# EDUPEDIA: Intelligent Tutoring System on Learning Difficulties

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**Abstract.** This study aims to determine the effectiveness of using the edupedia application based on the intelligent tutoring system in overcoming learning difficulties in students. This type of research is experimental research. The type of research used in this study is qualitative research with a quasi-experimental method with a group pretest design. Researchers measure the level of understanding of edupedia users in solving learning problems faced with treatment control and experiments. The effectiveness of the use of edupedia in overcoming learning difficulties for the experimental group illustrates that the existence of edupedia provides few solutions for students; the EduFace feature makes it easy for students and private teachers to hold meetings only via cellphone or laptop, then complete homework that is easy and understanding provides opportunities for students to improve learning achievement.

**Keywords:** Intelligent Tutoring System · difficulty learning · edupedia

## 1 Introduction

The development of the era of globalization is accompanied by the increasing role of information and communication technology in human life. Technology is one of the primary needs for people in the world who can access it as if the information was only at their fingertips. Technological progress continues to develop following the changing times and times that have entered a new era in life; this kind of life is known as e-life (electronic life), meaning that this life has been influenced by various needs electronically [1].

The relationship between technological developments and education has become the main focus of research topics from disciplines such as educational psychology or computer engineering to develop the required learning system [2]. The role of technology in education is one of the critical problems for students, caused by the process of learning the material and the system itself. One example of the role of technology in education is Artificial Intelligence which was developed into the Intelligent Tutoring System (ITS) [3].

The rapid growth of technology in education is evidenced by computer-based learning, including e-learning, mobile learning, educational games, and educational applications [4]. The development of e-learning has become part of the curriculum of several


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universities and private schools. That is an easy step to convert manual learning into a computer system tailored to student's needs and the results of learning assessments [5].

According to [6], learning is a relatively permanent behavior change resulting from practice or experience and the internal processes that occur within a person. However, the existence of learning difficulties is a natural thing experienced by students, so the role of technology in the field of education is a reason why e-learning has expanded student interest in implementing e-learning, which is suitable for heterogeneous learning processes with a population of students who do not understand the material. [4, 7].

What exactly is a learning disorder in that student? According to The United States Office of Education (USOE) cited by [8], a learning disorder is a disorder in one or more basic psychological processes that include understanding and using teaching or written language. These disorders are better known as learning difficulties that students commonly experience. So learning difficulties are an obstacle to receiving, digesting, and absorbing learning information the teacher provides.

Assessment of student learning outcomes is also essential to the education system. The knowledge possessed by students can be predicted how well these students solve problems in the future [5]. The existence of an assessment system for students is a solution and feedback designed to streamline the level of knowledge in a standardized learning process [9]. According to [10], the assessment system comes from every learning process, where the formative assessment system is based on student feedback in the learning process and the role of students in solving problems.

Creating learning using an adaptive system will not only meet different needs but also differences in the learning characteristics of students (Lo, Chan, & Yeh, 2012; Chrysafiadi). The role of technology may be to support students who not only learn from written knowledge but also process students' understanding without learning difficulties [2, 11, 12]. Student modeling technology is a model to assess students' knowledge levels and diagnose their learning abilities in each [5]. Then the solution from student modeling technology is intelligent tutoring systems (ITS) which aim to be an adaptive and personal.

The development of Artificial Intelligence 2.0 (AI 2.0) and Big Data provides the basis for developing the intelligent tutoring system (ITS) application, which is an application for tutoring in an interface between teachers and students. An intelligent tutoring system (ITS) is a software system with an independent subject selection of knowledge and teaching or learning [13]. Meanwhile, according to [5], the intelligent tutoring system (ITS) is a computer program that models students' psychological state by providing individual interactions to help the learning process according to the subject or skills students possess.

According to [3] which states that the intelligent tutoring system (ITS) is a tool as a complement to developments in the field of education; this is because the student learning process does not only depend on the education or supporting tools used but also in social and personal factors to be considered. The traditional intelligent tutoring system (ITS) model has four components: a domain model, a student model, a learning model, and a learning environment or interface between ITS users [14].

