

Development of Single Index Methods Software to Support Investment Management Learning

Nurika Restuningdiah

Universitas Negeri Malang, Malang, Indonesia, ✉ nurika.restuningdiah.fe@um.ac.id

Abstract

The portfolio is a collection of financial assets in a unit that is held or created by an investor, investment company, or financial institution. Investors can invest their funds in the form of a portfolio (a collection of financial assets such as stocks, bonds, and mutual funds traded on the exchange). A good portfolio combination will optimize investor returns. The choice of various types of financial assets held in a portfolio greatly influences the optimal portfolio. The purpose of this study is the development of Optimal Portfolio Software to support investment decisions, using the Single Index model so that it useful for investors and innovate learning in Investment Management courses in the classroom. The development process consists of the Analysis Stage, Design Stage and Development Stage. This research has produced Single Index Methods Software, which has been validated by expert judgment.

Keywords: *Single Index Methods Software, Investment Management Learning, Investment Decision Making*

Introduction.

A portfolio is a collection of financial assets in a unit that is held or created by an investor, investment company, or financial institution. Investors can invest their funds in the form of a portfolio (a collection of financial assets such as stocks, bonds, and mutual funds traded on the exchange). Investment in the form of a portfolio is preferable to investing only money in one asset. There is a saying in investment that says, "don't put eggs in the same basket." If an investor only invests in one type of stock (for example, stock A), then if there is a loss (risk) on the stock, the investor will experience a large loss of all funds invested. However, if the investor makes a portfolio, for example, investing funds in shares A and Shares B, then there is a possibility that stock A's price will go down, but stock B has increased (Ali, 2007). Likewise, if there are risk-free assets (government bonds) in the portfolio, the investor does not experience a large loss as well as investors who only invest in one type of stock. Optimal portfolios are portfolios with the best performance or portfolios that provide the highest combined return with the lowest risk results.

A good portfolio combination will optimize investor returns. The choice of various types of financial assets held in a portfolio greatly influences the optimal portfolio. Various methods can be used to determine the optimal portfolio, such as the Markowitz ratio method, the single index method, and so on. The Markowitz ratio method calculates the optimal portfolio by optimizing the angle of the ratio of excess returns and the risk of the standard deviation of the portfolio. The optimal measurement concept used is the best combination of the highest excess return and the smallest risk. The Single Index Model method calculates the optimal portfolio by optimizing the angle of the ratio of excess returns and portfolio risks measured by the single-index model. The optimal measurement concept used is the best combination between the highest return-excess and the smallest risk (Hartono, 2014)

Investors in every decision making always depend on the information they receive. Complete, relevant, accurate, and timely information is needed by investors to make investment decisions regarding the types of financial assets that will be selected in their portfolio, to produce an optimal portfolio. The decision making requires software that can provide accurate information, which can help investors to determine the optimal portfolio with various existing models. Investment decisions related to portfolio selection are discussed in the Investment Management course, but so far in the learning process, students are still given theoretical information, not yet associated with real information on the capital market. This software can also be useful

for the accounting learning process, especially the Investment Management course

In investment management, the most important thing is to identify the best portfolio performance. Theoretically, this can be seen from the optimal portfolio growth (Le and Platen, 2006). The purpose of the portfolio performance assessment is to find out and analyze whether the portfolio formed has been able to increase the likelihood of achieving investment objectives and can be known which portfolio has better performance. The performance of a portfolio must always be monitored to maintain optimal portfolio performance. Changing market conditions, for example, will potentially affect portfolio performance. If portfolio performance is not optimal due to changing market conditions, the portfolio needs to be rebalanced.

Evaluation of portfolio performance is related to two main issues, namely: (1) evaluating whether the portfolio returns that have been formed are able to provide returns exceeding (above) other portfolio returns that are used as benchmarks (benchmarks), and (2) evaluating whether the returns obtained are appropriate with the level of risk borne. (Tandelilin, 2010).

The single index model can be used as an alternative to the Markowitz model to determine efficient sets with simpler calculations. This model is a simplification of the Markowitz model. This model was developed by Markowitz (1963) called the (single-index model), which can be used to calculate expected return and portfolio risk (Hartono, 2014).

