

# INTERFACE DESIGN PRINCIPLES FOR MALAYSIAN INTERACTIVE SCIENCE COURSEWARE

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## ABSTRACT

In today's Malaysian educational setting, most of the interactive courseware has been used as a new way to fully support the teaching and learning activity. Within these practices, the uptakes of interactive courseware in classroom were increased. Therefore, there are ongoing debates concerning the effectiveness used of the interactive courseware in classroom. Part of the arguments' that had been acknowledged is deals with the quality of the interface design performance within the interactive courseware. Towards the issues concern, this paper discusses the 5 establish principles of interface design and its practical applications on the existing Malaysian interactive science courseware designed for the Smart School. The data describes in this paper is a part of the result from main research study undertaken on the development of a new doable set of interface design principles that is currently being completed. The new doable set of interface design principles moreover presuming will help the interface designers' and the courseware developers in future development and improving the possibility of learning experiences.

## Keywords

Educational courseware design; interface design, interactive learning experience

## INTRODUCTION

In the field of education, interactive courseware is increasingly been used by the educators to disseminate numerous lessons in classroom. Interactive courseware commonly packaged to be use with a computer as a supplementary material specifically in the teaching and learning process in classroom (White & Weight, 2000). Towards this, interactive courseware had been described as an additional material for the teachers and educational kit for the students. Accordingly, it been acknowledged as well that the major reason why interactive courseware been used in classroom is the capability of the interactive courseware itself to instruct and educate the students (Gauss & Urbas, 2003). Moreover, the uses of the interactive courseware are more accordable not only because it is very suitable for presenting educational content, but also because of its capabilities in motivating students to work collaboratively (Williams & Jacobs, 2004). Differently, the value of interactive courseware used in classroom can be priceless help if it's can motivate students to learn meaningfully by engaging them more in their learning. But then, the courseware itself can never replace the teachers because they always been required to guiding the students in teaching and learning process (Schwier, & Misanchuk, 1988). Similarly, teachers also do not assure if interactive courseware simply putting in classroom will support the teaching and learning process. Thus, as part of these unsatisfied, it can be useful to think about the quality of interactive courseware because it may or may not be helpful to a certain group of students in accomplishing their individual goals. In term of quality, there are varying judgments and though being discussed. One of that is referred to the uptakes level increased if the interactive courseware is in a good quality. Towards this idea, there are two main ways of viewing the quality of interactive courseware that can be found in the literature. Firstly, those who are looks at the developed product and "why and how" it's worked (Eberts & Brock, 1988; Kulik & Kulik, 1991). On the other hand, the others who had been looking at the development process of the interactive courseware and how it can be designed for the specific

users (De Diana, 1994). With this different of views, it's shown that the first group was judged the quality of the interactive courseware by looked more at how the interactive courseware work and what the interactive courseware can provide to the end user. Besides, the second group are been looking at how the interactive courseware supposedly work. This can be mentioned by those who are considered that using interactive courseware only as an enjoyment and entertainment resources.

