In-app controls for small business accounting information system: a study of domain understanding

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Abstract

Purpose – The purpose of this paper is to examine the context of cognitive load and the role of in-app controls that serve as visual aids to promote business process understanding and the use of accounting information system (AIS) for small business users.

Design/methodology/approach – In total, 164 participants from small- and medium-sized enterprises were invited to participate in an experiment with between-subjects 2×2 factorial design. Researchers provided two sets of manipulations in the form of in-app control aids, namely Navigation and Guidance. Groups of individuals either received both navigation and guidance, only navigation or only guidance, or no treatment at all. These four different groups were then tested by a range of tasks to measure user understanding on small business domain knowledge and accounting business process provided by the system.

Findings – The findings indicate that although several early indications were visually observed wherein Navigation and Guidance may help reduce individual cognitive load and hence provide potential value for a better understanding of business process, the statistical analysis has not yet been able to substantiate the differences. Despite visually supporting the hypotheses, neither Navigation nor Guidance proved significant on accuracy (scores), efficiency (time) and individual cognitive difficulties. It appears that a systematic training on the accounting process is arguably imperative in order to reduce the extraneous cognitive load due to a relative gap of accounting logic and users' knowledge of their business process. Ultimately, it would promote the germane knowledge where the integration of user's own business process and accounting process can manifest effectively.

Research limitations/implications – Aligned with the findings of the research and its correlation with learning, apparently the learning process is not merely determined not only by the application control features being embedded, but also by the domain knowledge of individuals who interact with the system. Training related to the discussion of the accounting process should be conducted more intensively to minimize the gap between the knowledge upon the problems on individual business process and the mechanism of the accounting process.

Originality/value – This research takes a new approach in examining user acceptance toward an AIS by comparing task performance with and without the assistive devices, to assess how these visual aids may overcome the cognitive load of the individual.

Keywords Cognitive load, Human computer interaction, User acceptance, Business process, Accounting information system, Cognitive multimedia learning theory, Small medium business

Paper type Research paper

Introduction

With the current rapid advances in technological innovation, several new information technology and information system applications have emerged due to the increasing number of the types of modifications needed in different types of business sectors. These information technologies affect social and business life all over the world including Indonesia. All business sectors in the areas of financial institution, trade, healthcare, transportation, education and so forth use information systems to support business processes and activities. Information systems are prominent resource with strategic value

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and it holds a crucial role of competitiveness as well as key competencies in the sustainability of an organization or company (Melville, 2010).

Regardless of its size, small- and medium-sized enterprise (SME) has proven that the sector shows favorable advantages. SMEs in Indonesia have been chosen primarily due to its current prominent role, generally in the economic development of the country (Tambunan, 2011). In light of its crucial role for the country, therefore, SMEs are expected to maintain the stability of its economic performance. By looking at its development in the national economy, the need for useful technology as well as planning tools exists to support the sustainability of these SMEs. With the agility and speed as the main identifier, SMEs shall choose and implement an information system that provides flexibility in recording the transaction data at every business event. In this case, the required accounting information system (AIS) is the one that reflects relevant and quality information for the business sector.

Prior to the implementation, system analysis should be carried out to stipulate prior facts and requirement details of the system as well as to identify potential issues. This system analysis process should be performed to minimize the possibility of system implementation failure that might occur when the system has been put into operation. The incongruity between systems functionality and enterprise's requirements is the most common problem in adopting a system (Wu *et al.*, 2007; Panayiotou *et al.*, 2015). System analyst "capability" to anticipate this incongruity problem would contribute to system acceptability, that is the extent that users understand and ultimately accept the proposed system.

The notion of user acceptance has been receiving extensive scrutiny in information system area. Current studies have discussed the use of an information system from the perspective of the user perception, for example, with the use of the TAM model (Ghobakhloo *et al.*, 2013; Hong *et al.*, 2015; Nah and Tan, 2015; Park and Kim, 2012; Barhoumi, 2016; Oktal *et al.*, 2016) and the use of unified theory of acceptance and use of technology (Hong *et al.*, 2015; Bandyopadhyay and Barnes, 2012; Wang and Wang, 2010) to observe the two main variables of perceived usefulness and perceived ease of use. Despite many efforts that have been employed from perception viewpoint, it appears that there is little research known that has built the work on behavioral lense. Looking how users understand system cognitive wise would arguably enrich the current comprehension of user acceptance toward a system use.

The current research attempts to examine through a cognitive lens, user acceptance toward the effort to promote understanding of users when interfacing AISs that have been designed and developed by the researchers. The research engaged two instruments that may be used by the participants in assisting their task, i.e., Navigation and Guidance. In the implementation of this research, the participants were faced with four different treatments randomly. In addition to Navigation and Guidance, other factors that are allegedly more influential in the interaction between the AIS and SMEs are the level of their understanding toward the accounting process and the role of AIS products in recording the events in the company's business processes. This means that there is a considerable possibility, despite the fact that Navigation and Guidance may visually assist in overcoming the cognitive load of the user, their existing domain knowledge tends to play a more dominant role in the success or the failure on solving business process problems.

The purpose of this study is to fill this important gap in the literature by identifying and examining the context of cognitive load and the role of visual aids to promote user understanding. This research has contributed on creating an open source-based AIS design which may be used by the SMEs for their business processes and accounting reports. Experiment on user acceptance of this AIS was carried out by examining the context of cognitive load and the role of visual aids to promote users' understanding upon the system.

The remainder of the paper is organized as follows. The next section describes literature review and develops the hypotheses. The third section explains the research design, including respondents and experimental procedure. Results and discussions are presented in the fourth section.

Literature review

Small- and medium-sized enterprises

SMEs in Indonesia consist of numerous, diverse business sectors in which these enterprises greatly impact the amount of revenue of the country. Several types of SMEs are source of foreign exchange; in other words, SMEs have become an investment for the country. Furthermore, SMEs are capable of reducing unemployment in the society, therewith increasing the level of public welfare. SMEs that have been established have been able to employ millions of workers who were previously unemployed, indicated with 96.2 percent of the total workforce is employed in the SME sector (Tambunan, 2011).