The key to the successful implementation of the intelligent tutoring system (ITS) is the ability to adapt, increase pedagogical activities for students and meet student needs.

The intelligent tutoring system (ITS) tries to identify some characteristics of each student that allow them to conform to the criteria and to find out how they react to some actions in the learning process [14]. Then [13] stated that the Intelligent tutoring system (ITS) is a system for selecting subjects from specific knowledge and pedagogical knowledge and providing individual guidance to students with the interface method.

In this study, researchers have developed an application called "EDUPEDIA" as a service offering that offers several services to make it easier for customers to order private teachers for students with the concept of "Go Smart Through Edupedia". This application can be used for individual learning purposes with private teachers directly or as an interface to overcome the learning process's difficulties. The characteristics of the application developed by the researcher are EduHome, EduFace, and EduDiscuss, which are advantages offered to support students' needs for personal learning. Researchers who have a graduate background in education from one of the private universities, namely PGRI Madiun University, are inspired by the phenomenon of technological development and the need in the field of education to develop an intelligent tutoring system (ITS) into an EDUPEDIA application. This innovation is a form of concern for the world of children's education, which is integrated with technological developments.

Edupedia application is included in the form of e-commerce that offers educational services by connecting students or parents with private teachers. The concept offered is that with just one press, there will be an agreement between the user and the private teacher. Edupedia, is a private teacher service provider application that offers convenience, security, and comfort for users, especially parents of students, in helping solve problems with learning difficulties. The services offered in this application are EduHome, EduFace, and EduGroup, which are advantages offered to support the needs of students for private learning.

## 2 Literature Review

### 2.1 Theory of Uses and Gratifications

*Uses and gratifications* theory says that media users play an active role in choosing and using the media. In other words, media use is an active part of the communication process. The *uses and gratifications* theory assumes that users have choices to satisfy their needs [15]. Several assumptions underlie this theory. These basic assumptions include:

a) An audience is a group of active consumers who consciously use the media in connection with the fulfillment of personal needs and social needs that are converted into certain motives.
b) The selection of media and its content is a reasoned action and has a specific purpose and satisfaction according to the initiative of the audience.
c) All factors that exist in forming active audiences, such as motives, expected gratifications, and gratifications received in principle, can be measured because the audience has adequate self-awareness regarding the use of media, their interests, and motivations so that they can be evidence for researchers.

d) The mass media compete with other sources to meet the audience's needs.

The suitability of the theory used in this study is the uses and gratifications theory, a theory that assumes that users have choices to satisfy their needs. So that this theory follows the concept of the application proposed by the researcher, namely Edupedia. Edupedia is an application that offers several services to make it easier for customers to get private teachers for children with the concept of "Go Smart Through Edupedia." Customers obtain this convenience to obtain private teachers according to their needs and get output in the form of report cards to see the progress of the learning process through the Edupedia application.

### 2.2 Artificial Intelligence

According to [16] which states that there are several studies on Artificial Intelligence that have developed into six separate but related fields consisting of natural languages, robotics, perceptive systems (vision and hearing), genetics programming (also called evolutionary design), expert systems, and neural networks, which are as follows:

a) *Natural Languages*, especially in the computer science departments of universities and vendor laboratories, aim to produce systems that translate ordinary human instructions into a language that computers can understand and execute.
b) *Robotics.* With *robotics*, scientists and engineers build machines to complete physical tasks coordinated humanly. For over two decades, robots have become essential in manufacturing to complete simple but necessary tasks, such as painting and welding. Robots perform tirelessly repetitive tasks, produce high-quality output more consistently than humans, and are not subject to hazards such as paint inhalation or retinal damage.
c) *Perceptive* systems involve creating machines with visual and aural perceptual abilities that influence physical behavior. In other words, this research aims to create robots that can "see" or "hear" and react to what they see or hear.
d) In *Genetic Programming,* a problem is divided into segments, and the solutions to these segments are linked together in various ways to breed new *"child" solutions.*

The last two branches of AI are the most relevant for managerial support. Expert systems are concerned with building systems that incorporate the decision-making logic of human experts. A newer branch of AI is Neural Networks, named after studying how the human nervous system works but uses statistical analysis to recognize patterns from large amounts of information through adaptive learning processes [16].

