduction of instruments of social software brings a wide range of opportunities and challenges for educational institutions of higher learning. This is due to the fact that the basic characteristics of these tools make it possible for new forms of interaction and collaboration to occur. According to the study from [12], these are the main traits of social software tools: Users can change the content, which can happen often and without warning; the content is improved by adding feeds from other apps; quality control relies heavily on peer-based and informal methods; the apps are usually small, don't depend on a specific platform, and are easy to carry around.

Nowadays, cross-platform applications have significantly contributed to the digitalization of educational processes over time, adapting to technological advancements and innovations, particularly in the past pandemic setting. In this

study [13], the influence of these apps on enhancing or perhaps substituting existing education systems was analyzed by documenting the process by which instructors and students comprehend their activities and the educational settings in which they occur.

Recent research has shown the effectiveness of cross-platform apps in both the educational and industrial sectors due to their accessibility and user-friendly nature.

3. **Application overview**

This section will present the software application that helps students improve the learning process.

3.1 **About the application GUI**

This paper presents a Graphical User Interface (GUI) application that utilizes the Python language on Windows. PyCharm served as the Integrated Development Environment (IDE) for the current application's development.

When the user runs the application, a window will appear on the screen where he must do the next steps:

- choose the course to be parsed by the current application;
- select either the Arabic or Roman style for the chapter numbers;
- introduce the key words that he wants to learn about from the course;
- introduce the frequency of all other words (apart from the key word) that you wish to observe.

The input introduced must be a DOCX file and is considered to have this format:

- At the beginning of the course, there is a complete summary.
- At the beginning of each chapter, after mentioning the chapter number and title, the chapter summary appears (see Fig.1).
- Following each chapter's summary, the text precedes all subchapters (and even lower chapters if applicable).

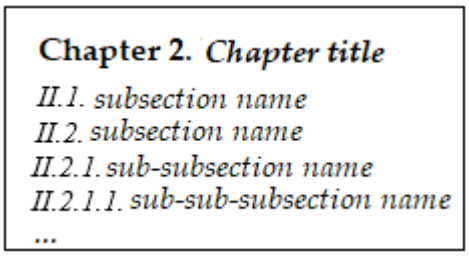

Fig.1. Example of how chapter II starts on the course used as input for the application

Press the "Extract text" button after filling out all the fields in the application window (see Fig.2). The system will produce a TXT file with the following contents:

- All phrases that contain the key word will be listed, along with all the chapters in the hierarchy that also contain that phrase;
- All the words from the document that differ from the introduced keyword and have at least the frequency number introduced previously are included.

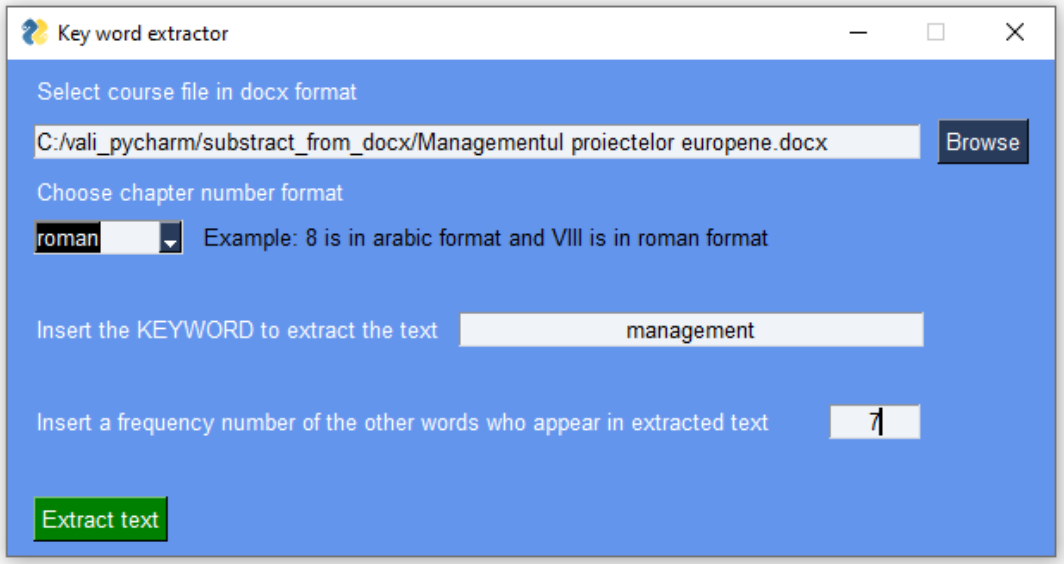

Fig.2. An example of the application being used

3.2 **Implementation of the application**

The application has been designed to work in single-user mode with no data-based use.

Modular programming and separation of concerns, the Model-View-Controller (MVC) pattern, and event-driven programming are the software techniques that have been used to implement the application. Decomposing the code into multiple functions for data extraction (*extract_paragrafs*, *summary_to_str*), data processing (*extract_chapters_number*, *find_chapters_name*, *get_chapter_chain*), report generation (*create_str_report*, *generate_report*), and user interface management shows its modularity. This modular approach increases maintainability by enabling module modifications without affecting others, reusability within the program or in other projects, and testability by independently testing each module.