Several studies have discussed the importance of AISs for SMEs in order to remain competitive and fulfill the needs of their consumers, for instance, some of them suggested that AISs significantly affect the accounting performance of SMEs (Fagbemi and Olaoye, 2016) and that the presence of AIS has a highly important role in the sustainability of the company (Harash, 2017).

System analysis and design

System analysis and design merely focused on the process of how an information system is developed (Rob, 2015). Ramakrishnan (2012) defined system analysis and design as a methodology to develop a high-quality information system which combines information technology, people and data to fulfill business requirements. System analysis and design associated with relevant development strategies may assist professionals in improving information systems.

Prior to the implementation, system analysis process should be carried out to identify potential issues as well as to stipulate facts and details of the system. This system analysis process should be performed to minimize the possibility of system implementation failure that might occur when the system go live. The incongruity between systems functionality and enterprise's requirements is the most common problem in adopting a system (Wu *et al.*, 2007; Panayiotou *et al.*, 2015).

System development is associated with the other two system components, namely system analysis and system design. By carrying out a system analysis, a person may gain an understanding about the details of the existing system, from here that certain individual may decide whether the system is appropriate or requires improvement. System analysis is essentially a process of identifying problems, and by the identification process a person may obtain several information that may be used to provide recommendations for improvements to the system. System design, on the other hand, is a planning process toward information system, which aims to replace or complete the existing system.

AIS, one important type of information system, plays a fundamental role in supporting the company's ability to resist rivalry and dominate the competition. AIS serves as the driving force of the organization through the provision of relevant information.

Human computer interaction

An exceptionally rapid growth of computing has made the effectiveness of human computer interaction (HCI) serves as an immensely crucial matter. HCI focuses on the interaction between humans and computer systems, including the process of user interface and the basic processes that generate the interaction.

HCI is a discipline that examines the communication or interaction between users and the system. The goal of HCI is to ensure the function and usefulness of the system, to provide effective user interaction support and enhance a pleasant user experience (Carey *et al.*, 2004; Or-Bach, 2015).

Upon the HCI examined in this research, thus the study sought to review the user acceptability of the AIS tested. User's acceptance is one of the most applied measures to evaluate IS/IT adoption success (Ghobakhloo *et al.*, 2013; Goel and Gupta, 2014). User acceptance testing (UAT) is a process used to verify a solution work for the user. UAT is performed not to ensure that a software does not crash and meets requirements but its function is to ensure that the solution given by a system is beneficial for users. The purpose of UAT is to collect several inputs from actual system users, those who have experience in the business processes and will be using the system to complete the related tasks (Sualim *et al.*, 2016).

Cognitive load theory

Information has different impacts on the working memory load. Cognitive load theory (CLT) recognizes three sorts of cognitive load that occurs in working memory during the individual learning process. The intrinsic cognitive load is defined as the working memory load affected by certain complexity of the task given, the extraneous cognitive load is defined by the technique in which the tasks are presented (learning instruction), whereas germane cognitive load is defined by the quantity of load that a person devoted to pertinent learning behavior (Korbach *et al.*, 2019).

Intrinsic cognitive load pointed the multifaceted nature of the information that is being gained without knowing how the knowledge is obtained (Sweller, 2011). Extraneous cognitive load denotes a specific condition when certain information inflicts strenuous cognitive load due to the manner in which it is introduced, in this manner this cognitive load might be reduced by changing the instructional procedure (Sweller, 2011). Germane cognitive load, on the other hand, varies from the intrinsic and extraneous cognitive load. Germane cognitive load denotes the working memory resources utilized by a person when dealing with intrinsic cognitive load when they face certain information (Sweller, 2010).

This research is not imposing its focus on the intrinsic cognitive load due to its nature in the form of inherency. Intrinsic cognitive load is the inherent level of difficulty related to particular instructional point and this may not be modified by any instructional material. Intrinsic cognitive load is determined by the element interactivity – i.e., certain complexity of the task given and ability of the individual (Korbach *et al.*, 2019). When a person encountered certain information and this information is then processed with a certain level of expertise, the intrinsic cognitive load possessed by the individual is fixed and changeless in nature. This is one of the crucial feature of intrinsic cognitive load (Sweller, 2011). The research, on the other hand, attempts to focus on extraneous and germane cognitive load, since these two forms of cognitive load may be altered by instructional interventions. Extraneous cognitive load is initiated by how information is displayed to an individual and is under the control of instructional designer, consequently this load may be attributed to the design of the instruction material. Due to limited cognitive resources to process the extraneous load, the amount of resources accessible to process the intrinsic load and germane load is decreased. To conclude, while the intrinsic cognitive load is generally thought to be definitive, instructional designers may control the extraneous and germane load. It is recommended that they limit extraneous load and enhance germane load.

CLT is essentially related to the procedures used to reduce extraneous cognitive load (Sweller, 2010). This theory has been used to yield a huge number of instructional procedures designed to modify cognitive load (Sweller, 2011).

Cognitive multimedia learning theory

When an individual is faced with certain information, they may attempt to understand the information obtained. Cognitive theory of multimedia learning(CTML) has concentrated on the idea that individual endeavor to make relevant connections between the words and pictures accessible in the information obtained, and that they take in more profoundly than when they merely encounter the information by words or picture only (Mayer, 2009). CTML outlines particular standards for researchers, instructors and instructional designers that are intended to enhance learning with the use of multimedia (Schrader and Rapp, 2016).

It can be seen from Figure 1 that multimedia information is assumed to enter through the eyes and ears and register in the sensory memory. Individuals may notice these momentary information in the sensory memory (referred to as cognitive process of selecting), then it is transferred to the working memory. Within the working memory, an individual may organize the incoming information into another form of representation (sound into verbal model and images into pictorial model). This phase is referred to as the cognitive process of organizing. Lastly, an individual may integrate the pictorial and verbal models with each other along with relevant knowledge from long-term memory (which is called the cognitive process of integrating) (Mayer and Estrella, 2014).