### 2.3 Intelligent Tutoring Systems

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The key to the successful implementation of the intelligent tutoring system (ITS) is the ability to adapt, increase pedagogical activities for students and meet student needs. The intelligent tutoring system (ITS) tries to identify some characteristics of each student that allow them to conform to the criteria and to find out how they react to some actions in the learning process [14]. Then [13] states that the Intelligent tutoring system (ITS) is a system for selecting subjects from specific knowledge and pedagogical knowledge and providing individual guidance to students with the interface method.

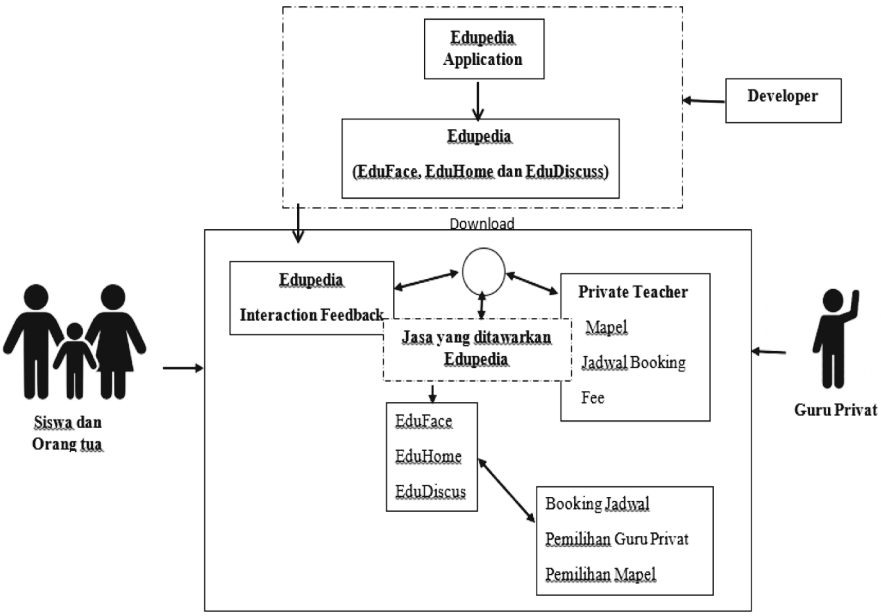
### 2.4 Edupedia

Edupedia is an *e-commerce application* that offers educational services by connecting students or parents with *private teachers*. The concept used in this application is "*Go Smart* through Edupedia," so the researcher proposes two types of systems to build the application concept. The suitability of *uses and gratifications* theory is a theory that assumes that users have choices to satisfy their needs. An application that offers several services makes it easier for *customers* to get *private teachers*. The concept can be described as follows (Fig. 1).

The main customers targeted by application users are students and parents who entrust the quality of student learning to private teachers so that the Edupedia application can simplify the learning process and can monitor the quality of student learning with the report cards that are presented/become part of the application content so that harmony is realized. Goals between private teachers, students, and parents. Edupedia offers private tutor services to facilitate the learning process developed from the intelligent tutoring system (ITS) so that students can understand the learning process according to their needs and improve learning outcomes. The services offered in this application are:

a) ***The Surface*** is a learning system between students and private teachers with an interface through the Edupedia application, so it does not require direct interaction but through the EduFace system. Learning subjects and booking schedules tailored to student needs so students can understand the obstacles to learning before using EduFace.
b) ***EduHome***, is a learning system between students and private teachers directly so that private teachers will come home to provide the learning that students need.
c) ***EduDiscuss*** is a learning system between several students, study groups, and private teachers.

