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Learning Pattern Analysis through Learning Analytics: Improving Language Learning in Ubiquitous Contexts

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ABSTRACT

Background. The increasing use of technology in education, particularly application-based learning, has the potential to enhance language learning. Effective language acquisition relies on analyzing learning patterns to improve student engagement and outcomes. With the growing role of learning analytics, this research explores how technology can be applied to understand and improve language learning in a broader context.

Purpose. The study aims to analyze language learning patterns through learning analytics and explore how technology can contribute to enhancing language learning in various contexts. Specifically, it focuses on identifying how different learning behaviors and engagement levels influence language proficiency.

Method. A quantitative research approach was used, collecting data from 200 learners who utilized language learning applications. The data were analyzed to identify patterns in user engagement and learning behaviors, focusing on the relationship between time spent on different types of learning materials and language proficiency outcomes.

Results. The findings reveal that learners who spent more time engaging with conversation and writing materials generally showed better language skills. In contrast, students with basic language proficiency were found to focus more on grammar and vocabulary materials. This suggests that more advanced learners benefit from interactive, communicative tasks, while beginners need a focus on foundational elements like grammar and vocabulary.

Conclusion. The study concludes that language learning is more effective when it involves social and contextual interaction, rather than relying solely on passive methods like memorization. These findings offer valuable insights for the design of language learning applications that are more adaptive to student preferences, encouraging more personalized and engaging learning experiences. The research highlights the importance of considering different learning patterns to enhance the overall effectiveness of language learning technology.

KEYWORDS

Learning Analytics, Language Learning, Learning Technology

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INTRODUCTION

The development of digital technology has brought significant changes in the way we learn. The use of technology in education, especially through online learning and mobile device-based learning applications, has created new opportunities in the teaching and learning process (Shang, 2022). Learning can now be done anytime and anywhere,

providing wider access for learners in different parts of the world. In this context, language is one of the increasingly important elements to learn, given the global need to communicate in various languages, especially English (Chiu, 2022).

Learning analytics has become a powerful tool in improving our understanding of how individuals learn. Through the analysis of data collected from learning activities, we can understand the patterns that underlie the learning process (Morrice, 2021). This analytics not only focuses on academic achievement, but also on the processes that occur during learning interactions, which can provide valuable insights for the development of more effective teaching strategies (Cabangcala, 2021).

However, while learning technologies and analytics offer great potential to improve learning outcomes, the main challenge lies in their application in highly dynamic and often unstructured contexts (Hayes, 2019). Learning that takes place in various contexts, such as in the classroom, through mobile applications, or in self-paced learning situations, presents a variety of variables that are difficult to predict. In this case, the ability to understand learning patterns becomes essential for tailoring teaching strategies to individual needs and preferences (Le, 2022).

It is important to note that in language learning, context factors have a great influence. Language learning relies not only on verbal interaction, but also on the ability to adapt to different situations and communication needs (Ra, 2019). Effective learning in diverse contexts requires a deeper understanding of learning patterns that occur outside of traditional learning environments. Therefore, the analysis of learning patterns through learning analytics is a crucial first step to identify the factors that affect the language learning process in a more holistic way (Shi, 2020).

One aspect to consider is the use of data generated during learning, which is often contextual and diverse. Through the use of learning analytics, this data can be analyzed to find learning patterns that may not be visible with traditional approaches (Hong, 2022). For example, analytics can reveal when and where learners tend to be most productive, as well as how they interact with learning materials. These findings can provide very useful insights in designing learning materials that are more in line with students' learning habits (Zhao, 2023).

Finally, the integration of learning analytics with language learning in an all-in-one context opens up great opportunities to personalize the learning experience (Vu, 2021). By analyzing learning patterns, teachers can design strategies that are more responsive to the needs of individual learners, improve the effectiveness of language learning, and provide more meaningful experiences. The use of learning analytics in this context is not only about improving learning outcomes, but also about providing a deeper understanding of the learning process itself (Vlaeva, 2021).

Many studies have shown that language learning in a one-size-fits-all context has different challenges compared to learning in a more structured environment. While digital technologies and platforms offer great flexibility and accessibility, the use of data to understand learning patterns in these contexts is still limited. Although learning analytics has developed rapidly, its application in language learning, especially in contexts that are not limited to the classroom, has not been widely explored (Huang, 2019).

There is still little research that reveals how learning patterns that arise from the use of technology outside the classroom can be identified and utilized effectively (Tao, 2020). Although learning analytics are often used to improve academic outcomes, most research focuses on more traditional learning environments and pays less attention to how evolving technologies can affect learning patterns in a broader context. Therefore, there is a need to further explore how learning analytics can be used to explore the learning patterns that occur in more flexible and dynamic language learning situations (Wang, 2020).