Hypotheses development

Germane cognitive load is highly enforced at the point when the intrinsic cognitive load is high and extraneous cognitive load is low. This occurs in light of the fact that individual must devote a huge extent of working memory resources to manage the essential learning materials. In the event where the extraneous cognitive load is increased and the germane cognitive load is decreased, in this way learning is reduced due to the fact that the individual utilize working memory resources to deal with the extraneous components inflicted by the poorly designed instructional material as opposed to the basic, intrinsic material. Hence, the germane cognitive load is merely a component of the working memory resources devoted to the interfacing components that determine intrinsic cognitive load. Therefore, when more working memory resources used to consume extraneous cognitive load, there may be less resources available to manage the intrinsic cognitive load, hence inhibiting learning produced by the germane load (Sweller, 2010).

Instruction is intended to enhance usable knowledge held in long-term memory through the information store principle. This information enables the working memory to work at a high state as indicated by the environmental sorting out and connecting guidelines, which at that point allows individuals to engage in activities that would generally be tough or impractical (Sweller, 2011).

Among the endeavor to promote germane and reversibly reduce extraneous load is by considering in-app controls. In-app controls are those features considered to have visually favorable functions to be installed in targeted system design, such that users can better

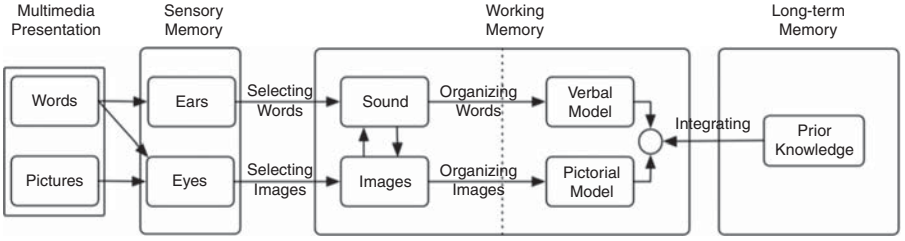

Figure 1.
Cognitive theory of multimedia learning

Source: Mayer (2009)

understand and effectively transfer the working memory used from user cognitive processing into the long-term memory so new knowledge is created. The experiment held in this research involved two in-app controls, one of which is the Navigation. Navigation is presented in the form of diagram that resembles a button which shows the stage of case completion (see Figure 2). The button will turn green when the participant has completed the case given. Navigation is intended to facilitate participants in answering the questions given, thus this will have an impact on higher score acquisition:

H1. Participants who worked on the cases with the help of Navigation signify better task performance than the performance of participants who did not receive Navigation.

This hypothesis is then operationalized in three specific hypotheses:

H1a. Participants provided with Navigation generate higher scores than the participants who are not provided with Navigation.

H1b. Participants provided with Navigation perform more efficiently than the participants who are not provided with Navigation.

H1c. Participants provided with Navigation experience fewer cognitive difficulties than participants who are not provided with Navigation.

Within the CLT described earlier, it has been stated that extraneous cognitive load is a load caused by instructional material. In this regard, efficiency may also be affected by the efforts caused by the design of instructional materials. When an individual emits less effort and achieves a relatively higher task performance by following the instructions provided to them, it can be said that the instructional material has been well designed and is efficient (Hoffman and Schraw, 2010).

Instruction was rigorously coordinated to establish and extend prior knowledge and skills (Torgesen *et al.*, 2010), which certainly may have an impact on the individual's cognitive load. Aligned with this statement is the statement by Sweller (2010), stating that instructional material may impose cognitive load on the individual and this cognitive load may be caused by the element interactivity related to either intrinsic or extraneous cognitive load.

Another feature used in the research experiment is Guidance. Guidance is an in-app control feature presented in the form of words, listed at each stage of the task solved by the individuals. The use of Guidance is expected to facilitate participants in answering the questions, considering that Guidance as an instructional material may put out less effort

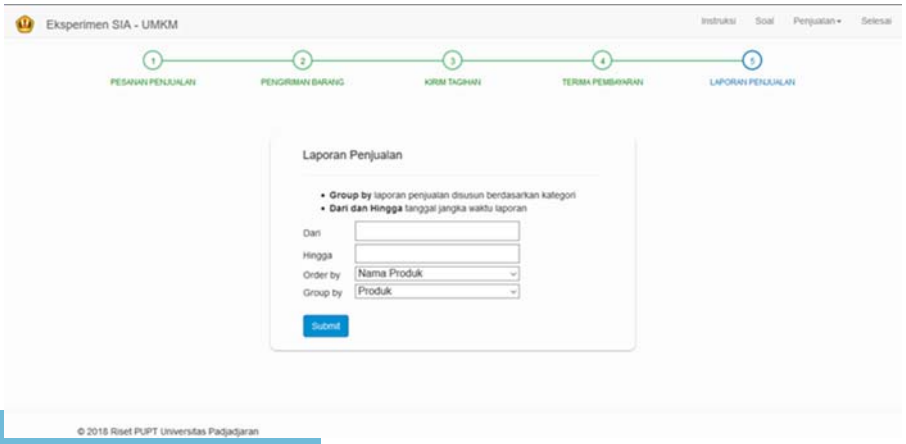

Figure 2.
In-app control – navigation

and higher task performance (Hoffman and Schraw, 2010), thus this will have an impact on higher score acquisition.

Consistent to the one stated in discussing instructional material in the form of Navigation, it is assumed here that materials which are optimally designed and tend to be more efficient may require the individual to emit less effort and achieve relatively higher task performance (Hoffman and Schraw, 2010).

Likewise the Navigation, assistance in the form of Guidance given to the individual may impact on the reduced amount of cognitive load perceived by the individual while working on their task:

H2. Participants who worked on the cases with the help of Guidance signify better task performance than the performance of participants who did not receive Guidance.

This hypothesis is then operationalized in three specific hypotheses:

H2a. Participants provided with Guidance generate higher scores than the participants who are not provided with Guidance.