MVC pattern implementations divide code into three interrelated components: model, view, and controller. The model includes data structures like *list_roman*, *dict_roman_to_arabic*, and *dict_arabic_to_roman*, as well as data logic functions. The GUI function creates the view's layout and interactive components using PySimpleGUI. The generate_report function and the GUI event-handling mechanism serve as the controllers for the Model-View interactions. The separation of concerns enables the independent development and maintenance of each component, permits the addition of new features without affecting other parts of the program, and enhances testability by isolating components.

The application also uses event-driven programming, where user activities affect program flow. The event loop within the GUI function constantly monitors button clicks and responds accordingly. Using *sg.Window*, the software is ready for user interactions when it is read with a timeout. Checking for events and running code blocks validates inputs and generates reports when the user presses the "Extract text" button. By allowing different functions or code blocks to handle each event, this method enhances the responsiveness and modularity of the application.

The key modules used for the program's development include: docx (for data extraction from the input document), PySimpleGUI (for GUI application creation), and PyInstaller (for generating an executable from the developed application).

Upon extracting the text from the input document, it is necessary to determine the number and names of the chapters (see to Fig.3).

```
def find_chapters_name(str_summary:str, chapter_fmt:str)->str:
    global list_roman
    lines = str_summary.split('\n')
    chapter_name = ""
    # find chapters title, without number (number will be added for each chapter)
    for line in lines:
        if 'roman' == chapter_fmt:
            for elem in list_roman:
                temp = elem + "."
                if temp in line:
                    temp2 = line.split(elem)
                    chapter_name = temp2[0]
                    return chapter_name
        else: #is arabic
            for line in lines:
                for chr in line:
                    if chr.isdigit(): #here is chapter name
                        temp = line.split('.')
                        for elem in temp[0]:
                            if False == elem.isdigit():
                                chapter_name += elem
                        return chapter_name
```

Fig.3. The implemented function to find chapters name from the extracted data of input

Once all chains of the subchapters have been identified, a dictionary is created with the chapter/subchapter combination as the keys and the matching paragraphs as the values. A dictionary is constructed using chapters as keys and all subchapter chains as values. This allows for the inclusion of all subchapter chains of a paragraph that include the specified keyword.

In order to identify all words that have a frequency more than or equal to a certain value, a dictionary is created and filled accordingly. Each word serves as a key, while the number of occurrences is stored as the corresponding value. The ultimate outcome is appended as textual content into a TXT file, designated by the keyword. The file created for the example shown in Fig.2 will be named "management.txt".

Fig.4 shows the flowchart of the software of the application.

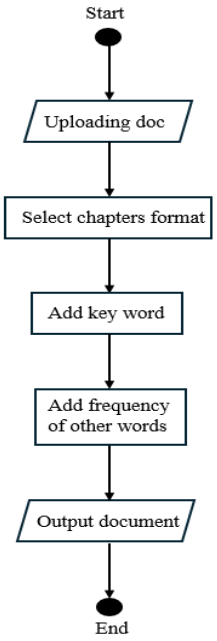

Fig.4. Flowchart of the software application

4. **Future perspectives**

The program described in this article may be enhanced to function as a cross-platform application by including the Kivy module from Python, hence enabling its usage on smartphones.

By adding a blockchain-based technology in order to manage and verify students academic credentials and background records, we can increase transparency, security, and traceability. Students would have a secure and safe way to verify their digital records and their academic background and can easily

share it with peers of their interest: potential employers, educational institutions, etc.

In order to create a more holistic environment in which students can have access to all necessary resources through a single interface, future improvements could include integration with other educational tools and platforms such as LMS, virtual laboratories, and e-libraries.

Adding multi-language support can help to break barriers to a global audience by eliminating language barriers. Multi-language implementation would not only help in the translation of the interface but would also ensure that text extraction and analysis tools can be processed in different languages.

Wearable tech, like fitness trackers and smartphones, can give teachers useful information about their students' mental and physical health. Teachers and students can better understand how things like stress levels, physical exercise, and sleep habits affect learning and come up with ways to improve general health and academic success by keeping track of these things.

Adding game-like features can get students more interested and motivated. Quizzes, leaderboards, badges, and awards are all interactive features that make learning more fun and active.

5. **Conclusions**

Educational software tools or applications make learning faster, more personalized, and more engaging with AI and data analytics. The results and literature review elucidated how such applications are changing the way of learning to be more easy and flexible.

The paper presents an application that enhances students' learning process by elaborating on phrases containing specific keywords and generating a text file as an output. Although there are many similar applications (most support English language) that can be used for the same purpose, this application supports Romanian language beside English language, which makes it the first application of its type (to the best of our knowledge). Using Python provides a quick response and process to the uploaded document.

The software architecture techniques used in this application create a well-organized framework that improves maintainability, scalability, and user responsiveness. Event-driven programming, modular programming, and the MVC pattern create a reliable, efficient application that follows excellent software development principles.

The application presented in this paper can be improved by supporting more languages, which may serve many students around the world. Also, this application can be a cross-platform application, which provides great flexibility and relability to be used by more students even by those with limited resources.

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