The single index model is based on the observation that the price of a security fluctuates in the same direction as the market price index and has the same reaction to a factor or a composite stock price index (CSPI), because returns from a security and returns from a common market index can be written with the formula as follows:

$$R_i = \alpha_i + \beta_i \cdot RM + e_i$$

Description:

R_i = return of securities i

α_i = expectation value of a security return that is independent of market return

$\beta_i \cdot RM$ = Beta which is the coefficient that measures the change in R_i due to changes in RM

RM = return rate of the market index is also a Random variable

e_i = residual error which is a random variable with the expected value equal to zero or $E(e_i) = 0$

Single index model divides the return of security into two components;

- a. The unique return component represents by alpha (α_i), which is independent of the market return.
- b. The return component associated with market return represents by beta (β_i) and RM . So the return expectation form can be written with the equation.

Methods

The development of this software uses the SDLC (System Development Life Cycle) approach. System Development Life Cycles (SDLC) (Martin et al. (1994); Bodnar and Hopwood (1995); Mc Leod (1995)). Mc Leod (1995) grouped SDLC into five phases, namely: planning phase, analysis phase, design phase, implementation phase, and use phase. While the book was written by Martin et al. (1994) divides SDLC into three phases, namely the definition phase (feasibility analysis, requirements definition), construction phase (system design, system building, system testing), and implementation phase (installation, operations, and maintenance).

The development process contains three (3) stages, namely Analysis Stage, Design Stage, and Development Stage, whereas each stage has an output that supports the process of content development of earnings management software, as illustrated in figure 1 below.

The information for each phase is as follows:

1. **The definition phase** defines precisely what the system must do in detail so that computer specialists can build the systems needed. The analysis is made relating to the following levels:
 - a. Feasibility Analysis, in this stage, the definition is as clear as possible about what the system must do, such as what expectation of the outputs, inputs that must be received/entered, what the main database

is needed, and how outputs should be available. Important activities in this feasibility analysis are defining the scope or boundaries precisely, who will be served, what should be done and what should not be done, what data is included, and what data is not included. In this feasibility analysis also carried out an analysis of costs and benefits that will be achieved by the system.

- b. **Requirements definition.** The entire SDLC process depends on defining the needs carried out here, which includes defining what the system will do accurately and completely. With the help of the user-manager, the analyst produces a comprehensive system requirements document, which contains a detailed description of the output of the system and the processes used to convert input data into output. This document also contains an evaluation of the costs and benefits of the new system and is an improvement in planning for further development processes. This document is the core definition phase and approved by the parties concerned. Once approved, these needs are considered permanent and in essence, cannot be changed until the operation and maintenance stages. Thus, managers must feel confident that the requirements document has explained all the system requirements accurately and completely.