H2b. Participants provided with Guidance perform more efficiently than the participants who are not provided with Guidance.

H2c. Participants provided with Guidance experience fewer cognitive difficulties than participants who are not provided with Guidance.

Instructional material may cause a load in the form of extraneous cognitive load which is used to present the content, whereas germane cognitive load refers to the load imposed by learning processes (Jong, 2010). Consistent with the prior discussion above, it is assumed here that instruction (in this case, Navigation and Guidance) that tends to be more efficient may require the individual to emit less effort and achieve relatively higher task performance (Hoffman and Schraw, 2010).

Here, with the theoretical foundation that we have discussed in the previous sections, we assume that when individuals are provided with both tools in solving the tasks, namely Navigation and Guidance, the individual may obtain higher score:

H3. Participants who worked on the cases with the help of Navigation and Guidance signify better task performance than the performance of participants who did not receive Navigation and Guidance.

This hypothesis is then operationalized in three specific hypotheses:

H3a. Participants provided with Navigation and Guidance generate higher scores than the participants who are not provided with Navigation and Guidance.

H3b. Participants provided with Navigation and Guidance perform more efficiently than the participants who are not provided with Navigation and Guidance.

H3c. Participants provided with Navigation and Guidance experience fewer cognitive difficulties than participants who are not provided with Navigation and Guidance.

Research design

Participants

Participants from Indonesia SMEs were invited to participate in a between-subjects 2×2 factorial design. The invitation has been sent to each participant through e-mail in order to participate in the research experiment. To persuade and obtain optimum participation, prize conferment was prepared in the form of phone credit for those participants who had completed the entire questions in accordance with the instructions.

In the implementation of this experiment, initially invitations were distributed to a number of SMEs through e-mail, so that respondents may directly perform the experiment in a distant state (online) through the web address given in the e-mail. However, due to the consideration of inadequate numbers of respondents, a workshop was held to discuss the need of AISs in the sector of SME, with the aim of attracting more participants. Prior to the core discussion of the workshop, participants were requested to complete their tasks, namely the experiments. At the time when the participants have completed their task, the workshop continued with the presentation of the AIS in the SME sector and a brief discussion on the use of the AIS that the participants previously used in this research experiment.

Overall, 203 participants from various SME sectors have been obtained. Their average age is 28.45 and 51 percent of them are male. Of these 203 participants, 108 individuals have obtained their bachelor degrees. Most participants engaged in the experiment have been running their businesses in the food and beverage sector (32 percent), followed by other service businesses (23 percent) and the fashion business sector (20 percent). The majority of the participants obtained an annual income of less than IDR50,000,000 and the majority of these businesses owned less than ten employees. Several individuals claimed that they have utilized several types of AISs, including Accurate software to as many as eight participants, MYOB and SAP by six participants, respectively, and seven others claimed to have used other types of AISs.

Procedure

To answer the need for system acceptance evaluation, this research used an experimental method to measure the ability and understanding of users in using the AIS that has been developed.

Each participant is given the opportunity to complete their tasks. There were three parts of cases that contain questions related to the experiments carried out. The first part was the demographic data of participants, which consisted of ten questions. The demographic data requested from the participants were data on gender, age, recent education, business field, the amount of annual income and experience in using AISs.

The second part of the case received by the participants was questions related to the accounting treatment in the case of purchase and sales. The question consisted of one question on sales module and one question on purchase module. Research experiment was virtually emphasized at this point, in which the participants were confronted with the research treatment. There are two factors or two different treatments carried out by the participants to assess the acceptance toward the system, namely the use of Navigation and Guidance. Thus, there are four possibilities that may be faced by the participants in conducting the research experiments, namely with Navigation and with Guidance, with Navigation and without Guidance, without Navigation and with Guidance, and without Navigation and without Guidance (as shown in Table I). This experimental research attempted to ensure that randomization runs effectively; therefore, the placement of the subjects in the experimental group or control group is conducted randomly (automated by the system) without considering any factors related to the subject.

Navigation is an assistive device found in the AIS that has been developed, which can be used to guide participants to solve the case from the first submodule to the final submodule. Navigation in the system is represented visually in the form of picture,

Table I. Research treatments

	With Guidance (WAS)	Without Guidance (NAS)
With Navigation (WNV)	WAS WNV	NAS WNV
Without Navigation (NNV)	WAS NNV	NAS NNV

indicating the participants the order of submodules to be solved. Navigation is indicated by the number knob and the name of the submodule below it, accompanied by a line that indicates what submodules should be solved by the participant. Whereas Guidance is an assistance device represented visually in words, indicating the participants every blank field to be completed by the participants.

The last part of this experiment contained several questions about the level of difficulties perceived by the participants in using the AIS developed. The questions presented to participants were related to the level of users' ease of use and understanding on using the AIS.

Scoring mechanism

In this research, scoring is focused merely on the second part of the experimental procedure, namely the questions related to accounting treatment in terms of purchase and sales.

In the module of sales, participants were requested to work on six questions related to the function contained in the sales module. Table II shows the functions and scoring mechanisms of the sales module.

Similar to the sales module, participants were requested to work on six questions related to the function contained in the purchase module. Table III shows the functions and scoring mechanisms of the purchase module.

Result and discussion

This section presents the results of the statistical analysis. Descriptive statistics are provided in the first part and then the result of ANOVA analysis.

Prior to the discussion of the result, we provide an index containing the definition of the variables discussed. The description of each variable is described in Table IV.