Many existing studies are more focused on improving learning performance using quantitative data, but rarely pay attention to qualitative factors that can be indicators of learning patterns. Language learning often involves different types of interactions, both verbal and non-verbal, which can be difficult to measure with numbers alone. In fact, this interaction can significantly affect learning outcomes. The absence of an approach that combines quantitative and qualitative data in learning analytics is a gap that needs to be filled so that the understanding of learning patterns can be more comprehensive (Smagorinsky, 2020).

In addition, while there are already several analytical tools available to monitor learning progress, there is no truly effective approach to understanding and tailoring individual learning experiences, especially in a one-size-fits-all context. Language learning in this context involves a variety of factors, ranging from individual preferences, learning habits, to social and cultural contexts. However, most of the existing learning systems have not been able to accommodate this diversity optimally. This is where it is important to analyze learning patterns with a more personalized and flexible approach (Dehghanzadeh, 2021).

Finally, the lack of understanding of how data generated in an unstructured learning context can provide useful insights is a major challenge. A lot of the data collected through learning apps and platforms is not always interpreted effectively to improve language learning (Hu, 2020). Data that is too general or not specific enough often does not provide a clear picture of how best to support learners. Therefore, the development of analytical models that are more sensitive to the context and learning patterns in an all-round environment is an important step that needs to be taken (Truong, 2019).

Filling the gap in understanding learning patterns through learning analytics in various language learning contexts is very important, considering the rapid development of technology in education. Language learning is now not only happening in the classroom, but also in daily life through applications, social media, and other digital interactions. For this reason, it is important for us to develop an approach that can capture the learning patterns that emerge in these contexts, in order to maximize the potential of technology in supporting effective and adaptive language learning (Jamatia, 2019) .

The main goal in filling this gap is to design an analytics system that not only relies on quantitative data, but also integrates qualitative aspects that can provide a more complete picture of how students interact with learning materials. By utilizing learning analytics, we can gain deeper insights into individual learning habits, including the preferences and obstacles they face, as well as how external factors affect their learning process. This approach aims to create a more personalized and relevant learning experience for each student (Barash, 2020).

The hypothesis proposed is that by identifying learning patterns through more comprehensive data analysis, we can create a more effective language learning environment, even outside of the traditional classroom. Language learning that takes place in various contexts and through various platforms can be further optimized if we understand how individuals access, interact and digest material. Therefore, this research seeks to fill the existing gap by utilizing learning analytics to improve language learning in an all-round context.

RESEARCH METHODOLOGY

This study uses a quantitative research design with a data analytics approach to analyze language learning patterns through learning analytics. This study aims to explore how data collected from various learning platforms can be processed to gain insights into individual learning habits (Ewing, 2020). This research also includes the use of predictive models to identify factors that

affect the language learning process in various contexts. The data collected will be analyzed with statistical techniques to reveal patterns that can improve the effectiveness of language learning (England, 2022).

The population in this study is students who are learning languages in various versatile learning contexts, such as online learning, mobile applications, and digital social interactions. The sample taken consisted of 60 language learners who used language learning applications or other digital platforms. The sample selection was carried out randomly by considering diversity in terms of age, language proficiency level, and cultural background, to get a more representative picture of learning patterns in various groups of learners (Elmortda, 2019).

The instrument used in this study is a digital-based language learning application that can collect data on user learning activities, such as time spent in the application, types of material learned, and social interactions that occur during learning (Chen, 2022). In addition, questionnaires containing questions regarding students' learning preferences, constraints, and personal experiences will also be used to collect qualitative data. Data from these two instruments will then be combined to get a more complete picture of the learning patterns that occur (Bakken, 2023).

The research procedure begins with the selection of participants to be included in the study, then they will be asked to use language learning applications for a certain period. During this period, data on their activities will be collected, including time spent using the app, selected materials, and interactions in forums or social media related to language learning. Next, participants will fill out a questionnaire that provides additional information about their learning experience. The collected data will then be analyzed using descriptive statistical methods and cluster analysis to identify emerging learning patterns, which can be used to design more effective learning strategies (Beste, 2019).

RESULT AND DISCUSSION

The data collected during the study period showed a variety of diverse learning patterns from 60 participants. Table 1 illustrates the average time spent by participants in using language learning applications every day. This time varies between 30 to 120 minutes per day, with most participants spending around 60 minutes. Table 2 shows the distribution of the most frequently accessed materials, with grammar and vocabulary materials being the most popular. This data gives an idea that learners are more focused on the basics of language learning, which indicates their need to strengthen the foundation of the language before moving on to more complex material.

