



Automated Assessment of Students' Attitudes and Academic Resilience Through Learning Management System Data Integration

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Abstract

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One of the online platforms used to support learning activities is the Learning Management System (LMS). LMS supports the evaluation of cognitive aspects but not affective ones. As learning is mostly asynchronous, it presents challenges for lecturers in assessing students' attitudes. However, LMS generates data that can potentially be used to evaluate student attitudes and academic resilience. With the system log on the LMS, we can process data into information on the level of understanding, learning attitude, and persistence of students. This research is related to the design of an analytic dashboard that is integrated with LMS using Moodle. The dashboard will display an evaluation of student learning activities from the attitudinal aspects of motivation, discipline, responsibility, and academic resilience aspects consisting of persistence, reflecting and asking for help, and negative affect and emotional response. The study involved 160 new students, with data collected from 130 participants. The method used is a Research and Development (R&D) approach, which includes three stages: introduction, development, and testing. Data triangulation was used for validation by comparing online assessments with student self-evaluations. The final stage visualizes the results of system log analysis through the analytic dashboard. Findings showed that motivation scores from self-assessment correlated with LMS data, while discipline and responsibility assessments yielded different results. Academic resilience measures also showed discrepancies between student and mentor assessments. This research highlights the potential to visualize affective learning aspects within LMS platforms, providing lecturers with valuable insights into both cognitive and affective dimensions of student performance.

Keywords:

LMS; Moodle; e-learning; attitude aspects; academic resilience

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INTRODUCTION

With the increased use of online and hybrid learning methods, more universities are using e-learning as the main tool in their education programs (Harandi, 2015). In certain countries, the usage and acceptance of learning management systems (LMS) growing under COVID-19 (Alturki & Aldraiweesh, 2021; Makumane, 2023; Raza et al., 2021). Students used the LMS to successfully complete their courses during social distancing (Raza et al., 2021). Educational institutions need LMS because it can provide convenience and alternatives to online



learning, on the other hand, it also ensures the integrity, optimization, and objective control of the learning process (Y. Zhang et al., 2020). LMS has become an effective platform for continuous learning that requires less time and resources and is beneficial in distance learning (Alturki & Aldraiweesh, 2021).

Therefore, in this research, a method is needed to evaluate students' affective based on their cognitive activities. LMS can provide insights related to the analysis of attitudinal aspects such as motivation, discipline, and responsibility as well as student academic resilience, which is the psychological resilience of students facing obstacles during the educational process. Data obtained from cognitive activities such as quizzes, materials, assignments, and forums are then analyzed to map aspects of attitude, academic resilience, and student engagement in the online lecture process.

Several studies on LMS and online learning explain that LMS is a tool and method that can be used to explain student behavior and help identify possible student errors during the learning process (Y. Zhang et al., 2020). It is useful because of the accessibility of learning files, participation in the formation of content, real-time monitoring, and the flexibility to self-regulate what knowledge to learn (knowledge of self-control) (Korneenko, 2019).

López-Zambrano et al., (2020) suggested applying clustering rules from modules developed on the Moodle LMS to data mining to improve student performance. Research conducted by Y. Zhang et al., (2020) collected data on the LMS according to the quantitative, qualitative, and students' social activities. The analysis is carried out through visualization of student behavior and log file examination results.

Learning behavioral engagement is the result of interaction between students and the learning environment. (Sun & Bin, 2018). Learning behavior can be divided into two types: explicit and implicit. Explicit learning behavior relates to the learning process, methods, content, results, etc. Implicit learning behavior relates to motivation, attitude, and learning style (P. Zhang et al., 2020).

Learning discipline is characterized as a manifestation of student obedience and adherence to the regulations established by the school and educators throughout the educational process, motivated by an intrinsic awareness cultivated via training. Arikunto (2013) defines learning discipline as behaviors that demonstrate obedience and compliance, underpinned by the understanding that one must fulfill responsibilities and duties to attain educational objectives. Research by Siregar (2020) indicates that motivation comprises three primary components: initiating, guiding, and reinforcing human behavior.