Descriptive statistics

On the overall data with the amount of 203 data, there are several data which are identified as outliers. These data are then excluded from the data processing process. After the outliers

Function	Activity	Score
Product order	Delete an order	1
	Select customer name	1
	Select the date	1
	Select the term	1
	Select the name of the product	1
	Input the quantity ordered	1
Product delivery	Input the receipt number	1
	Select order ID	1
	Select the date	1
	Input the amount of delivery cost	1
	Input the amount of product sent	1
Invoice	Insert receipt number	1
	Select data from receipt number	1
	Input the date of the receipt	1
Payment	Select the payment date	1
	Input the receipt number paid	1
	Input the amount of money to be paid	1
	Select the payment method	1
Report	Select report arrangement	1
	Select the period of the report	1
Total score		20

Table II. Scoring mechanism – sales module

Function	Activity	Score
Product order	Delete an order	1
	Select the supplier	1
	Select the date	1
	Select the term	1
	Select the name of the product	1
	Input the amount ordered	1
Product receipt	Input the receipt number	1
	Select order ID	1
	Select the date	1
	Input the amount of delivery cost	1
	Input the amount of product received	1
Invoice	Input the receipt number	1
	Select data from the receipt number	1
	Select the date	1
Payment	Select the date of payment	1
	Input the receipt number to be paid	1
	Input the amount of money to be paid	1
	Select the payment method	1
Report	Select report arrangement	1
	Select the period of the report	1
Total score		20

Table III.
Scoring mechanism – purchase module

NAV	Navigation, an assistance in the form of an overview of the stages in a cycle
IAS	Guidance, an assistance in the form of text that contains an explanation of the functions that exist in the accounting information system
TMF	Time-first, time spent by the participants to work on the first case
TMS	Time-second, time spent by the participants to work on the second case
SCF	Score-first, score obtained by the participants for the results of the first case received
SCS	Score-second, score obtained by participants for the results of the second case received
SQE	Sequence, the sequence of cases received by participants in solving the case on the experiment
TSC	Total score, the number of scores obtained from both cases
TTM	Total time, the length of time spent by the participants on solving both cases
COG	Cognitive difficulties, the level of difficulty experienced by participants during the experimental stages

Table IV.
Explanation of variables (abb.)

were taken out, the usable data used in this research are amounted to 164 data. In this section, descriptive statistics present the information of each personal information according to the grouping of the four treatments (i.e. WNV, NNV, WAS and NAS).

Table V shows the demographic data of the participant. Of the overall participants, more than half of them are female (56 percent). The mean of the age is 28.27. In terms of the recent education, the majority of participants have obtained their bachelor degrees. Furthermore, in the entire cohort (i.e. WNV WAS, NNV WAS, WNV NAS and NAS NNV), most participants have been running their businesses in the food and beverage sector. The majority of the participants obtained an annual income of less than IDR50,000,000 and the majority of these businesses owned less than ten employees. Several individuals claimed that they have utilized several types of AISs, such as MYOB, Accurate, SAP, etc.

Manipulation check

To avoid the occurrence of similarities between the characteristics of the groups from the same treatment, we have conducted the Comparison of Characteristic variable test. This test is intended to determine the maximum difference from each experimental group.

	Research treatments			
	WNV WAS	NNV WAS	WNV NAS	NAS NNV
Gender				
Female [Male]	29 [15]	27 [17]	19 [21]	17 [19]
AGE – mean [SD]	28.91 [8.47]	28.39 [7.02]	27.33 [5.64]	28.44 [7.05]
Education				
Senior high	6	4	5	4
Undergraduate	24	22	25	16
Diploma	5	5	3	7
Post graduate	9	13	7	9
Business field				
Convection	2	0	2	2
Technology	1	1	4	0
Fashion	10	9	7	5
Food and beverage	14	14	10	14
Other sectors	17	20	17	15
Annual income				
Lower than IDR50m	30	27	25	24
Between IDR50–300m	11	11	11	11
Between IDR300m to 1bn	3	3	0	0
Higher than IDR1bn	0	3	4	1
Amount of employee				
Less than 10 people	41	33	32	34
10–30 people	3	10	6	2
More than 30 people	0	1	2	0

Table V.
Demographic statistics of the participants

Based on Table VI, the results of the manipulation test indicated that there was no significant difference from each experimental group, except for the groups with the use of Navigation toward the efficiency (time) variable. It can be said that participants who do not obtain Navigation may spend more time than participants who obtain Navigation; therefore, they may perceive higher ease of use in solving the problem in one of the cases.

	WNV ($n = 84$)	NNV ($n = 80$)	Sig. *t*-test	WAS ($n = 88$)	NAS ($n = 76$)	Sig. *t*-Test
SCF 1	17.37	17.11	0.377	17.35	17.12	0.422
TMF 1	819.1	892.23	0.343	832.81	880.2	0.540
SCF 2	17.39	16.89	0.086	17.22	17.07	0.612
TMF 2	829.32	1,028.58	0.012	990.99	851.97	0.083
Perceived ease of use toward the menu of accounting information system	5.24	5.09	0.498	5.09	5.25	0.475
Perceived confidence that the use of accounting information system may facilitate transaction management	5.79	5.76	0.905	5.7	5.86	0.438
Perceived difficulties in understanding the accounting information system application and the questions given	4.52	4.25	0.326	4.36	4.42	0.837
Perceived ease of use on the method to solve the question regarding accounting transactions	5.54	5.3	0.254	5.41	5.43	0.904
Perceived difficulties in the process of recording transactions in the accounting information system	3.57	3.68	0.701	3.62	3.62	0.981

Table VI.
Manipulation checks between treatments

Table VII presents the descriptive statistics upon the accuracy of the answers to the questions given to the participants, captured by the correct number of answers in sales module and purchase module, respectively. In general, participants score higher when dealing with the cases in sales module.

Table VIII presents the descriptive statistics upon the efficiency of solving the answers to the questions given to the participants, captured by the time spent (in seconds) on solving the answers in sales module and purchase module, respectively. In general, participants solve the sales module faster than the question related to the purchase module.