In addition to the points above, this application offers services for students, and parents can assess satisfaction by providing a rating for private teachers. The goal is to create service improvements that refer to technological developments and are directly integrated




Source: processed, 2022

**Fig. 1.** The concept of "Go Smart through Edupedia".

with improving the quality of learning by continuing to develop and strengthen integrated solutions through strengthening connectivity solutions for segments with comprehensive offerings, along with creating products suitable for market segments.

Customer needs are very diverse, ranging from the need to improve the quality of children's learning to the creation of character debriefing related to student learning. The expected target in application development is to create a wide range of Edupedia ranging from SD/MI, SMP/MTs, and SMA/SMK levels. All related parties, especially customers, can feel the benefits. The emergence of the Edupedia application will make it easier for customers to get/choose a private teacher as desired.

The concept offered is that with just one press, there will be an agreement between the user and the *private teacher*. Application Edupedia has advantages, namely (Fig. 2):

*a) One-click call to a private teacher*

Service users who have problems in learning can access the *Edupedia application* with one click; they will be directly connected to the desired educator. The services offered are from EduFace, EduHome, and EduDiscuss, so they are very diverse and tailored to the needs of students.

*b) Educational Design*

The *Edupedia* application is an application designed to solve problems related to education.

c) Edupedia is a trigger application for overcoming learning difficulties with *private teachers.*

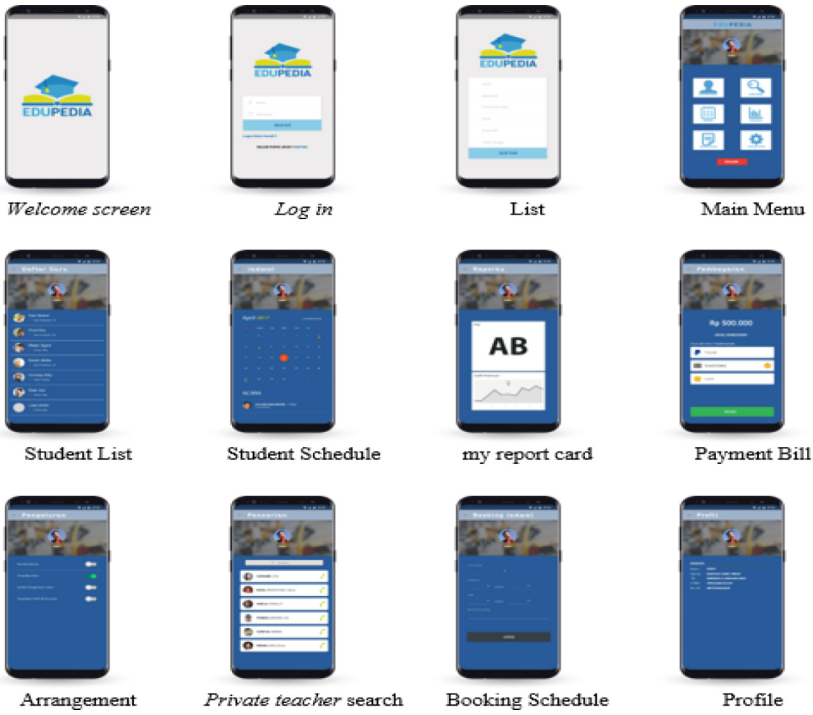



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**Fig. 2.** Student Side Edupedia Application.

d) As a provider of jobs for both students and *fresh graduates.*

From the advantages offered, it is expected that Edupedia can be a solution alternative in dealing with student learning problems, with development potential that is constantly upgraded according to the needs of students. Edupedia's reach is broad, starting from elementary, middle, and high school children. The researcher presents an image of the application that is presented to provide an overview of the services provided, which are as follows:

The picture above reflects some of the conveniences obtained by private teachers, namely being able to arrange teaching schedules according to the desired time and being able to assess student learning outcomes through report cards which will later be reported to parents, so that they can be used as evaluations for all parties, both parents and private teacher.