### **The nature of interactive courseware in Malaysian educational setting**

With the concern of the effectiveness usage of interactive courseware in educational setting, starting in 2003, the schools in Malaysia had been changed the medium of instruction in the teaching and learning. In conjunction, to produce these interactive learning materials, most of the private companies in Malaysia have been willing to invest in collaborating with the government. Out of this collaboration, various types of interactive learning material have been developed including: (1) interactive multimedia CD-ROMs (stand – alone based) (2) browser-based teaching-learning materials including online tutorials, and (3) a joint program in collaboration with overseas schools called *My School Net* (Azizah et al., 2005). ON top of this, thousands titles of teaching and learning courseware have been developed by the Malaysian government, in collaboration with more than 100 private sector companies (MOE, 2006). Today, interactive courseware has become the most important and admired delivery medium in e-learning in Malaysia. It is also considered valuable not only because of its capacity to present educational content (Rohana, 2006), but because it is very suitable for presenting rich learning environments in which students can work collaboratively (MOE, 2004; MOE, 2006). Statistics from the Ministry of Education were show a growing demand and acceptance of e-learning system (MOE, 2008) and research by them also shows that there is a broad range of factors that contribute to this acceptance, such as student interaction, attitudes of the teachers and the quality of the interactive courseware performance. Therefore, many scholars concluded that those students and teachers in Malaysia who have been involved in the implementation of interactive courseware are generally positive about their experiences (Siew Ming et. Al, 2009; Baharuddin et. al, 2006). Despite the support for this, there have been few studies dealing with the effectiveness of this interactive courseware provided (e.g. MOE, 2008; MDC, 2007; Baharuddin et. al, 2006; Kamariah, 2006, MOE, 2004). And it would appear that, as the interactive courseware has rolled out to *Smart Schools* across Malaysia; two main issues have been identified by the educators. Firstly, much interactive courseware in Malaysia fails pedagogically and misleads students in understanding the content (Kamariah, 2006; Jowati, 2005). A second issue identified is the current interactive courseware is not tailored to students' needs and learning ability (Muda & Mohamed, 2006). Therefore, both of these main issues are been argued critically involved the quality of interface design in accommodating student needs. Towards the issues been concerned, this paper discusses the principles of interface design based on the analysis done within existing Malaysian interactive science courseware designed for the *Smart School* in Malaysia. The potential set of principles examined moreover presume will help interface designers' particularly in designing the quality interactive courseware and can be use by the courseware developer as well to create a good interactive courseware that can improve the level of product usage and learner experiences. The data describes in this paper therefore is a part of the main research study undertaken on the development of a new doable set of interface design principles that is currently being completed.

### **METHODOLOGY**

**Sampling:** The interactive science courseware involved in this research study was the pilot project interactive courseware that has been used in the teaching and learning of science among Year 3 students (9 years old) in designated *Malaysian Smart Schools*. The design platform is stand alone-based comprises 3 CD's and consisted of three main topics, namely: (1) Learning about Living Thing: Animal and Plants,

(2) The Worlds around Us (part 1), and (3) The World around Us (part 2).

Each of these topics had been presented with a different numbers of lessons ranged from 6 to 11 lesson title. Table 1, illustrates the components of the interactive science courseware that had been studied and Figure 1 demonstrate a screenshot sample of interface design for each section.

**Table 1:**

Sections and components of interactive science courseware been studied

Sections in the interactive science courseware	Components included
Front page / Opening page	Text, images, sound/audio
Introductory Page	Text, images, animation, sound/audio
The Lesson Topic / Tutorial/ Activity Page	Text, images, animation, sound/audio, video
Test Page	Text, images, sound/audio



**Figure 1:** Screen shot of the front page for each section

**Method:** A content analysis technique was used as a research method for the purpose to identify the common principles been used and ascertain the most common principles that can potentially be use for the future courseware. 5 interface design principles and characteristics documented throughout the literature (Table 2) and 4 interface design principles and characteristics that had been revealed from the existing Malaysian standard courseware guideline (Table 3) were used as a guideline in analyzing the courseware. Analysis had been commenced with:

- (1) Identifying the common principles that been used in the existing interactive science courseware against the international principle and the existing Malaysian government guideline,
- (2) Categorizing the most common interface design principles that been used in the existing interactive courseware,
- (3) Ascertain the most common principles that can potentially be use for the future development of interactive science courseware.

The frequencies of the characteristics variables for each principles also were recorded and been calculated manually.

**Table 2:**

5 well-liked international interface design principles and guidelines revealed from the established literature

<b>Principles</b>	<b>Guideline Description</b>
<b>The <i>consistency</i> within a product</b>	The use of the design features on screen layout and the actions/commands within a product should have similarities
<b>The <i>flexibility</i> of the system's respond to the different individual differences</b>	The capability of the courseware responds to the individual differences.
<b>The <i>familiarity</i> of the element use to the intended audience</b>	Standardized commands use or consistency of the visual appearance will provide user with the familiarity of the product in order to ensure the content easy to learn by the novice audience, and easy to use for the expert and efficient.
<b>The <i>efficiency</i> of clear and immediate feedback to the user</b>	Providing a clear and immediate feedback for each user action and ensure that the user kept informed about what the system is doing or has done. For example, constantly kept informed the user about what they are doing now, where they are now and what the system requires.
<b>The <i>Compatibility</i> of the product system</b>	The structure and flow of a system should match and support the general strength and weakness of the user as to make sure the design acceptable.
<b>The <i>aesthetic</i> of the screen appearance</b>	Ensure that the user, by looking at, can tell the state of the device and the alternatives for the action that can take by the user. For example, through the use of sound and touch it will provide the user to see what functions are available and what the system currently doing.