Treatments	Task *M* (SD) [*n*] Sales	Purchase
WNV NAS	17.35 (1.6416) [40]	17.26 (1.6639) [40]
NNV NAS	16.86 (2.2823) [36]	16.83 (2.1712) [36]
WNV WAS	17.39 (1.7681) [44]	17.5 (1.6636) [44]
NNV WAS	17.32 (1.7491) [44]	16.93 (2.0162) [44]
Total	17.24 (1.8539) [164]	17.15 (1.8839) [164]

Table VII.
Descriptive statistic of accuracy in both cases (score wise)

Treatments	Task *M* (SD) [*n*] Sales	Purchase
WNV NAS	810.66 512.9573 [40]	765.93 388.718 [40]
NNV NAS	957.44 488.7565 [36]	947.36 528.5564 [36]
WNV WAS	826.75 476.9213 [44]	886.95 549.1594 [44]
NNV WAS	838.86 493.8042 [44]	1,095.02 524.9763 [44]
Total	854.77 491.595 [164]	926.52 512.7515 [164]

Table VIII.
Descriptive statistic of efficiency (time wise)

Analysis of the learning effect aims to ensure and prevent the effect on the sequence of questions presented toward the results obtained by the participants as a form of experience that potentially interfere the actual conclusions. To anticipate the existence of a learning effect, researchers randomly distributed a sequence of questions for each participant. Each participant was given the opportunity to pass two different sequences of questions. Participants who obtained the first order may first work on the sales case, then proceed to the purchase case, whereas participants who obtained the second order may first work on the purchase case, then proceed to the sales case.

Based on the data from Table IX, it can be seen in general that within the aspects of accuracy and cognitive difficulties, the order of there is no significant difference on the sequence of the case given. On the other hand, there are relatively different conditions that occur in the aspect of efficiency in the execution of the task. The value of time that reflects the efficiency of both sales case and purchase case indicates significant differences. The order given to participants did not truly affect the length of time spent by the participants (Figure 3).

ANOVA analysis

Before conducting the ANOVA analysis, we checked the normality assumption to ensure that the entire data are normally distributed at each condition. The normality test that has been conducted on the three variables in the research (i.e. accuracy (sig. = 0.000), efficiency (sig. = 0.033) and cognitive difficulties (sig. = 0.018)) indicates that the numbers are less than 0.05; therefore, it can be concluded that the data are not normally distributed. Regardless, this has no effect considering that ANOVA is robust to departure from normality (Stevens, 2009).

Furthermore, we also conducted the homogeneity assumption prior to the ANOVA analysis. Analysis of the homogeneity assumption indicates total score (sig. = 0.661), efficiency (sig. = 0.690) and the level of cognitive difficulties (sig. = 0.699), with and without the assistance from Navigation has the similar variance (or in other words homogeneous) because sig. > 0.05. Moreover, for the results of total score (sig. = 0.171) and the level of cognitive difficulties (sig. = 0.467), with and without the assistance from Guidance has dissimilar variance (or in other words, not homogeneous) because the value of sig. < 0.05. However, total time data along with the presence and the absence of Guidance have the similar variant (homogeneous) because the sig. > 0.05.

H1

Navigation, one of the tools found in the AIS that have been developed may be used to guide the participants in solving their task. With Navigation, participants are predicted to obtain higher score than participants who are not provided with Navigation because participants who obtained Navigation were more directed than those who did not receive Navigation. In addition, with the presence of Navigation, participants may complete their task faster

	Case order		
	Sales first ($n = 76$)	Purchase first ($n = 88$)	Sig. (t-Test)
Sales – accuracy	17.17	17.31	0.641
Sales – efficiency	1,146.99	602.40	*0.000*
Cog. difficulties	4.92	4.84	0.523
Purchase – accuracy	17.22	17.08	0.627
Purchase – efficiency	674.57	1,144.11	*0.000*

