Applying Cognitive Walkthrough to Evaluate the Design of SPIN Interface

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Abstract

This study focuses on cognitive methods Walkthrough to measure the usability of SPIN interface design. SPIN is an interactive online teaching and learning system that can be accessed by lecturers and students of Universiti Kebangsaan Malaysia (UKM) through internet. The existing SPIN interface design is difficult to access because of the different user interaction styles when browsing information on SPIN. A "low-fidelity" prototype to the new SPIN interface was designed based on the design of conceptual models that have been produced. Walkthrough cognitive methods applied in this study involving a small group of professional designers and developers to evaluate the prototype interface design new SPIN. Result of this study is a prototype of SPIN "high-fidelity" interface which can be accessed by multiple groups of users.

Keywords: *cognitive walkthrough, design interface, usability evaluation*

1. Introduction

A cognitive walkthrough method becomes an important aspect of this study to measure the usability of SPIN interface design which was developed through a mock-up of low-fidelity prototype. SPIN works to help lecturers to interact with virtual students through interactive teaching and learning. Among its functions; upload/download learning materials such as tutorials, quizzes, exercises, projects and lecture notes, communicating through emails, conversations and discussions, announcements and information display. Each pages of SPIN interface has links to each other, and many more teaching and learning features that involves two users. Cognitive walkthrough exercise which has been carried out is focusing on user's mental operations manual and not the interface design characteristics. Problems can be identified with more specific because it can connect user to the cognitive process features available on the interface [1]. Cognitive walkthrough methods do not require the development of a fully functioning system; it is implemented in the preliminary stage to save on repair costs that might be occurred in future [2] and [3]. The objective of this study is to carry out the cognitive methods during the initial stage of redesigning the SPIN interface based on the requirements that have been discovered with students.

2. The Cognitive Walkthrough

The cognitive walkthrough methods have been implemented since 1990 [4], this method evaluates user interface design that gives detailed attention to support an interface of a survey (exploratory learning) [5]. Evaluation can be done by system designers in the early stages of design before running the Empirical testing [2].

According to [5], a Cognitive walkthrough to evaluate usability is a combination of software exploration and the cognitive learning model that can be explored. It is a theory structured evaluation process that included in a set of questions in the questionnaire [6]. Each item was built to focus the designer observation and individual aspects that help to make implicit decisions to solve problems [8].

The cognitive walkthrough methods involves one or a group of respondents whose selected from a particular background to test or explore (self-Exploration) the usability of interface design in an application system [7]. A design evaluator is normally the experts, interface designers or any other developers who have collaborated in the design and development processes [8].

The Cognitive walkthrough method was carried out on systems that have not been fully completed (working state) or the mock-up system. It was conducted to improve the weaknesses in terms of user's understanding and acceptance of the interface design approach. Each part that does not give understanding to the user will be identified and improved. According to [9], there are three procedures for the implementation of cognitive Walkthrough methods: firstly, to explain briefly about the users who will test the system and their academic background. Secondly, describe the tasks to be tested on the system specifically. Finally, a list of tasks for user to complete the assignment.

3. SPIN Interface Design

SPIN interface design is based on the conceptual design model that has been produced by [10], which involves explicitly the idea or the concept of user interface display. Conceptual design model covers the SPIN interface interaction style. Table 1 shows the interaction style issues being investigated along with a description of the interface SPIN.

Table 1. Interaction styles issues

Interaction Style Issue	Task
Command line languages	Users interact with the computer through the use of the language provided by typing commands in SPIN applications using the keyboard, keywords or instruction word.
Menu	Use of the SPIN interface menu such as pull-down menu, pop-up menu or menu hierarchy.
Direct manipulation	Manual control icons or graphic objects that can be controlled by the user, such as drag and drop objects (drag and drop) and the mouse pointer.
Form fill-in	Users using the notification area or discussion and chat boards to communicate
Question/answer and query dialogue	SPIN users communicate with the applications via the search dialog box to create a query to access information in the database.
WIMP Interface	Users are more comfortable using WIMP (windows, icons, menus and pointers / pull down menu) while accessing SPIN.

3.1 Conceptual Design Method

Participatory design method (PD) [11] is used to develop the conceptual design of the interface SPIN model involving lecturers and students as partners carried out in iterative design. It involves two phases, namely: (1) explore the idea of early [12] (initial Exploration of work) and (2) discovery process [13].

3.1.1 Explore Initial Idea

Exploring the initial idea involves six users, which are; three lecturers and three students. The purpose of this phase is to get consumer reaction and opinion on the use of SPIN applications. The technique used is observation and interview, which took 15 to 20 minutes per person. Before starting the session, the user is given a description of the research objectives and their role as design partners. Next, they were given the below task:

Task Lecturer / student:
1. upload / download the lecture notes
2. deliver announcements or instructions
3. implement the relevant features
4. communicate with students / lecturers

3.1.1.2 Exploring Initial Idea Analysis

Table 2 shows the analysis and output of the reaction and views as the issue of consumer interaction styles. The list is compiled based on the duplication of information.