Responsibility is intrinsically linked to an individual's obligation to fulfill their tasks. Humans are inherently responsible entities. Sarah (2019, in Dewirati Juita et al., 2021) posits that responsibility encompasses an individual's attitude and conduct in fulfilling tasks and obligations towards God, the state, the environment, society, and oneself. The answer indicates that a sense of responsibility is a trait of civilized and cultivated individuals. An accountable individual will accept all repercussions of their decisions with complete willingness and awareness (Zubaedi in Bariyyah et al., 2018) Academic responsibility is a component of personal integrity. Academic accountability refers to an individual's commitment to achieving their academic obligations through completing assigned assignments.

KBBI (*Kamus Besar Bahasa Indonesia*) defines responsibility as the obligation to bear all duties, whereas academics pertains to topics associated with education, including studying and completing tasks (Depdikbud, 2021).

Academic resilience is a notion that is being extensively investigated worldwide, corresponding to the rising necessity to create programs aimed at fostering academic resilience (Hart & Becky, 2015). (Rutter, 1999) asserted that resilience is not a trait that manifests in every circumstance. This indicates that individuals may exhibit resilience to some stress and challenges yet may not demonstrate resilience in other domains. Academic resilience is a crucial variable in study, as students universally encounter academic problems. Consequently, examining how students manage their academic challenges is essential, as this will correlate with their engagement in learning activities.

In research conducted by Afriyeni et al., (2021) a positive relationship was found between academic resilience and online learning satisfaction. This suggests that increasing academic resilience can significantly improve student satisfaction in distance learning, especially when done online. Other studies show that the higher the level of student optimism, the higher the academic resilience. (Rikumahu & Rahayu, 2022).

The purpose of this research is to develop an analytic dashboard that can perform automatic assessments of students' attitudes and academic resilience through LMS data integration. This research will analyze attitudinal aspects such as discipline, responsibility, motivation, and student academic resilience based on the activities of providing materials, assignments, quizzes, and forums. Furthermore, the data logs that have been collected through the LMS will be analyzed and evaluated through a graphical or tabular visualization display on the analytic dashboard that shows the frequency and level of learner activeness as well as a reference for lecturers in assessing aspects of student attitudes and academic resilience during online learning.

METHODS

The method used is the Research & Development (R&D). Borg and Gall (in Ghufroon 2011) stated that R&D consists of three stages: introduction, development, and testing. The introduction is done by conducting a literature review related to the use of LMS in online learning, an analysis of student behavior in online learning activities, and an analysis of the variables/parameters in Moodle that affect behavior analysis and resilience in lectures. Then a correlation is made between the existing variables and aspects of attitude and academic resilience. At this stage, the data collection process is also carried out through the LMS Moodle.

The components of attitude assessed in this research are discipline, responsibility, and motivation. The subject population in this study was 160 students. The characteristics sample in this study are new students in the Informatics major at UM Bandung with the number of samples that become data in this study as many as 130 students.

Furthermore, the prototype development stage begins with designing an analytic dashboard based on cognitive activities carried out during learning.

Cognitive activities recorded in the LMS activity log are then linked to the table of specification of aspects of attitude and academic resilience.

The next stage was a limited test of the analytic dashboard on 130 new students who were registered and active on the LMS for campus introduction and orientation courses which was conducted for 4 days. Data triangulation was conducted to support the validity of the assessment of attitudes and resilience aspects through questionnaires. This evaluation sheet relates to the collection of information regarding the attitudinal and psychological aspects of students during the learning process.

The components of attitude assessed are discipline, responsibility, and motivation. The preparation of the questionnaire on the discipline aspect (n=8 for students) measures several sub-aspects of students, namely attendance and punctuality, time management, adherence to rules, organization and planning, work quality, stress management, and independence. The responsibility dimension (n=7 for students) encompasses the following sub-aspects: task completion, commitment to learning, academic integrity, acceptance of penalties, cooperation and leadership, environmental awareness, and adherence to social ethics and standards. Moreover, the motivational component (n=5 for students) encompasses multiple subcomponents, specifically zeal for learning, dedication to education, inquisitiveness, receptiveness to feedback, and sustained attention and focus. The studied resilience aspects (n=6 for students, n=7 for mentors) encompass perseverance, reflection, adaptive seeking, adverse impact, and emotional response.

This test is conducted at the end of the semester using data that has been collected during one semester. The results of the analysis are expected to show the correlation between the variables/parameters that have been determined with the attitudinal and psychological aspects to be evaluated.