## 3 Method and Procedures

The purpose of this study is to implement, evaluate, and optimize EDUPEDIA, which is based on the difficulties of the student learning process, so that researchers develop individual e-learning with an intelligent tutoring system (ITS). This type of research

is experimental research. The population in this study were users of the EDUPEDIA application. The type of research used in this study is qualitative research with a quasi-experimental method with a group pretest design. This research technique will use tests and non-tests (instruments using Edupedia features, observations, and interviews). The test used in this study was an oral test and observation following the object under study. In this study, researchers will measure the level of understanding of edupedia users in solving learning problems and whether edupedia can provide alternatives or solutions for users.

The Edupedia application is designed and developed from the intelligent tutoring system (ITS) to provide an adaptive system for each student so that it can improve student learning outcomes. The main research question in this study is how the traditional intelligent tutoring system (ITS) model was developed into the EDUPEDIA application to improve the quality of student learning with an adaptive private tutor ordering process. After the data is obtained and evaluated, Edupedia can be optimized and implemented in full-scale research and used to solve student learning problems.

The project in implementing Edupedia in the population is regulated by the researcher as follows:

a) The Control group, are students who have learning difficulties but are still overcoming problems with independent study (conventional method)
b) The experimental group is students with learning difficulties using Edupedia to solve learning problems using EduFace, EduHome, and EduDiscuss.

Work data for the control and experimental group researchers will be collected to conduct an assessment. This assessment functions on whether the experimental group can improve their learning outcomes after experiencing learning difficulties using the Edupedia application or vice versa and whether the control group is superior to the experimental group in dealing with their learning difficulties.

## 4 Result and Discussion

Table 1 shows the results of descriptive tests from respondents used by researchers to serve as experimental objects. Based on the table, the number of respondents is as many as ten users of the edupedia application. The most significant respondents came from high school with as many as ten respondents, junior high school with as many as eight respondents, and elementary school with as many as two respondents. The following Table 1 is presented.

Before classifying the experimental project, the researcher conducted an initial assessment to see the users' level of learning difficulty. Table 1 shows that there are three levels of education for application users, SD, SMP, and SMA/K, so they have different initial assessment levels. Table 2 shows the percentage of the initial assessment to respondents.

Based on Table 2 shows that the initial assessment for edupedia users aims to find out how the level of student learning difficulties can affect learning achievement. The description of the level of learning difficulties faced by students is very diverse; for example, at the elementary school level,, it shows that the difficulty that is often experienced

**Table 1.** Description of the research sample

| | Frequency | Percent |
|---|---|---|
| The final number of samples | 20 | 100 |
| Education Level | | |
| SD | 2 | 0.10 |
| SMP | 8 | 0.40 |
| SMA/K | 10 | 0.50 |
| User Age | | |
| 7–12 | 2 | 0.10 |
| 13–15 | 8 | 0.40 |
| 16–20 | 10 | 0.50 |
| User Gender | | |
| Woman | 10 | 50.00 |
| Man | 10 | 50.00 |

**Table 2.** Initial Assessment of Learning Difficulty

| | Frequency | Percent |
|---|---|---|
| **Elementary School Level** | 2 | 100 |
| Reading, Writing, and Counting Levels | 1 | 50.00 |
| Level of Understanding and Solving Problems | 2 | 100 |
| **Junior High School Level** | | |
| Subject Understanding Level | 3 | 37.50 |
| Case Solving Level | 1 | 12.50 |
| PR Incompleteness Level | 4 | 50.00 |
| Exam Comprehension Level | 8 | 100 |
| **High/Vocational High School Level** | | |
| Subject Understanding Level | 7 | 70.00 |
| Case Solving Level | 6 | 60.00 |
| PR Incompleteness Level | 8 | 80.00 |
| Exam Comprehension Level | 8 | 80.00 |

is how to understand and solve a problem asked by the teacher or in a book. Then at the junior high school level, the difficulties that are often faced are students preparing to take the midterm or end-of-semester exams and students who do not complete the homework assigned. Furthermore, for the high school/vocational level, the difficulties often

faced are preparing to take the mid-semester or end-semester exams and completing homework.