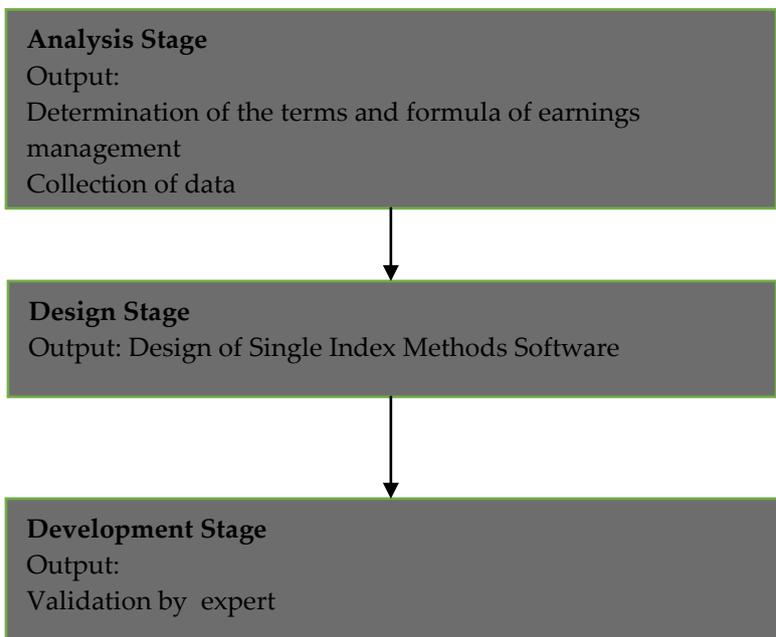


Figure 1. Development of Single Index Methods Software

2. Construction phase, the stages include:

- a. **System Design.** Based on the system requirements document, the Information Systems specialist (SI) designs a system that can satisfy all existing needs. The system design includes decisions about what hardware and software will be used to run the system, planning the contents and structure of the database, the processing modules (system building programs), and how the relationship between one module with another module.
- b. This stage will produce a document that explains in detail how the system will work. This document will be provided to the programmer to create computer code and database for the system, which includes charts describing the structure of the system, detailed descriptions of databases and files, detailed specifications for each program in the system, programming process plans, system testing plans, and plans for system conversion and installation.
- c. **Building and Testing the System.** There are two activities, including building system (building), the

first is creating computer programs, and the second is creating a detailed design of the database and files used by the system. IS specialists usually decide on hardware configuration, system software, database management system (DBMS), and programming languages. The IS specialist examines each module of the system produced and also tests the entire system. Final testing will involve the user to ensure that the system can work correctly in the user environment.

3. Implementation Phase, the stages include:

- a. **Installing the System.** The main activity that is quite important in this stage is data conversion, namely the strategy of moving from the old system to the new system, then no less important is the provision of training for people involved in the new system and motivating them to change the old habits pattern, because if users do not understand how to use the system and reject changes, then the system will fail. At this stage, the training of system operators is conducted.
- b. **Operations and Maintenance.** The last stage of the SDLC is the operational and maintenance stage. Environment and organizational needs can change quickly, new systems may be outdated before installation, so there need to be some modifications to the system. The process of modifying a system so that it can adapt to changing needs in an organization is related to system maintenance. Maintenance of this system will also follow the flow of SDLC, and can also be an improvement from the previous system or can be in the form of making a new system so that the cost of maintaining the system can be greater than the cost of the initial development of the system.

Validation by Experts

This study used primary data by questionnaire to infer the validity of earnings management software. The indicators validated are the suitability of the material and the accuracy of the material. The questionnaire uses a Likert scale of 4. Criteria for each rating scale is score 4 for very clear, 3 for clear, 2 for unclear, and 1 for very unclear. The data analysis used is by calculating the percentage, according to the formula:

$$P = \frac{\sum x}{\sum x_1} \times 100\%$$

Notes:

P= percentage

$\sum x$ = Score of respondents' answer in 1 item

$\sum x_1$ = Maximum score in 1 item

The validation of each item has several criteria, such as valid, valid enough, less valid, and not valid. Table 1 shows the score for each criterion.

Table 1. Validation Criteria

ANSWE R	CRITERIA
80 – 100	Valid
60 – 79	Quite Valid
40 – 59	Need Revision (Less Valid)
0 – 39	Need Revision (Not Valid)

Source: Sudjana (2005)

The questionnaire gave an accounting lecturer as a material expert in the investment management system and a practitioner as a media expert. The questionnaire of earnings management software also includes additional forms of comments, criticisms, and suggestions from the validator related to the software. Feedbacks from the expert be the basis for the revision of the earnings management software.

Results and Discussion

Flowchart of the development of making Android-based banking earning management software