The final stage of the research is to prove the data visualization of the learning activity log analysis results with the results of the questionnaire assessment which is carried out with descriptive statistics and describes the concepts measured, namely discipline, responsibility, motivation, and academic resilience. The research will be considered successful if there is a value from the assessment questionnaire that shows conformity with the value displayed on the analytic dashboard developed. It is expected that this research can support online and hybrid teaching and learning activities at UM Bandung, help lecturers evaluate attitudinal aspects, and provide feedback to students based on valid data.

RESULTS

The attitudinal aspects such as discipline, responsibility, and motivation are assessed with two different approaches, the first by taking data from the LMS log, while the second is conducted self-assessment by the student and assessed by psychologists. Meanwhile, the academic resilience aspect consists of perseverance, reflecting adaptive help-seeking and negative affect, and emotional response is assessed with self-assessment and mentor assessment.

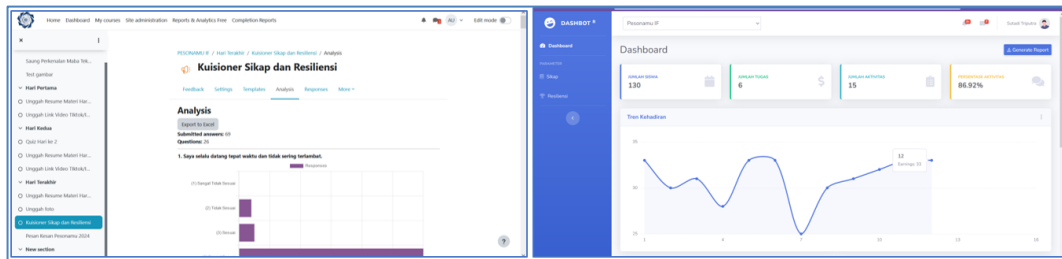


Figure 1. LMS and analytic dashboard pages

Figure 1 is LMS and analytic dashboard pages. In LMS, there are materials, forums, assignments, and quizzes that are delivered to students. The collection of this activity can be used as data needed to assess students' attitudes and academic resilience by looking at the logs from Moodle. The prototype developed is an analytic dashboard that can display data visualization of the results of measuring student attitudes and academic resilience derived from the LMS. The process of developing this dashboard is carried out in parallel with the time of using the Moodle LMS (data collection).

In the testing phase, dashboard testing and validity assessment through questionnaires on aspects of attitude and academic resilience were conducted. There are two types of questionnaires for data collection, which are self-assessments filled in by students and data from LMS logs. After the students' learning evaluation, the results indicate that these three attitudinal qualities most indicate student participation at UM Bandung. The following are the results of the assessment of student attitudes and academic resilience.

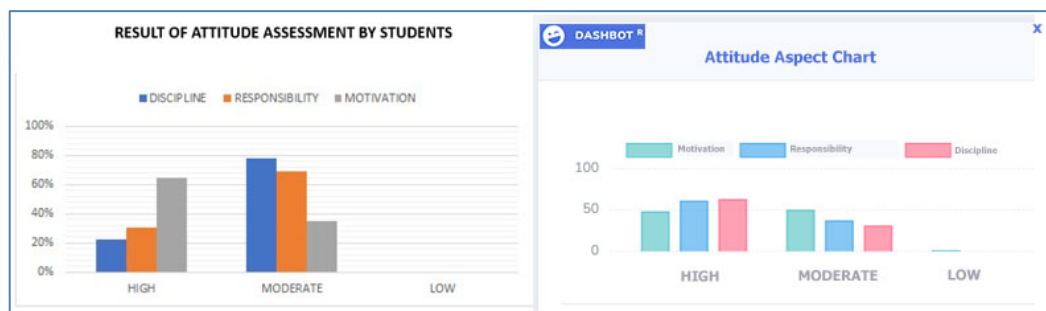


Figure 2. The comparison result of the attitude assessment between students and the dashboard

Figure 2 are charts comparison of the results of the assessment of attitudinal aspects self-assessment by students and from LMS data. In the first graph, most students have high motivation (65%) when carrying out academic tasks. This proves that new students have a high drive and enthusiasm to learn something new. Students with motivation in the moderate category (35%), indicate that they have enough enthusiasm to learn something new. Meanwhile, student assessments of responsibility (69%) and discipline (78%) were in the moderate category. Moderate responsibility also means that students are quite capable of taking responsibility for mistakes and learning from experience. Furthermore, discipline in the moderate category means that students can follow the applicable rules and obey the instructions of the assigned tasks. Meanwhile, students who assessed attitudes in

the moderate category in the attitude of discipline (22%) and responsibility (31%). Students are quite capable of obeying the applicable rules and being responsible for the feedback given by the mentor. This relatively positive attitude in new students can support good adaptability to the new environment.

