Utilization of Learning Management Systems (LMS) Salam Al Azhar as the Learning Process in Al Azhar 35 Islamic International Primary School

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Keywords	ABSTRACT
Learning management system; process mining; distance learning.	*This paper explores the use of Learning Management Systems (LMS) in a primary school setting, focusing on Al Azhar 35 Islamic Primary School. LMS offers numerous advantages over traditional learning systems, and its application in primary schools is relatively rare in Indonesia. The study employs the Process Mining Project Methodology (PM2) to analyze LMS data, assess its readiness, and examine its suitability for process mining. The study identifies structured data with relevant Case ID, Activity, and Timestamp fields, indicating the data's suitability for process mining. The frequently observed LMS activities include Dashboard, Course Overview, and My Course. These activities are analyzed to assess the LMS's practicality, efficiency, and advantages. The findings reveal that LMS is beneficial for both teachers and students. The study concludes that PM2 methodology is a suitable approach for process mining in education, and the data from Al Azhar 35's LMS is ready for analysis. Future research opportunities include analyzing the learning processes in more diverse case studies, improving data quality, and exploring learning patterns in various classes, semesters, and courses.*

INTRODUCTION

Learning management system is a computer-based system to manage learning in an institution that facilitates the teaching and learning process in everyday life (Rohmatulloh & Nugraha, 2022). The advantages of LMS than conventional learning systems are its ability to manage accessible learning materials through various devices, making it easier for teachers manage teaching materials, record progress and student performance, reduce development cost material, shorten learning time, as well as integration experience between teachers (Zheng et al., 2018).

This paper analyses the LMS used in a primary school to support a teaching process involving teachers and students in that primary school (Aldiab et al., 2019). This case is arguably quite rare in Indonesia, because in the current era, it is still very rare for primary schools to implement LMS. In general, only students and lecturers at state universities use LMS for their daily learning process (Cheng & Yuen, 2018). This may also be due to differences in technological knowledge for primary and college students with an age comparison far enough away as well. However, the Al Azhar 35 Islamic Primary School is trying as much as possible so that all students can still get used to and recognize technological developments even though they are still primary students (Suryanda et al., 2021).

Information systems in organizations can record logs of various event logs. These logs can be analysed by process mining techniques (Hachicha et al., 2021). Process mining lies somewhere between computational intelligence and data mining, and between process modelling and process analysis. The essence of process mining is to find business processes, monitor, and complete business processes that are already available in information systems (Jabr & Al-Omari, 2010). The purpose of process mining is

to obtain useful information from the event log and use it as a guide for the organization to evaluate its business processes (Juhaňák et al., 2019; Venkateswaran et al., 2021).

In flexible business processes, as in this case is in the process of online learning schools, the executions of the activities are not always according to the defined process (Kurniati & Wisudiawan, 2021). Generally, the Learning Management System (LMS) concept is a program designed to create, distribute and manage learning content (Prahani et al., 2022). This system can help teachers plan and create lesson plans, manage learning resources, manage student's learning activities, manage grades, recap student truancy, View transcripts and manage online learning postings (Jabr & Al-Omari, 2010).

Through LMS, teachers and students have the ability to interact directly (*synchronously*) or indirectly (*asynchronously*) through an integrated system (Alfalah, 2023). Some of the features available in LMS generally are the management of a variety of content, users and roles; online exams and student attendance; communication between students and between students and teachers; support for distribution of materials in a variety of formats; and user feedback (Aisa et al., 2015). The main advantages of LMS are interoperability, accessibility, re-usability, durability, serviceability and adaptability (Hermawan, 2014).

As Van der Aalast said in his book, Business Project Management in 2016, Process Mining is a process management approach of business process analysis based on event logs (Hermawan, 2014). Automatically generated event log in the information system according to the user's real-time access, so that the event log can said to describe the running of actual processes within the organization. The event log data is parsing by process exploration to identify trends in process execution (Van Der Aalst et al., 2012).

Process mining may answer questions about business processes. For example, what and why business processes were carry out in the past, what might happen in the future, when and why the implementation of business processes is different from procedures, how to control business processes, and how to redesign processes to improve their performance (Jabr & Al-Omari, 2010).

In education fields, the process mining can applied in curriculum mining, student registration, professional training, computer-supported collaborative learning, and others (Ead, 2019). Process mining can be used to analyse the learning process, specifically computerized and managed learning within the Learning Management System (LMS) (Arulogun et al., 2020; Saidi et al., 2021). The survey also explained that the EDM concept is closely relate to intention mining (IM), sequential pattern mining (SPM), and graph mining (GM).