a. Company Data Filling

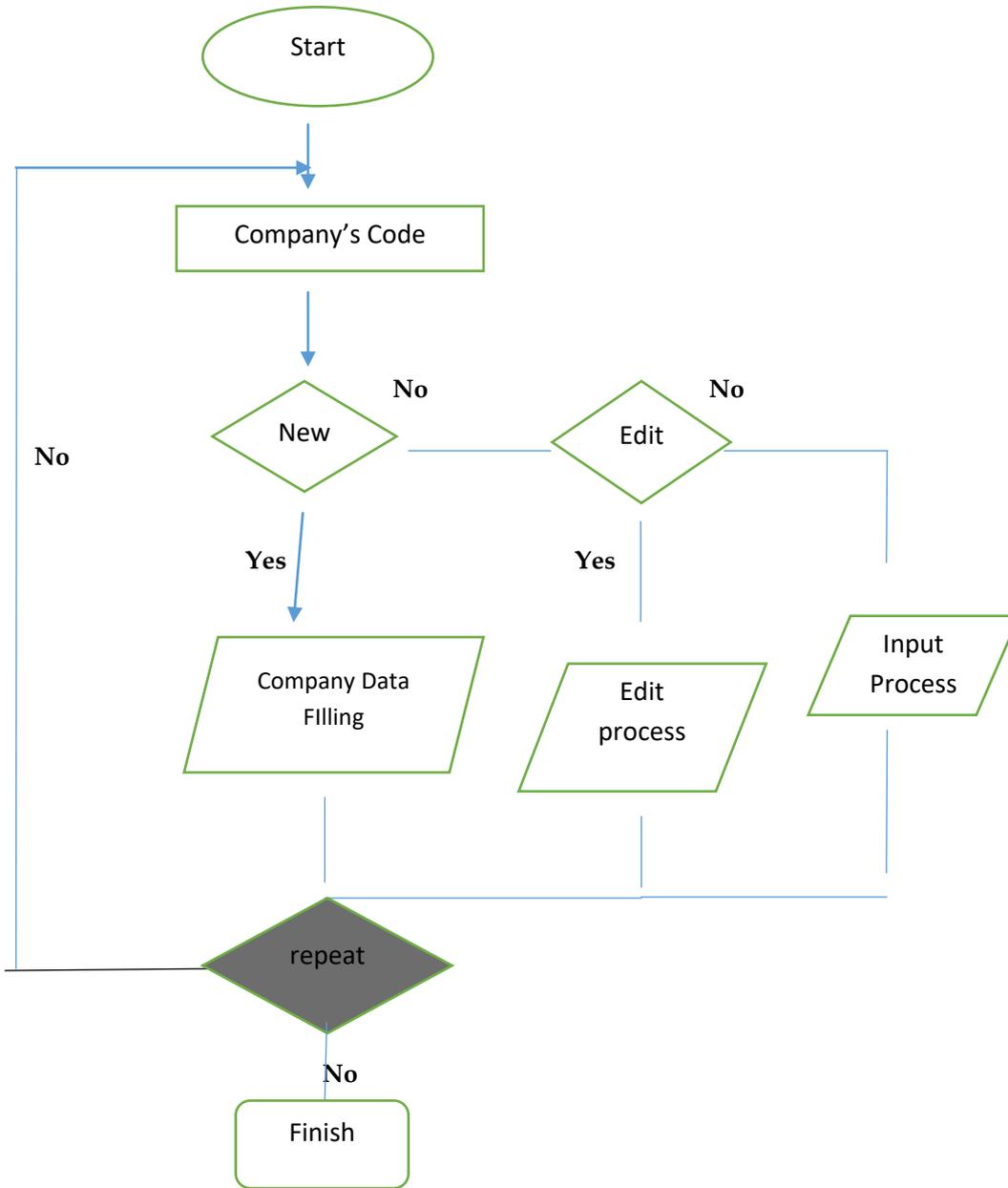


Figure 2. Flow Chart Of Company Data Filling

Flow Chart Of Stock Price Filling

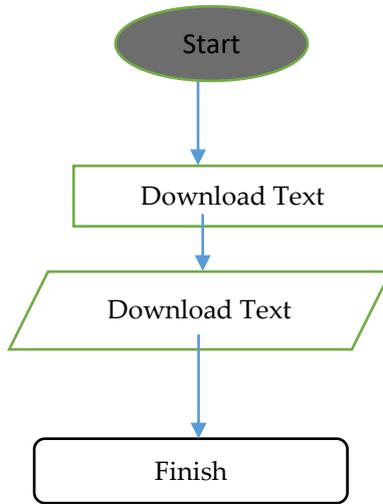


Figure 3. Flow Chart Of Stock Price Filling

Portfolio Calculation

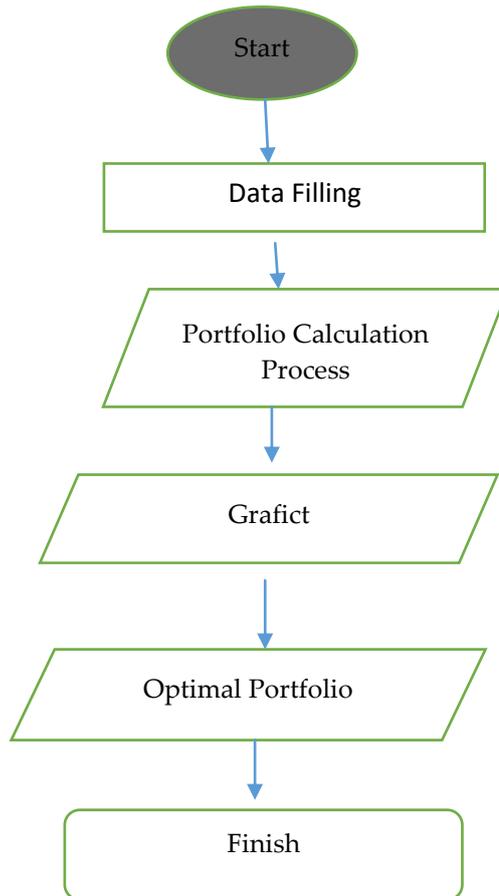


Figure 4. Flow Chart Of Portfolio Calculation