Table 1: Average App Usage Time per Day

Usage Time (minutes)	Number of Participants (%)
30-60	45%
60-90	35%
90-120	20%

Table 2: Frequently Accessed Learning Materials

Learning Materials	Usage Percentage (%)
Grammar	40%
Kosa Kata	35%
Conversation	15%
Reading and Writing	10%

Data shows that most learners spend a relatively short amount of time learning a language every day. Only about 20% of participants spend more than 90 minutes per day studying, while the majority tend to be less. This reflects a more fragmented learning pattern, where learners tend to allocate more limited time but more often in interaction with applications. This phenomenon may be caused by personal time limitations or the tendency of learners to choose learning that does not require a long time commitment.

In addition, the most accessed materials are grammar and vocabulary. This material shows that learners tend to focus on the basic aspects of the language that are more structured and easy to master. Although conversational material and writing skills also have a significant contribution, they are accessed with a lower frequency. This could be due to learners' lower confidence in using the language actively or perhaps due to time constraints that limit them from practicing conversation or writing.

Most of the study participants were between the ages of 18 and 24, with the majority of them being college students or young workers. The data showed that most of the participants had a fairly good educational background, with 70% of them having a minimum of high school education and another 30% having a bachelor's degree. Participants come from a variety of cultural and social backgrounds, with most using language learning apps as a means to improve their English language skills, both for academic and professional purposes.

Participants also showed variation in terms of language proficiency, with most having a basic to intermediate level of proficiency (A1-B2 according to the CEFR). Only 15% of the participants had an advanced level of English proficiency (C1-C2). This shows that the majority of learners are still in the early stages of language learning and need a more in-depth approach to teaching.

With relatively high educational backgrounds and language proficiency that is still at the elementary to secondary level, the study participants showed that they prefer language learning applications that offer a difficulty-based approach. Participants from lower-level groups tended to access basic grammar and vocabulary materials, while participants with higher levels of ability began to try more complex materials such as conversation and writing. This shows that the level of difficulty of the material needs to be adjusted to the ability of each participant so that learning is more effective.

The fact that most participants have a fairly high educational background, but are still at a basic level in language mastery, suggests that time and social context factors can affect their learning speed. The use of language apps is often more influenced by independent learning habits and time flexibility that allows them to learn in a short and divided time.

The data shows that there is a significant relationship between the length of time spent using the app and the type of material accessed. Participants who spent longer hours (more than 90 minutes per day) tended to access more conversation and writing materials, while participants who spent less time accessed basic materials such as grammar and vocabulary more often. This indicates that learners who have more time to learn are more likely to focus on developing active skills, while learners with limited time tend to focus more on language basics.

In addition, the relationship between the level of language proficiency and the type of material accessed is also clearly visible. Participants with higher skill levels tend to access more complex materials, while those at the basic ability level prefer simpler materials. This shows that understanding the level of learners' abilities can help in compiling more targeted material and support the improvement of their language skills.

In the case study, one participant who had an intermediate level of language proficiency (B1) spent about 75 minutes per day using a language learning app. He accesses conversation materials

and listening skills more often. Analysis of learning patterns showed that these participants tended to learn in short sessions, focusing on direct interaction in the target language. He also interacts more often in the discussion forum provided by the app, which indicates a tendency to learn socially.

These participants use the app for professional communication purposes, such as improving their speaking skills in a work context. Nonetheless, he rarely accesses grammar or vocabulary materials separately, which suggests that he prefers to learn languages contextually through hands-on practice, rather than through memorization or formal learning. This case study illustrates the importance of a more practical and contextual approach to language learning.

The results of this case study show that some learners tend to be more active in social learning and conversation, which can affect their language mastery. Such learners may feel more comfortable in an interactive and practical context, rather than through a more theoretical and formal approach. This shows that application-based language learning must consider learners' social preferences in designing materials that are relevant and acceptable to users.

The case study also shows that apps that prioritize direct interaction and practical use of language have a significant impact on learners' progress, especially in speaking and listening skills. In this case, language learning apps designed to provide a contextual and dynamic learning experience can help improve learners' skills faster.

The relationship between time use and the type of material accessed in this case study is aligned with larger data, which suggests that learners who spend more time tend to choose materials that focus on active skill development. This is directly related to the results found in the overall data analysis, which shows that the more time allocated to learning, the greater the tendency of learners to focus on speaking and listening skills, which require more practical practice than more passive reading or writing skills.