Table 2. User's reaction and suggestion

Interaction Style Issue	Lecturer's Opinions and Suggestion	Student's Opinions and Suggestion
Command line languages	• Different instruction for each set confused the user • Need to enter a complete staff identification number for login, differ from other UKM information system.	• The information display did not specify status of students, either undergraduate or graduate, and their semester
Menu		• Does not understand the abbreviation used for faculty in the "pull down" menu.
Direct manipulation	• Not able to access all student emails in the course taken • Features such as quizzes, tutorials, training and project can only be viewed but not manipulated.	• Unable to update student profile except for mobile phone number and email address. • Students are unable to browse information remotely. • Feature "Launch Learning Objects & communication" is displayed but left unused.
Form fill-in	• Admin unable to access all sets of group teaching aids. • Courses cannot be search by keywords.	• Sometimes an announcement from other lecturer which is not related to the course appears on the screen. • Student unable to send email to each other individually, except to those who register for the course.
Question/answer and query dialogue	• Only document for the particular semester can be accessed. Any lecture notes or item transfer is quite complicated.	• Feature "fast download" unable to download a complete set of lecture notes.
WIMP Interface	•	• Information displayed include the calendar but with no time. • Information on lecture hall without the building details. • Inconsistent used of language, all topics are in English but the courses name are in Malay.

As shown in Table 2, there is much confusion on the display of content which led to difficulties for user to access the information on SPIN. The language used for instruction is inconsistent and unclear as the selection set in the course. "Pull down" menu is used to view faculty has increased consumer confusion because the acronym used is not provided with a description. SPIN applications are not flexible because users can not directly manipulate information, such as student email information will not be shown for the lecturer to contact the desired student and administrator cannot reach all the set of courses in the teaching group. Features "Launch Learning Objects & communication" has no function. However, the WIMP interface style of interaction is not a problem faced by the lecturers, but students who are confused about the information display on lecture classes and language used on the courses offered.

3.1.2 Discovery Process

Discovery process is the second cycle after the input from the initial idea of exploring phase. Users are divided into a group of four combining lecturers and students. The technique used was brainstorming through the workflow model and analyze the interface SPIN session. The time allocated

is 30 minutes. Work flow model is based on interaction style issues that have been analyzed in the first phase. The SPIN interface analysis session began with an interactive brainstorming within groups. Everyone in the group play a role to give opinions and to record findings.

3.1.2.1 Discovery Process Analysis

Table 3 below shows the analysis and the output gathered by users during the brainstorming session.

Table 3. User's suggestion

Interaction Style Issues	Suggestion
Command line languages	• The usability in terms of information delivery can be improved such as: o Flexible used of staff number or the last four digits to enter the SPIN application o No need to create an additional set into the timetable to visualize it. o Indicate the status of students in the feature "view profile"
Menu	• There must be a legend for each letter stands for, or • The full list of faculty names in the menu "pull-down"
Direct manipulation	• The usability in terms of information delivery can be improved such as: o Display registered students' emails hierarchy. o Features displayed to help user to control the information. o Student can access SPIN application remotely.
Form fill-in	• The efficiency of database can be enhanced so that: o Admin can control all sets in the courses o The courses can be searched via keyword o Student can send personal email to each
question/answer and query dialogue	• Student can access a complete set of lecture notes through the "fast download" feature. • There is a menu that allows transferring lecture aid to the new semester.
WIMP Interface	• Add the information of: o Time o Building name and label o Consistency of language used

Table 3 describes the findings on how to improve the usability by reorganize information on SPIN interface. The misunderstanding can be resolved by removing unused features like "launch learning objects and communication". Use the "pull-down" to display a full list of faculty names clearly not just use the acronym alphabet only. Consumerism manipulation and form filling are inter-related because it involves a visual guide. Menus or functions that allow administrators / lecturers should be provided to facilitate the manipulation of the content. Users can manipulate features such as answering quiz questions via the interface and SPIN database will generate and display the results on the interface. WIMP interface should be clear by adding a label, clock icon to show time and consistent use of language.