The first step to operate the Single Index Software is the Login of the user.



Figure 5. Login

Figure 6 shows the main menu

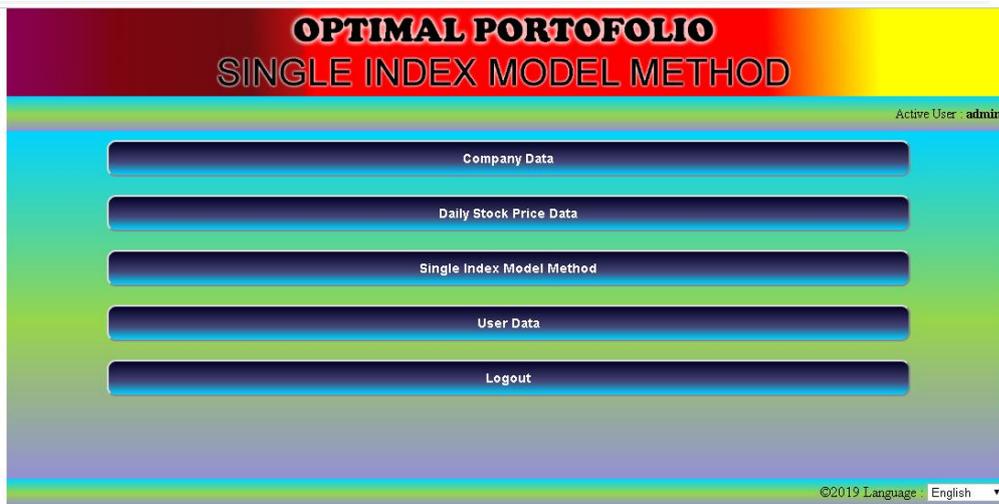


Figure 6. Main Menu

The second step is filling the company data, process daily stock price data, and calculate the Single Index Model to get the optimal portfolio