The top three types of analysis in Process Extract are Process Discovery, Compliance Verification and Improvement. Process mining will discovered the processes event logs to produce, visualizations of process models with the help of process mining algorithms, such as alpha minor, fuzzy minor, and heuristic minor (Chouhan et al., 2021). The resulting process model can be displayed according to certain notations, such as Petri Net, BPMN, state transition diagram, fuzzy net, and heuristics net. The results of the analysis in process mining can be used to monitor and improve process quality, check compliance with standard procedures, detect inhibiting activities in the process, and predict problems that may arise in process execution.

METHODS

The general methodology used in this research is the *Process Mining Project Methodology* or also commonly known as PM2. This method has the following advantages standard methodology in the application of process mining in various fields (Jabr & Al-Omari, 2010). However, this method also has drawbacks and it does not explicitly require the involvement of experts in the problem domain. It would be using the *ClearPath* method as an additional method to extend the PM2 process mining method with a process simulation approach that addresses issues of poor quality and supports rich stakeholder engagement (Jabr & Al-Omari, 2010). This method can help to cover the weakness of the PM2 method, which can emphasize the involvement of experts in each stage of the research.
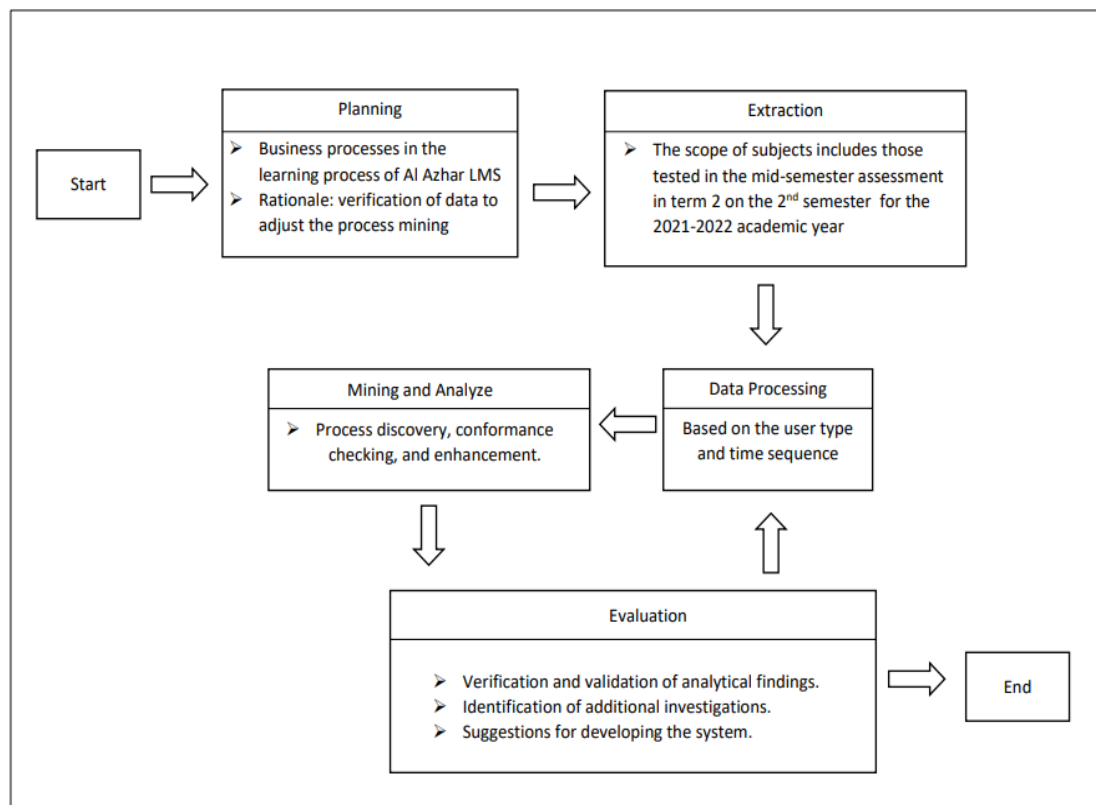
Figure 1. Research Method Flow

The research methodology involves a number of steps, including planning, retrieval, data processing, exploration and analysis, evaluation, also implementation and support (RAMLIH, 2021).

The focus in this research is on the planning stage, namely the feasibility study of the application of process mining on the learning management system that has used and developed by Al Azhar 35 Surabaya (RAMLIH, 2021).

The first step is planning, which is achieved by identifying business processes and analysing the LMS-based learning process at Al Azhar Islamic Primary School. The activities added at this stage are the identification of the minimum LMS components for process mining, as well as identifying the characteristics and quality of data from the learning process.

The second step is Extraction, which involves extracting data related to the instructional procedures applied to LMS. The data extracted in the form of a web log that holds user access data that automatically recorded by the system. Another thing that we need to do in this stage is finding event data. It is data generated by the correspondence of external events to time series. It also understood by the data collected and analysed to help understand what users were doing before, during, and after the incident.