The second graph, which is the result of an assessment derived from LMS data, shows the opposite, the level of responsibility (63%) and discipline (66%) is in the high category, meaning that students can show responsibility for their duties and demands in the new environment, and obey the rules and instructions of the new academic task. Meanwhile, students who have moderate responsibility (37%), this means that students are quite capable of acting by considering consequences and are quite capable of trying to complete tasks without the need to be supervised or reminded. In addition, 34% of students have a level of discipline that is in the moderate category, which means that they can understand and apply the rules during the activity. However, motivation in the moderate category is mostly experienced by students at 51%. Students are quite capable of encouraging themselves to be able to strive to complete tasks well. In addition, motivation in the high category is owned by 48% of students. This means that students can display enthusiastic behavior in completing the demands of new tasks. There are 2% of students who have low motivation, making it difficult for students to complete their assignments according to instructions and on time.

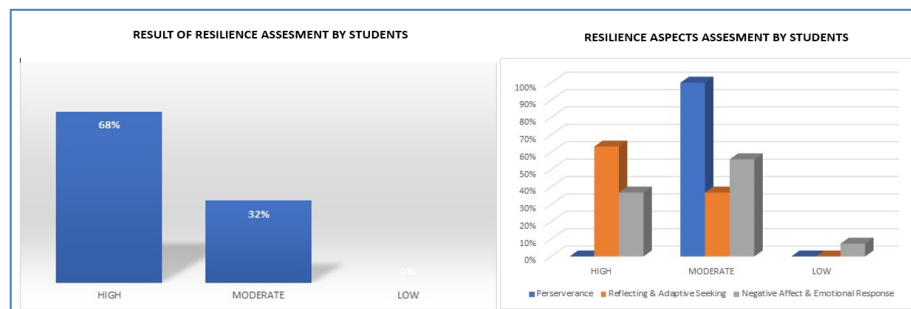


Figure 3. Description of academic resilience assessment by students

Figure 3 illustrates that 68% of students' academic resilience is in the high category, which indicates that new students have good resilience when dealing with difficult and new situations. In addition, 32% of students have a moderate level of resilience, meaning that students have enough ability to be able to rise to solve their problems.

The next chart illustrates how the aspects of resilience explain the resilience of students. In the persistence aspect, all students are in the moderate category (100%), which means that students are quite persistent in solving the difficulties they face. As many as 63% of students evaluate their abilities and weaknesses, and then ask for help from others when they cannot solve it. In addition, 37% of students are quite capable of evaluating their weaknesses and asking for help to solve their problems. On the other hand, 37% of students feel positive emotions and display feelings of optimism when facing difficult situations. As many as 56% of students feel positive emotions when facing difficult situations and are quite optimistic about solving problems that are perceived as difficult. Then, 7% of students feel negative

emotions and are less able to be positive when facing problems. These students tend to complain and despair easily when facing problems.

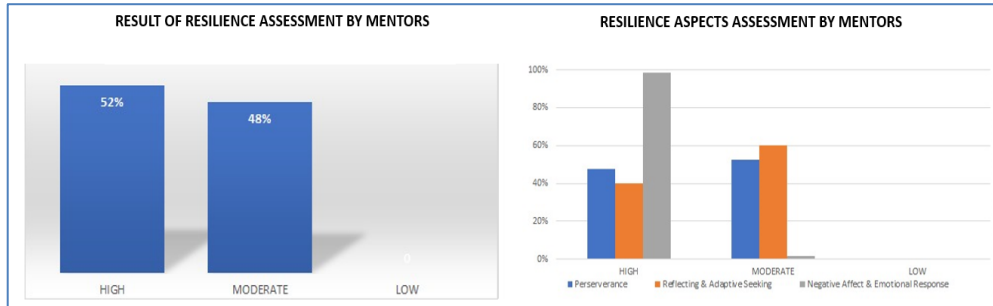


Figure 4. Description of academic resilience assessment by mentors

Based on the results of the graph above, the assessment from the mentor explains that most students' resilience is in the high category, which is 52%. This means that mentors assess new students as having resilience in facing difficult problems. In addition, 48% of students are considered to have moderate resilience, which means that student resilience is quite capable of rising from the difficulties faced.