Figure 7. Data Filling

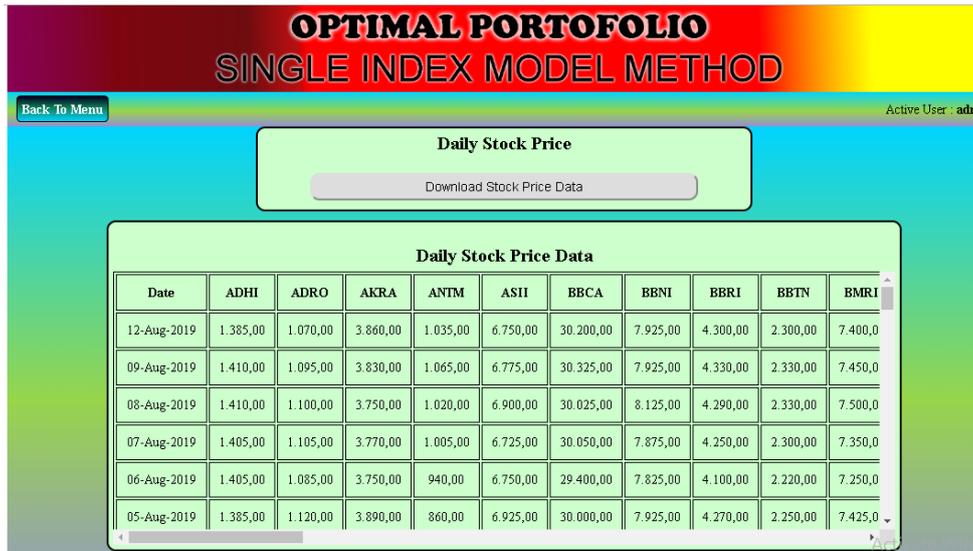


Figure 8 Daily Stock Price Data from Indonesia Stock Exchange

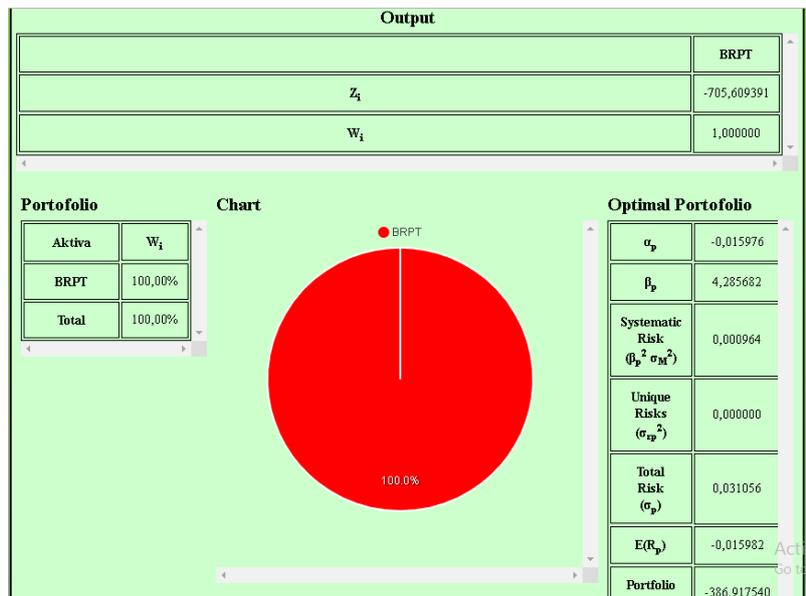


Figure 9 The result of the optimal portfolio using the Single Index Model

Results

Table 2 shows the results of material expert validation. The suitability of the material is 87,5 % (valid), and the accuracy of the material is 100% (valid).

Table 2. Material Expert Validation

Number	Explanation	Score		Percentage (%)	Result
		X	X_i		
1	The Accuracy of the formula	4	4	100	Valid
2	The Accuracy of the optimal portfolio	3	4	75	Valid
Average		3,5	4	87,5	Valid

Based on this validation, Single Index Methods Software was declared valid and did not need revision.

Table 3 shows the results of media expert validation. The technical quality, the key function, and the display quality of Single Index Methods Software software are 87,5% (valid), 100% (valid), and 88% (valid), respectively.

Table 3. Media Expert Validation

Number	Explanation	Score		Percentage (%)	Result
		X	Xi		
1	Technical Quality				
a.	The application is easy to use	4	4	100	Valid
b.	Entry and exit process is easy to use	3	4	75	Valid
	Average	3,5	4	87,5	Valid
2	Key Function				
a.	Key functions are easy to use	4	4	100	Valid
b.	Accuration of key functions	4	4	100	Valid
c.	Speed reaction of key functions	4	4	100	Valid
	Average	4	4	100	Valid
3	Display quality				
a.	Compatibility of color selection	3	4	75	Valid
b.	The effectiveness of the layout screen	4	4	100	Valid
c.	Font size	4	4	100	Valid
d.	Data Completeness	4	4	75	Valid
	Average	3,75	4	88	Valid

Revision of the Software is related entry and exit process and the combability of color selection. The media expert suggested adding a special button for entry and exit and change the color with a brighter color.

Conclusions

The Single Index Methods Software help for Investment Decision Making to Support Investment Management Learning. Students as active learners in student-centered teaching.

Single Index Methods Software is a learning media to simplify the learning process by using the real data of stock price in the Indonesia Stock Exchange. The optimal use of Single Index Methods Software can improve the effectiveness of the learning process. This study produced Single Index Methods Software for the investor and the student who learn investment management... The software was designed to enhance students' ability to self-study and help the investigation management learning process.

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