The results of observations and interviews were conducted by researchers who aimed to treat the control and experimental groups. The results of this treatment will show an overview and analysis of how the level of learning difficulties faced by students can be minimized through the features offered by edupedia, namely EduFace, EduHome, and EduDiscuss. Observations and interviews were conducted by researchers with an in-depth interview model that was not structured, then the results of the interviews were recorded and recorded, which were then analyzed by the researchers. The treatment for the control and experimental groups was given the same questions to see the effectiveness of using edupedia in solving students' learning difficulties. Data analysis introduced by Saunders [17] shows the main processes that can be applied in data analysis to strengthen the interpretation of meaning, namely: summarizing meaning, categorizing (grouping) meaning, and structuring meaning using descriptions [18].

**Levels of Learning Difficulties and Student Learning Achievements**

The existence of learning difficulties is a natural thing experienced by students, so the role of technology in the field of education is a reason why e-learning has expanded student interest in implementing e-learning, which is suitable for heterogeneous learning processes with a population of students who do not understand the material [4, 7]. These disorders are better known as learning difficulties that students commonly experience. So learning difficulties are an obstacle to receiving, digesting, and absorbing learning information the teacher provides. The same thing was conveyed by one of the students in the control and experimental groups:

*"In my opinion, the learning difficulties I experienced were because I could not understand the subjects well, either from the method or learning model."*

*"If I have difficulty studying because there is too much homework, it is not effective for me to understand every subject."*

Creating learning using an adaptive system will not only meet different needs but also differences in the learning characteristics of students (Lo, Chan, & Yeh, 2012; Chrysafiadi). The role of technology may be to support students who not only learn from written knowledge but also process students' understanding without learning difficulties [2, 11, 12]. The relationship between technological developments and education has become the main focus of research topics from disciplines such as educational psychology or computer engineering to develop the required learning system [2]. The same thing was conveyed by one of the students in the control group:

*"Schools should be able to provide an exciting learning process so that we can understand the subjects well so that the results and grades are also good."*

Student modeling technology is a model to assess students' knowledge levels and diagnose their learning abilities in each [5]; then the solution from student modeling technology is intelligent tutoring systems (ITS) which aims to be an adaptive and personal system. The key to the successful implementation of the intelligent tutoring system (ITS) is the ability to adapt, increase pedagogical activities for students and meet student needs.

**Learning Difficulty Levels and Edupedia Features**

Creating learning using an adaptive system will not only meet different needs but also differences in the learning characteristics of students (Lo, Chan, & Yeh, 2012; Chrysafiadi). The role of technology may be to support students who not only learn from written knowledge but also process students' understanding without learning difficulties [2, 11, 12].

Student modeling technology is a model to assess students' knowledge levels and diagnose their learning abilities in each [5], then the solution from student modeling technology is intelligent tutoring systems (ITS) which aims to be an adaptive and personal system. An intelligent tutoring system (ITS) is a software system that has subject selection of knowledge and teaching or learning independently [13].

Edupedia is an e-commerce application that offers educational services by connecting students or parents with private teachers. The concept used in this application is "Go Smart through Edupedia". Edupedia offers private tutor services to facilitate the learning process developed from the intelligent tutoring system (ITS) so that students can understand the learning process according to their needs and improve learning outcomes. Surface, EduHome, and EduDiscuss are offered to provide access to students in dealing with their learning difficulties. The opinion expressed by one of the students in the control and experimental groups that:

*"In general, today's students need something instantaneous, as well as when we were at school, and we found it difficult to understand if it was only explained at school, we needed additional hours or private lessons."*

*"Edupedia, I am new to it and do not know much about competitors, but I hope this application will be developed soon to make it easier for students, especially in the Madiun area, to use the features offered."*

Based on the opinion of one student in the control and experimental groups, it shows that there are different statements that, from the control side, students need access to learning outside school hours to solve learning problems in addition to private lessons or other conventional lessons. While the opinions of students in the experimental group think that edupedia provides quite various features to make it easier for them to solve learning difficulties, it is hoped that the features provided will be commercialized soon. There are three features offered by edupedia, namely the EduFace feature, which offers a learning system between students and private teachers in an interface through the Edupedia application, so it does not require direct interaction but through the EduFace system. EduHome, offers a direct learning system between students and private teachers so that private teachers will directly come home to provide the learning students need. EduDiscuss, offers a learning system between several students or study groups and private tutors directly. The opinion expressed by one of the students in the experimental group that:

*"Interesting, in this application, we can choose the features that suit us so that learning can be enjoyed, not only at school."*

*"So far, this application has made it easier for us to understand subjects other than at school."*

The Edupedia application is designed and developed from the intelligent tutoring system (ITS) to provide an adaptive system for each student so that it can improve student learning outcomes. The Edupedia application can simplify the learning process and monitor the quality of student learning with the report cards that are presented/become part of the application content to realize the alignment of goals between private teachers, students, and parents.

**Edupedia Features Effectiveness and student needs**

The characteristics of the application developed by the researcher are EduHome, EduFace, and EduDiscuss, which are advantages offered to support students' needs for personal learning. The purpose of individual learning with private teachers directly or interface is to overcome the difficulties of the learning process. The key to the successful implementation of the intelligent tutoring system (ITS) is the ability to adapt, increase pedagogical activities for students and meet student needs. An intelligent tutoring system (ITS) tries to identify several characteristics of each student that allow them to conform to the criteria and to find out how they react to some actions in the learning process.

Edupedia application is included in the form of e-commerce that offers educational services by connecting students or parents with private teachers. The concept offered is that with just one press, there will be an agreement between the user and the private teacher. Edupedia, is a private teacher service provider application that offers convenience, security, and comfort for users, especially parents of students, in helping solve problems with learning difficulties. The services offered in this application are EduHome, EduFace, and EduGroup, which are advantages offered to support the needs of students for private learning. The opinion expressed by one of the students in the control and experimental groups that:

*"Usually, we solve learning difficulties by asking for help from other students or just being stupid."*

*" In my opinion, the edupedia feature can overcome some of the learning difficulties that I experienced; moreover, there is an eduface feature; I only need a video call; it has been resolved with Ms. And Mr. Teacher."*

*"Finally, I can finish my homework and understand it easily, so I hope my grades this semester increase."*

The effectiveness of the use of edupedia in overcoming learning difficulties for the experimental group illustrates that the existence of edupedia provides few solutions for students; the EduFace feature makes it easy for students and private teachers to hold meetings only via cellphone or laptop, then complete homework that is easy and understanding provides opportunities for students to improve learning achievement. The relationship between technological developments and education has become the main focus of research topics from disciplines such as educational psychology or computer engineering to develop the required learning system [2]. The development of e-learning has become part of the curriculum of several universities and private schools. That is an easy step to convert manual learning into a computer system tailored to student's needs and the results of learning assessments [5]. Learning difficulties are a natural thing experienced by students, so the role of technology in education is a reason why e-learning has expanded students' interest in implementing e-learning, which is suitable

for heterogeneous learning processes with student populations who do not understand the material [4, 7]. Edupedia can simplify the learning process and monitor the quality of student learning with the report cards that are presented/become part of the application content to realize the alignment of goals between private teachers, students, and parents.

## 5 Conclusion

This study aims to determine the effectiveness of using the edupedia application based on the intelligent tutoring system in overcoming learning difficulties in students. The effectiveness of the use of edupedia in overcoming learning difficulties for the experimental group illustrates that the existence of edupedia provides few solutions for students; the EduFace feature makes it easy for students and private teachers to hold meetings only via cellphone or laptop, then complete homework that is easy and understanding provides opportunities for students to improve learning achievement. Creating learning using an adaptive system will meet not only different needs but also the differences in the learning characteristics of students. The Edupedia application is designed and developed from the intelligent tutoring system (ITS) to provide an adaptive system for each student so that it can improve student learning outcomes. The Edupedia application can simplify the learning process and monitor the quality of student learning with the report cards that are presented/become part of the application content so that the alignment of goals between private teachers, students, and parents is realized. The limitation of this research is that there is no hypothesis test to empirically determine the effect of the edupedia application on students' learning difficulties.

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