3.1.3 Findings

Research on initial idea exploration and discovery process with users produces the conceptual design of the SPIN interface, which represents by a mind mapping of information architect and user. The SPIN conceptual design helps to reorganize the information. RP method is used to get the right mind mapping model, which is in accordance with user requirement. Figure 1 shows a schematic structure of the research conceptualization. There are three levels:

1. Six styles of user interaction on SPIN interface
2. Summary of user reaction and opinion on the SPIN interface interaction style by category
3. Summary of users' suggestion to support their reaction and opinion

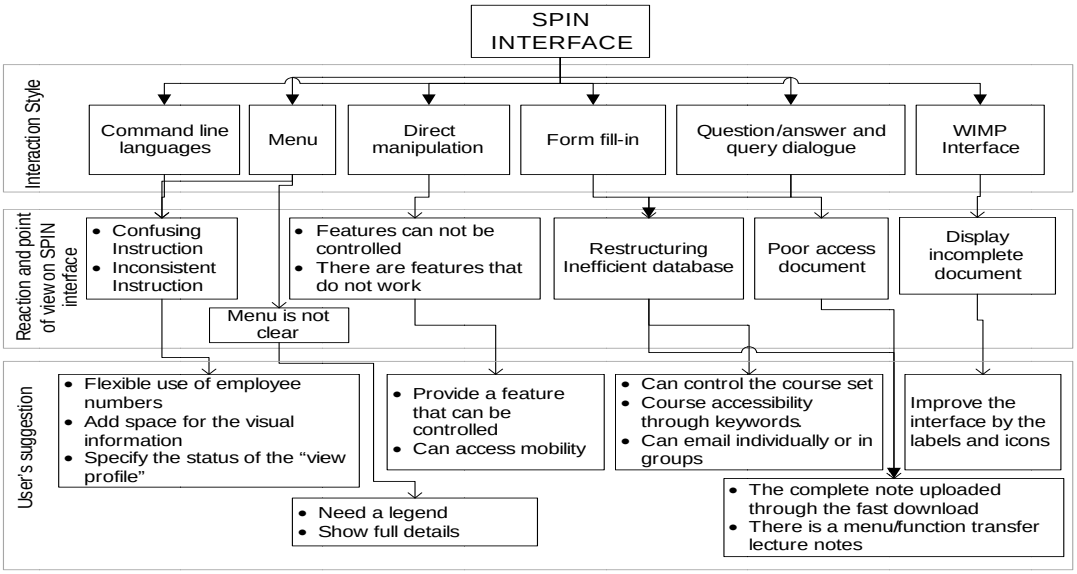

Figure 1. Research Schematic Structure

3.1.4 "Low-fidelity" Prototype

A mock up interface design was developed as a "low-fidelity" prototype to accelerate the development process iteratively. The purpose of SPIN interface is to implement the conceptual model that has been produced. SPIN interface emphasizes on design and button as required in the conceptual design model. Figures 2 to 7 are some examples of SPIN interface which have been developed. The interface represents the lecturers / UKM staff selection on courses activities, profile, and lecture notes.

Figure 2. SPIN main interface

Figure 3. UKM staff profiles interface

Figure 2 shows SPIN main interface that contains three buttons which are lecturers, students and user manual. Users can log into the system using either their complete employee number or the last four digits. Figure 3 portrays UKM staff profiles, users can update profiles, change the picture and change the password options.

Figure 4. Courses profile interface

Figure 5. Lecturers profile interface

Figure 4 illustrates the courses profile, a clear label on the icon describes information on the course. Lecturers are able to manage the set of courses easily. Figure 5 shows the lecturers profile can be easily updated.

Figure 6. Upload course interface

Figure 7. Activities interface

Figure 6 shows an interface to upload the course using friendly icons and labels. Lecturers can use the transfer function of the lecture notes before the new semester begins. Figure 7 displays the activities interface which uses icons and labels as a communication tools between lecturer and student.

3.1.5 Summary

Interface design with the high accessibility is important because it is user friendly and ready for use by all users, including people with disabilities. Interface design must have a balance usability features in terms of functions and the information contained herein.

4. Cognitive walkthrough evaluation

The purpose of cognitive walkthrough evaluation is to improve the SPIN interface design terms of user acceptance and understanding of interface design approach. Results of this research will help to develop a high-fidelity prototype as a final product. Interface design that does not help much on users' understanding will be identified and enhanced.

4.1 Methods

The cognitive walkthrough method involves the subject matter experts as participants, three lecturers and three graduate students work together to give comments and critique of SPIN interface design. Specific tasks to be carried out by the participants through the four phases of the evaluation process are:

Phase 1: "Will the user try to achieve the right effect?"

Users will decide their objectives when using the SPIN interface.

Example: Reading information available on the screen to understand the system goal.

Phase 2: "Will the user notice that the correct action button is available?"
Users find the option buttons or objects to click or the space to insert text.
Example: Login button, text field, hyperlink, link.

Phase 3: "Will the user associate the correct action with the effect to be achieved?"
Users choose a task that they understood and try to explore the system.
Example: fill in the space text field and password to log into the SPIN system.