Table IX. Learning effect between variables

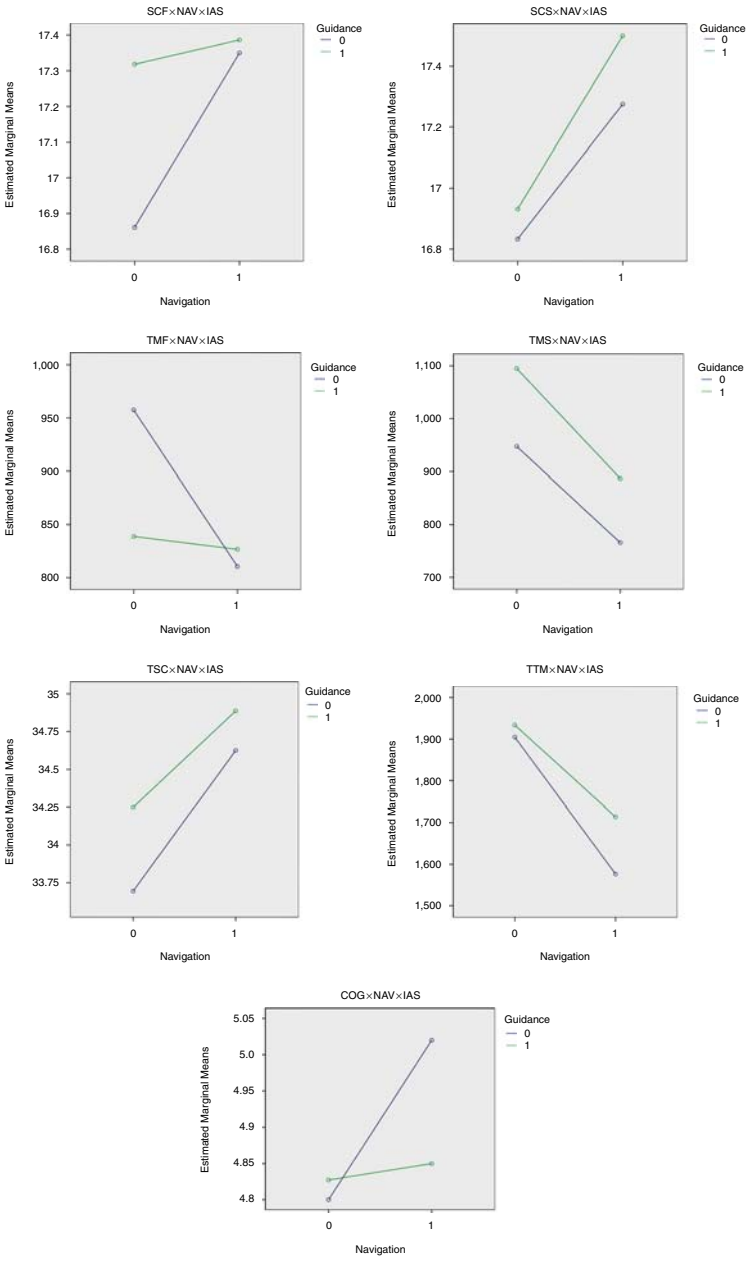

Figure 3.
Post-hoc charts – ANOVA analysis

because the workflow has been provided by the Navigation, whereas participants who did not obtain Navigation must first understand the flow of the transaction. Navigation is also expected to be able to reduce extraneous cognitive load because information about the flow of transactions has been provided; meanwhile, those individuals who do not obtain Navigation must first understand the flow of transactions, hence this will increase the cognitive load.

Table X indicates the number of participants who obtained Navigation and did not obtain Navigation. There were 80 (48.78 percent) participants who did not obtain Navigation and 84 (51.22 percent) participants who obtained Navigation. The average score of participants without the Navigation treatment was 34 points from a total of 40 points with a standard deviation of 0.342, whereas the average score for participants who obtained Navigation was 34.76 from 40 points with a standard deviation of 0.334. For the duration of solving the task, participants who obtained Navigation have spent 1,648.42 (27 min 28 s) in average with a standard deviation of 75.729, whereas participants who did not obtain Navigation have spent 1,920.8 (32 min) in average with a standard deviation amounted to 73,904. For data regarding the level of difficulty received by participants, participants who did not obtain Navigation experienced an average difficulty level of 4,815 from a scale of 7, whereas those who obtained Navigation experienced an average difficulty level of 4,931.

Table XI indicates different significance values for total score, total time and cognitive difficulties with regard to Navigation. If the value of sig. < 0.05, then there is a significant

	n	Mean	SD
Navigation			
Total score			
NNV	80	34.00	0.342
WNV	84	34.76	0.334
Total time			
NNV	80	1,920.8	75.729
WNV	84	1,648.42	73.904
Cog. difficulties			
NNV	80	4.815	0.086
WNV	84	4.931	0.084
Guidance			
Total score			
NAS	76	34.18	0.353
WAS	88	34.57	0.328
Total time			
NAS	76	1,732.06	79.093
WAS	88	1,823.79	73.503
Cog. difficulties			
NAS	76	4.916	0.088
WAS	88	4.839	0.082
Navigation and guidance			
Total Score			
WNV WAS	44	34.890	2.780
WNV NAS	40	34.620	2.676
NNV WAS	44	34.250	3.059
NNV NAS	36	33.763	3.763
Total time			
WNV WAS	44	1,713.70	683.26
WNV NAS	40	1,576.60	658.38
NNV WAS	44	1,933.89	673.76
NNV NAS	36	1,904.81	705.38
Cog. difficulties			
WNV WAS	44	4.850	0.746
WNV NAS	40	5.020	0.815
NNV WAS	44	4.827	0.789
NNV NAS	36	4.8	0.7282

Table X.
Descriptive statistics

	F	Sig.	η^2
H1			
H1a	2.54	0.113	0.015
H1b	6.626	0.011	0.039
H1c	0.932	0.336	0.006
H2			
H2a	0.635	0.427	0.004
H2b	0.722	0.397	0.004
H2c	0.409	0.523	0.003
H3			
H3a	1.107	0.348	0.020
H3b	2.490	0.062	0.045
H3c	0.656	0.580	0.012

Table XI.
ANOVA results

effect on the dependent variable with the Navigationtreatment provided. From the observation of the experiment in Table XI, only total time that has a significant value compared to the different conditions with the total score and cognitive difficulties that do not have a significant value. This shows that participants who get Navigation treatment complete their tasks faster than groups that are not provided with Navigation. Based on the results of the above tests, in general, *H1* is partially accepted, where *H1a* and *H1c* are not statistically, significantly different.

H2

Guidance is one of the tools provided in the AIS that has been developed. Guidance is given in the form of instructions on what must be filled in the AIS. With the Guidance received by the participants, it is expected that participants may obtain higher scores than participants who did not receive Guidance because participants who obtained Guidance may clearly know what must be included in the AIS. In addition, it is expected that participants who receive Guidance may work on their task faster than those who do not receive Guidance, because participant who receive Guidance are not obliged to think about the data that should be input compared to participants who do not receive Guidance that should think about the appropriate data to input into the AIS. With Guidance, it is also expected that the cognitive load of participants may be lower than those who do not receive Guidance because participants have been given instructions, therefore they can help the process of selecting the right data.

Table X shows the number of participants who obtained Guidance and did not obtain Guidance, there were 76 (46.34 percent) participants who did not receive Guidance and 88 (53.66 percent) participants who received Guidance. The average score of participants who did not receive Guidance was 34.18 points from a total of 40 points with a standard deviation of 0.353, whereas the average score for participants who obtained Guidance obtained an average score of 34.57 from 40 points with a standard deviation of 0.328. Meanwhile, the duration of work for participants who obtained Guidance is 1,823.79 (30 min 23 s) in average with a standard deviation of 73,503, and for participants who did not obtain Guidance the average time spent on solving the tasks was 1,732.79 (28 min 52 s) with a standard deviation of 79,093. For data on the level of difficulty, participants who did not obtain Guidance have the average level of difficulty of 4,916 from the scale of 7, whereas those who obtained Guidance have a mean level of difficulty of 4,839 from the scale of 7.

Table XI indicates the significance values of each hypothesis regarding the total score, total time and cognitive difficulties with regard to the Guidance. If the value of sig. < 0.05,

then there is a significant effect on the dependent variable with the treatment guide given. Somehow, it can be seen on the table that there is no dependent variable that has a significant effect on the Guidance treatment. Based on the results of the above tests, *H2a–H2c* are rejected with $p > 0.05$.