The graph above shows that all aspects are only in the high and medium categories. As many as 48% of students are considered to have high persistence, indicating that students are resilient in facing problems. Then, 52% of students are considered to have good enough resilience so that new demands on campus can be faced quite well. In addition, 40% of students evaluate their abilities and weaknesses and then seek help when they need it. Furthermore, 60% of students have evaluated their abilities so that they seek help when they feel unable. Students are considered to feel positive emotions as much as 98%, this shows that students feel positive emotions when facing new problems. In addition, 2% of students experience positive emotions and can respond quite well.

DISCUSSION

This study looked to develop an analytical dashboard that can automatically evaluate students' attitudes and academic resilience by integrating data from LMS. Most of the research related to the analysis of learning using the LMS platform is more directed to the evaluation of cognitive aspects. Some topics lead to the analysis of behavioral aspects, but they are less specific in determining the category of attitudes to be assessed and what variables or parameters are influential. Research done by Safitri et al., (2023) assessed the affective aspect by developing a mobile-based monitoring application integrated with the LMS. This application makes it possible to develop students' character through monitoring students' daily activities at home and outside of school. Other research is assessing cognitive aspects with technology such as Google Forms and WhatsApp platform using by teachers and students to provide multiple-choice assessments, one of various types of written assessments. By using Google Meet to provide interactive questions and responses with students, oral assessments are administered during online learning. When

students are learning using Google Meet, videos are sent in place of in-person assessments of their memorization, which are more effective (Santoso et al., 2023).

The difference in the results in this study, which are shown from the dashboard (LMS) data, the student, and mentor questionnaires indicates that the data displayed by the questionnaires have a lower level of reliability than the LMS data. LMS data is significantly more reliable than perception data. This aligns with research conducted by (Conrath et al., 1983), which showed a discrepancy between questionnaire data and diary data on research participants. This is because the data collected is different, the data obtained from the diary relates to individual events while the questionnaire data relates to the percentage of one's working time spent communicating with others. This is also similar to the research of (Andersen & Mikkelsen, 2008), who revealed that their research comparing questionnaires with diary data on respondents who experienced work accidents could not be compared because the questionnaire data asked participants to recall the occurrence of work accidents at that time, so there was a loss of accurate information when compared to diary data.

Based on the above researches, it is a reference that the difference in results between questionnaire data and LMS data in this study shows the difference in reliability inherent in the two types of measurement instruments. In addition, the data collected from the LMS and questionnaires are different. The LMS data focuses on the time of assignment collection, while the questionnaire data focuses on the assessment of learning conditions. LMS, as one of the supporting tools for cognitive activities, needs to be used for one semester so that activities and data become more varied—not only forums, materials, assignments, and quizzes—so that more detailed patterns of attitudes and academic resilience can be seen and produce a more accurate assessment of student attitudes and academic resilience. Future research can conduct tests with a longer period and do a comparison test by comparing the same data and conducting a correlation analysis based on the two data measured. Thus, validation of LMS data can be done using the questionnaire used.

CONCLUSION

Based on testing, it can be concluded that there are differences in the results of discipline and responsibility aspects where the results of self-assessment show that students feel moderately disciplined and responsible while on the LMS log these aspects reach a high value. On the other hand, the motivation aspect shows similar results between the self-assessment results and the log from the dashboard/LMS. This shows that the motivation aspect can be assessed based on students' cognitive activities during the online learning process using the LMS.

The results of the resilience assessment based on self-assessment and based on mentor assessment show different results, that most students feel they have moderate perseverance, reflecting and adaptive help-seeking is high, and negative affect and emotional response are moderate. In contrast, based on the mentor's assessment, students' perseverance is in the high range, reflecting and adaptive help-seeking is moderate, and negative affect and emotional response are high.

The difference in results on self-assessment, assessment from mentors, and data from LMS shows differences because indicates that the data displayed by the questionnaires have a lower level of reliability than the LMS data, also students assess their attitudes and resilience based on their overall experience while mentors assess the resilience of these students only during learning activities that are not too long in duration, so The LMS data is significantly more reliable than the perception data.

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