Phase 4: "If the correct action is performed, will the user see that progress is being made toward solution of the task?"
Users do task and describe how the SPIN system response for the request.
Example: Pressing the Log in button and access to the next page

4.1.1 Procedures

Sequences of specific tasks performed by users during the cognitive Walkthrough session are as below:

1. Enter the ID along with their password on the main page and press login button on SPIN system.
2. After login, users will see a lot of hypertext selection in the Menu Bar, and will explore the pages randomly.
3. In HOME menu, the user will scan all the notifications listed. Users will route the cursor to find out whether it can re-direct to another page or not.
4. In the PROFILE menu, the user will see the list of the menu list on the left side of the page and press each button to find out more information.
5. In Menu COURSES, users will find a choice of courses to be seen and clicking on the selection of courses is displayed. After entering a page that represents a course, the user's attention will focus on the menu list on the left of the page.
6. In Menu USER MANUAL, the user will press the icon to download the SPIN user guide which is provided in PDF format.
7. To exit the system, user will choose the YES or NO button at the LOG OUT menu.
8. Generally, the user's responses to all buttons or a direct hypertext links provided on each page will be observed. It is to ensure the accuracy of each design and reflects the functions they represent

4.2 Analysis and findings

Table 4 shows the results of cognitive Walkthrough methods conducted on students and lecturers for the evaluation of the initial design of the SPIN prototype. Each of the lecturers and students to respond either agree or disagree with the design of the interface that has been developed based on the arrangement of features designed as a percentage. Most of the features developed satisfy by both categories of participants. In terms of color features, all students agree with all color attributes while 33.33% and 66.67 % lecturers agree with the background and button colors respectively. 66.67% of lecturers agree on calendar and expiry session of the SPIN, while none of the students show their agreements.

Table 4. Percentage of interest on design criteria

Criteria	Description	Lecturer	Student
Colours	1. A blue background to display information	33.33	100
	2. Text	66.67	100
	3. Hypertext button	100	100
Font	1. Font type on text	66.67	66.67
	2. hypertext font	66.67	66.67
Button	1. Used of image as a button	100	100
Calendar	1. Remain	66.67	0
	2. Permanent at each page	66.67	0
Interface	1. layout consistency on each features	100	100
	2. Layout design	100	100
	3. Used of colour	66.67	66.67
Expiry Session	1. Automatic logout if no cursor movement	66.67	0
Icon	1. Help user to understand the function of button	100	100
	2. Icon can be selected with hypertext	100	100
	3. Animation on icon	33.33	100
Menu Selection	1. Location on layout	100	100
	2. Used of colour	100	100
Menu List	1. Location on layout	100	100
	2. Change of font colour when hover the cursor	0	66.67
	3. Hide and click to show	100	100
	4. Differentiate between hypertext and hyperlink	66.67	100
Feature	1. Announcement will be deleted automatically	100	100
	2. Quizzes	100	100
	3. Questions Bank	66.67	66.67
	4. Discussion Board	100	100
	5. Pending subject	66.67	0
	6. Viewers counter	100	0
	7. Upload file	100	100
	8. Status can be change from online to offline	100	100

Based on the cognitive walkthrough exercise, some suggestions for improvement have been proposed by participants. Table 5 shows the suggestions pertaining features that should be considered in developing a "high-fidelity" prototype. Among the suggestions are to improve the prototype color, font and expiry session criteria. Regarding colour criterion, the prototype should use UKM corporate colour and should follow the standard guidelines in text colour. The designer should differentiate font on text and hyperlink and follow font standard guidelines. For expiry session criteria, participants suggest that enough time should be estimated.

Table 5. Improvement Suggestion

Criteria	Description	Proposed Improvement
Colour	1. A blue background to display information 2. Text	Use UKM corporate colour Follows standard guidelines in text
Font	1. Font type on text 2. Font on hypertext	Differentiate font on text and hyperlink Standardize font for other criteria
Button	1. Used of image as a button	Icon can be clicked to redirect with hypertext
Calendar	1. Remain unchanged	To remain
Interface	1. Used of colour	Customize colour according to user group (lecturer/student)
Expiry Session	1. Automatic logout if no cursor movement	Estimate enough time
Icon	1. Animation on icon	Minimal animation (zoom-in and hover the cursor)
Menu List	1. Change of font colour when hover the cursor 2. Differentiate between hypertext and hyperlink	Change combination of colour to be more contra Remain the format for hyperlink to avoid confusion
Feature	1. Announcement will be deleted automatically on certain timeline 2. Upload file	Remain as in the old format Add in few more categories; notes, tutorial, exercises etc

5. Conclusion

The SPIN interface design can be developed iteratively through the implementation of cognitive Walkthrough method. Evaluation resulted from the SPIN interface prototype can help to improve the weaknesses of this study in terms of lecturers and students understanding and acceptance of the actual interface design approach. Cognitive Walkthrough method can also help to ensure the SPIN interface design meets the user mind mapping model, which identifies part of design that usually being misunderstood by lecturer and student.

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