H3

Navigation and Guidance are tools that are provided to participants in using the AISs, the more assistance provided, the more ease of use perceived by the user. Therefore, in this research, we grouped the user into four groups of cells by providing several treatments. Participants who obtain Navigation and Guidance (two tools), participants who only obtain Navigation (one tool), participants who only obtain Guidance (one tool) and participants who do not receive any assistance. Participants who received two assistive devices were expected to obtain higher score than the other groups; in addition, participants who received two assistive devices were also expected to be able to solve the cases faster, and with the two assistive devices provided would lower the cognitive load of the participants.

Table X shows the number of participants classified into each group where there were 44 (26.83 percent) participants who obtained Navigation and Guidance, 40 (24.39 percent) participants who only obtained Navigation, 44 (26.83 percent) participants who only received Guidance and 36 (21.95 percent) participants who did not receive Guidance or Navigation. The best accuracy values were obtained in group cells that received Navigation and Guidance treatment, while data on the quickness of solving the task indicate that participants who obtained Navigation but did not obtain Guidance solve the task faster than any other groups. And the lowest cognitive difficulties are received by participants who only receive Navigation treatment.

At a glance, the interaction between the variables of accuracy and effectiveness toward the factors of Guidance and Navigation is illustrated in Figure 2. From the figure, it can be seen that there are indications that participants who obtained Navigation and Guidance obtained higher scores than other participants and for the length of time, the participants who obtained Navigation but did not obtain Guidance solve the cases more quickly. This is possible because participants need more time to read the Guidance provided; therefore, it may spend longer time. But based on the data in Table XI, the entire variables do not fulfill the requirement for a variable to have effect because the sig. values are all above 0.05. Hence, *H3a–H3c* are rejected.

Discussion of the result and direction for future research

The research examines the use of AISs accompanied by the use of two assistance devices as the intermediary medium (i.e. Navigation and Guidance). In this case, the research aims to verify whether the provision of assistive devices in the form of Navigation and Guidance may affect the user's understanding toward the use of AISs.

In this research, we have focused to take samples randomly for several reasons. First, we had rigorously applied set of measures to capitalize the randomization and control of our sample in the experiment, which has been recognized as one of the most rigorous forms of collecting and analyzing data especially at the information system (Recker, 2013). Second, our current work is driven to seek evidence that resonate the theory statement as opposed to promote sample generalization (Wohlin *et al.*, 2000). Thus, we organized this experiment to ensure the participant characteristics to meet our control design. Third, sampling distribution of the means of various dependent variables in each cell adheres to the central limit theorem, even when $n = 10$ per group (Tabachnick *et al.*, 2007, p. 251). In our case, 164 participants were placed in four cells with approximately 40 data points.

The results of our research are absolutely astonishing. The public may certainly predict that there will be a significant difference that arises between the four groups of cells

under control. From descriptive calculations, it can be seen that there are several differences, but in the context of statistical significance, this difference is neglected. This indicates that SME activists, in remote online experiments and workshop experiments, evenly performed equally well in understanding the cases given as a matter of problem. So what aspects can be an explanation for this?

It is understandable that there is a possibility to conclude that the model is built tenuously that the internal validity is disrupted. It should be noted that experiments prioritize internal validity in which constructs involved in developing relationships between independent variables and dependent variables must be able to explain and predict the results which are consistent with the estimates predicted by the underlying theory. But we may ensure that the model's internal validity is maintained. First, manipulation checks consistently prove that there are no significant differences between age groups, gender, educational background and in fact the business processes involved. Thus, the experimental model and testing do not indicate sufficient concern, meaning that the input data presented have a significant impact on internal validity.

Second, we have anticipated the possibility of conditions that are not equivalent between the treatments upon the representation of the problems presented in the four treatments based on the two factors used. Larkin and Simon (1987) and Gemino and Wand (2004) have admonished that when conducting comparisons between representations (e.g. business processes), the measurement unit and the elements that form the representation must be able to fulfill informational equivalence prior to measuring computational equivalence. Two representations (the interface of AISs) are said to be informally equivalent, if the transformation process from one form to another does not involve significant loss of information. We proved this qualification by designing four treatments with similar platforms and environments for users who received both Navigation and Guidance, without Navigation and with Guidance, with Navigation and without Guidance, or without both assistive devices. This maintains the ability to isolate comparisons only on the computational differences.

As such, this insignificant difference is not a weakness in our external validity, and this still needs to be investigated. It seems that the use of the Navigation and Guidance feature applied to the interface and experiments for user experience (UX), although descriptively it indicates that there are differences in performance on the aspects of accuracy, which does not genuinely have a substantive effect on the learning process of SME activists. Or in other words, the learning process does not correlate with the application features and automation of the accounting process.

Another effort to explain this condition is to refer to the dual channel aspect of the theory of CTML (Mayer, 2009). Multimedia information is processed in separate modalities involving images and words that arrive from the external environment and enter into working memory in two modalities, namely visual and auditory. Both of these information are processed into built-in knowledge, which will be combined with long-term knowledge stored in long-term memory.

In the context of this research, it seems that the treatment provided to the individuals in the form of in-App Control does not truly assist in the process of accumulation and integration of long-term learning because it is not equipped with a long-term knowledge repository regarding the accounting process itself. The experience of users in managing their business has manifested itself in the form of knowledge which also includes their own version of accounting processes which is indubitably different and not standardized with the environment built into the AIS provided, even though this system uses features that we convinced to affect the localization of information and their cognitive abilities. It is probable that a continuous integration process needs to be carried out in order to close the open gaps between knowledge upon the business processes owned by the users as SME

activists, and accounting business processes that refer to the general principles. With the initial motivation that the AIS developed was directed to be a flexible system with activation or non-activation feature capabilities, generally, the developed applications have fulfill functional requirements. However, training and usage habits remain a priority that needs to be included in the user acceptance test agenda so as to enable the achievement of knowledge intercalation.

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