Thus, this data reinforces the importance of app design that adapts the material to the needs and preferences of students, to support a more effective learning process. Learners who spend more time learning tend to seek direct interaction with more complex material, while those with limited time focus more on the basics that are easy to digest and apply.

This study analyzed language learning patterns through learning analytics by involving 200 participants who used language learning applications in various contexts. The results showed that the majority of participants spent between 30 to 90 minutes per day learning the language. The most frequently accessed materials are grammar and vocabulary, followed by conversation and writing materials. Additionally, there is a significant relationship between the time spent in the app and the type of material accessed, with learners spending more time tending to access more complex materials such as conversation and writing.

The data also showed that learners with higher levels of language proficiency accessed conversation and writing materials more often, while learners with basic skills accessed grammar and vocabulary materials more. Case studies also revealed that learners with a more social and contextual approach to learning preferred active interaction in the target language rather than memorizing more formal material.

The results of this study are in line with several previous studies that show that language learning that involves hands-on practice, such as conversation and listening, is more effective in improving communication skills. However, in contrast to other studies that only assess the influence of time or type of material separately, this study shows a more complex relationship between time spent and the type of material accessed. Additionally, these findings reinforce evidence that

personalized and contextual learning, which involves more social interaction, can increase student engagement.

Some previous studies have suggested that application-based learning should integrate more practical materials, but this study shows a difference between learners who access materials independently and those who are more involved in social interaction-based learning. This shows that learning applications must be flexible and can adjust to individual preferences to increase learning effectiveness.

The results of this study provide clues about how learning patterns can be affected by diverse learning contexts. Notably, the results showed that learning that took place in a social context or based on active interaction was more supportive of the development of speaking and listening skills. These findings signify that language learning is not only about accessing material passively, but also requires deep interaction and the use of language in real-life situations to maximize the results.

This research also reflects a shift in the way language learning is viewed. Students are more likely to choose apps that allow them to practice the language in a more natural and direct context, which signals a change in learners' needs and expectations for technology-based learning. This shows that learning technology needs to be more adaptive and responsive to user preferences.

The implication of the results of this study is the importance of designing language learning applications that can accommodate various learning styles. The app should not only provide materials based on difficulty levels, but should also provide space for learners to learn actively and socially. Language learning should be designed with interactivity and social engagement factors in mind, which have been shown to increase motivation and success in learning.

In addition, this research provides insights for application developers to further personalize the learning experience by using data collected through learning analytics. By understanding individual learning patterns, applications can offer material recommendations that suit students' abilities and preferences. This opens up opportunities to create a learning environment that is more adaptive and responsive to user needs.

The results of this study can be explained by the fact that learners who have more time to learn languages tend to choose more complex materials, which require more active skills. Additionally, a preference for learning in a social or practical context reflects learners' tendency to seek experiences that are more relevant to their real lives. It is also related to the learning theory of constructivism, which emphasizes the importance of interaction and experience in the learning process.

Another factor influencing these findings is the availability of learning platforms that are increasingly flexible and can be adapted to the needs of students. More interactive and technology-based language learning apps provide opportunities for learners to learn in a more contextual way, which can improve their understanding of the language.

This research opens several avenues that can be further explored in the development of technology-based language learning. In the future, further research can be carried out to test the influence of social and interactive contexts in more depth on language learning. This could involve experimenting with learning platforms that are more focused on task-based learning and collaboration.

Further development can also be directed to the application of machine learning to analyze user data and adjust the learning experience more appropriately. As such, language learning apps can become smarter and more responsive, providing a more personalized and effective learning experience. The integration of learning analytics and learning technology can be an important step to improve the quality of language education in the future.

CONCLUSION

The study found that more effective language learning patterns involve active involvement in social contexts, such as conversation and writing, rather than just passive mastery of the material. The results show that learners with higher abilities tend to access conversation and writing materials more often, while learners with basic skills access more grammar and vocabulary materials. These findings challenge a passive material-focused learning approach, providing an idea that more contextual and interactive language learning can accelerate the development of language skills.

The main contribution of this study is the combination of learning analytics with more dynamic social context-based language learning. This approach paves the way for developing language learning applications that are more adaptive and responsive to user needs. By using learning pattern analysis, this study offers a novel methodology for designing personalized learning experiences, which can improve language learning engagement and effectiveness, both in formal and informal contexts.

The limitation of this study lies in the use of learning applications that only cover certain aspects of language learning, without taking into account external factors such as the social and cultural environment of students. Further research needs to explore more deeply the role of broader social contexts in influencing learning patterns, as well as develop more complex methods involving new technologies such as artificial intelligence (AI) for more accurate and in-depth analysis of user data.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.
Author 2: Conceptualization; Data curation; In-vestigation.

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