Then in the third stages, there is a Data Processing stage is carried out by processing the extracted data, by setting the views, aggregating events, enriching logs and filtering logs, so that they become event logs that are ready to be analysed.

The next step is the one that be seen as the central step, it is namely Mining and Analysis, which includes the discovery of business processes, compliance verification, process improvement and analysis. The analysis focuses on the learning process of students, because in one course class there are several roles involved, which are about less than 25 students, with two homeroom teachers, a subject

teacher, and an editorial staff. The process analysis performed by teachers and editors in one subject class will be too subjective and not representative of teachers and editorial staff in other classes.

In this final phase, an Assessment will conducted to interpret the results of the learning system analysis. Subsequently, a number of conclusions and contributions will drafted for the development of the system in subsequent academic years.

RESULT

A. Analysis of Learning Systems at Al Azhar 35 Islamic Primary School Surabaya

Salam Al Azhar is a website-based application used by the Al Azhar Islamic Boarding School Foundation *(Yayasan Pesantren Islam Al Azhar)* in the learning environment of all branches in Indonesia, one of them is at Al Azhar 35 Islamic Primary School Surabaya [2]. This system supports the main teaching methods in the form of face-to-face in class as well as online learning, which we usually call the hybrid learning method in distance school learning systems.

In the 2021/2022 academic year, Al Azhar 35 Islamic Primary School Surabaya provides space for 18 classes consisting of 3 classes at each level from grade 1 to grade 6. Each grade consists of approximately 60-70 students, and 10-15 teachers with their own subjects that they teach (depending on the needs of each grade). Thus, all learning activities, in particular examination activities at Al Azhar 35 Islamic Primary School Surabaya can be carried out online and more efficiently on the site LMS or Salam Al Azhar (Shofiatun, 2021).

At the beginning of the academic year, the school leaders and administrators of the IT coordinator in each unit carry out a data synchronization process between the data of the tutors, the data of students per class, and also the subjects that will be given at each level. This is one of the key first steps as it will take place over the next academic year. Then at this point, there are also several courses based on existing data such as data on teachers and subjects taught. As a result, every time a subject is created, the registered teachers and students are added to certain courses and classes as determined by the classroom teachers and school heads.

After the process runs smoothly and has been completed, students can carry out the learning process at LMS when the new school year has been opened and implemented, starting from odd semesters to even semesters. Activities carried out by these students throughout the school year include viewing and obtaining material provided by the tutor, taking quizzes, daily tests, assessments, working on assignments, to exams at the end of each semester or grade promotion.

B. Data Identification and Justification

Case studies discussed in this study is a learning process in determining the new school year with the main focus on student activities in the learning process, especially on school exams which are held regularly.

Analysis of the identification and justification of the data has been carried out by answering the ten questions in the list and will be answered and summarized with the description below:

1. ***Structured data?*** The available data is in the form of web logs, which can be converted into a table format with columns and rows of data. The data that's contained in the Salam Al Azhar learning system is structured data. Starting from the learning data inputted by the supervisor or lessons teacher, student's data per class or grade, assessments, exam schedules, and so on, have been neatly arranged on this learning site.

2. ***Are Case ID, Activity, and Timestamp fields available?*** Case ID in the form of activities carried out by students, whether in the form of exams or other learning activities, will be clearly recorded in the system along with the time and duration of their implementation. The entire activity process will be kept clear by the system.

3. ***Same case ID on more than one row?*** There is the same case ID in more than one row, so the data can be used for analysis by process mining. This can be proven by the existence of

Nissa Auwliya Luth Dendy[1], Lu Wang [2]
case studies with examples of exams conducted at the same time, which can be attended by more than one student up to dozens but still can run well and are structured in the learning system.

4. ***Different activities in the same case?*** Case ID can carry out the same activities, it can be proven by students or teachers who can carry out exams and learning activities at the same time. On the basis of these data, an analysis can be carried out for the process mining.

5. ***Different timestamps in the same case?*** There are multiple timestamps on the same case ID. This indicates that there is a history of activities in a case. This can be seen by the existence of several activities carried out by teachers and students who are always recorded in the learning system.

6. ***Date and time in one column?*** The date and time are stored in a row, along with the start time, end time, and the duration of the recorded activity.

7. ***Data stored in one file?*** The data is stored in one file that can be downloaded from Salam Al Azhar, in the form of a Microsoft Excel text file or Comma Separated Values.

8. ***Multiple timestamp patterns across multiple columns?*** There is a timestamp pattern that shows when an activity is carried out by the user (teacher or student), namely a timestamp pattern that shows the date, month, year, hour, minute, and duration when an activity was carried out by the user.

9. ***Readable activity names?*** Activity names according to the stages of using the LMS by teachers or students as the users.

10. ***Can activity names be generalized?*** The same activity names in the same different case already have the same activity name, so we can conclude that activity names can become widespread.

Based on the answer to the hypothesis above, it can be concluded that Salam Al Azhar already has sufficient data to be analysed by process mining. The required components are already available, with some notes to change the initial data format according to the needs in the process mining.

C. Data Extraction and Processing

Al Azhar Learning System Management already has sufficient data to be analysed by process mining. The components needed are available, with some notes to change the initial data format according to the needs in the mining process (Van Eck et al., 2015). At this stage, several conditions are identified that have the potential to become problems in the analysis with process mining.

There are several main activities that appear frequently in the dataset are:

1. ***Dashboard*** → Presentation of data or information in real-time. The data in question can be in the form of raw data or data that has been processed. The main function of using a dashboard is to make it easy to read information quickly and accurately from the linked database.

2. ***Course Overview*** → Consists of classes that can be accessed to be able to take certain exams which are usually conducted in the middle of the semester and at the end of the semester. In this function, the student who take the tests and the teacher responsible can access and learn about the current activities. Especially for teachers and supervisors, they can find out about the activities of the students taking the examinations and what is going on now.

3. ***My Course*** → Consists of several courses or subjects taken by students or taught by each teacher. Apart from that, there is also a supervisor and also an editor function for selecting exam questions before they are distributed to all students. In this function, the user can find out the list of subjects intended for each user. In addition, there is also a guide for working on questions and also a schedule that has been determined by the teacher who serves as supervisor and editor.

The five most frequent activities are as follows. *Course viewed* activity records user activity when viewing course descriptions. The *Course view module* activity records user activity when viewing course details at a particular meeting. The *Quiz attempted* activity shows when the user attempted to answer the question/quiz. The three activities according to the confirmation from the expert team members show the three activities that are most often carried out by users on this system. *Activity Completion* activity course updated records the condition when the completion of an activity is updated. Meanwhile, the activity *status of the submission* has been viewed shows when the user views the status of the assignment/ quiz submission.

D. Data Experimental and Validation

Based on the discussion, it was concluded that the application and use of modern digital technology has become an important necessity in people's lives today. With this digital-based technology, it can be used to add and improve strategies to facilitate one's daily work in the world of education. This is because the use of technology is also a big influence because of the use of learning methods with the Learning Management System (LMS) system that has been developed by Universities and Education in Indonesia. With the support of this Learning management system (LMS) application, it can provide convenience and also create the learning system is increasingly directed, effective and efficient.

This can be proven in practice using it by several validators as contributors to testimonials in this study. Herewith attached the result of a short interview related to the implementation of the LMS:

Table 1. Short Interview

No	Aspect	Total User	Practicality Value	Criteria
1	Easy of Use	77	95,61%	Beneficial
2	Efficiency	77	96,44%	Beneficial
3	Advantage	77	87,72%	Beneficial
	Total		297,77%	Beneficial
	Average		99,25%	Beneficial

Based on the table above, it can be concluded that the use of LMS is quite beneficial because it can facilitate the learning process at school and make it easier. Furthermore, the application of this LMS is very helpful and supports the ease of learning for both including teachers and students who are registered as active member in it.

CONCLUSION

The conclusions that can be drawn from this study are as follows. The methodology applied in this study, namely the Process Mining Project Methodology, can be used as a general methodology for process mining projects. This research data shows that this methodology can also be applied to analyse the readiness of data for the implementation of process mining in process analysis.

The case studies chosen in this study are the learning process in one class of one subject or course in one semester. Furthermore, it also covers examination activities in the classes followed and also taught by each lesson's teacher. Can represent the problems encountered in implementing process mining in a learning management system. The diversity of user access patterns according to roles and time of the semester can shown in the process analysis. Based on the analysis that has done, the Al Azhar Learning Management System or commonly known as SALAM Al Azhar has their own data that is ready to be analysed by Process Mining (Shofiatun, 2021). With some notes to improve the quality of the data and the results of the analysis.

Nissa Auwliya Luth Dendy[1], Lu Wang [2]

Suggestions for development and potential for further research can used. The research methodology applied in this study can tested in larger and more diverse case studies, to make it a general method that can applied in various other cases. In addition, this research can also be analysed by process mining by improving data quality in the form of other functions, for example recording access time in (hours: minutes: seconds) (Chouhan et al., 2021), as well as creating an aggregation scheme to describe the relationship between one activity and another.

The potential for further research is to analyse the learning process of all classes in one course, all courses in one semester, and one course in several semesters. As done to recognize learning patterns in various classes, in the same semester or in different semesters.

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