**Table 3:**

4 interface design principles identified from the Malaysian standard courseware guideline

<b>Principles</b>	<b>Guideline Description</b>
<b>The <i>consistency</i> of the style and standard elements used</b>	The use of design features for colours, text, characters, and icons should be consistent and the system also shall provide similarities of the commands or actions used in prompts, menus, or help screens.
<b>The <i>Flexibility</i> of element and commands use in accommodating different user preferences</b>	The selection of the design features of text, audio, graphic, video or animation shall be concern of the biases on ethnicity or religion, appropriate for the age group concerned, and accommodate a wide range of differences user abilities and preferences in order to ensure the content easy to learn and easy to use by the user
<b>The <i>familiarity</i> provided to the intended user by repetitive uses of the same design features</b>	The design features of text, graphic (such as characters or icons) or audio used should be use again and again or similar. By making standardized, so the intended audience will familiar with the product.
<b>The <i>efficiency</i> of feedback to the user</b>	Any user action on screen layout should include sound/audio effect and should have a confirmation dialogue to sustain student interest.

## RESULTS AND DISCUSSIONS

The main purpose of the analysis is to identify the most common principles that had been used in the existing interactive courseware. By comparing the principles suggested by the international scholars and principles recommended in the existing Malaysian standard courseware guideline, there are 4 similar principles been expose. Though the principle of aesthetic appearance did not mentioned specifically in the existing Malaysian standard courseware guideline, however this principles still considered needed to be used as an overall analysis. This is because aesthetic is very closely related to the overall usability of the interface appearance. Thus, for this courseware analysis, 5 compatible interface design principles have been employed. Covering all main topics of science subject for year 3, 26 lesson topics had been reviewed thoroughly based on these 5 interface design principles. They were as the following:

- (1) The consistency of the style and standard elements used,
- (2) The flexibility of elements and commands use in accommodating different user preferences,
- (3) The familiarity of the standard design features given to the difference intended user,
- (4) The efficiency of clear and immediate feedback given to the user's action, and
- (5) The aesthetic pleasuring of the overall screen appearance.

Moreover, these 5 interface design principles are containing with a number of characteristics as presented in table 4.

**Table 4:**

The characteristics of interface design principles used for the analysis of existing courseware.

Principles	Characteristics
<b>The consistency of the style and standard elements used</b>	<ol style="list-style-type: none"> <li>1. The clear sequences of the screens appearance.</li> <li>2. The consistency of colours used.</li> <li>3. The consistency of text style.</li> <li>4. The consistency of characters used.</li> <li>5. The same actions yield the same result.</li> <li>6. The similarities position of main menus,</li> <li>7. The standard tool on navigation bar.</li> <li>8. The same introductory montage.</li> </ol>
<b>The flexibility of elements and commands use in accommodating different user preferences</b>	<ol style="list-style-type: none"> <li>9. Providing user with the button to pause, to continue or to exit the activity.</li> <li>10. Providing user with an appropriate working sound.</li> <li>11. Have a confirmation dialogue to ensuring the user action as a feedback.</li> <li>12. Avoided biases of ethnicity and religion in human characters used.</li> <li>13. Avoided biases of ethnicity and religion in colours used.</li> <li>14. The graphic images used should suitable to the intended user.</li> <li>15. The colour used should suitable to the intended user.</li> <li>16. The audio used for human character appropriate gender or age.</li> <li>17. The audio effect for icon or symbol appropriate with user.</li> <li>18. The text character used easy to read.</li> <li>19. The text character used suitable to the intended user.</li> </ol>
<b>The familiarity of the standard design features given to the</b>	<ol style="list-style-type: none"> <li>20. The human and animal characters used again and again.</li> <li>21. The symbols or icons are replicate used with standardized commands.</li> </ol>

<b>difference intended user</b>	
<b>The efficiency of clear and immediate feedback given to the user's action</b>	22. Remaining accurate responses on confirmation dialogue. 23. Providing user with the visual or audio effect on action that user performs. 24. Allowing the user to operate the task properly.
<b>The aesthetic pleasuring of the overall screen appearance</b>	25. Telling the artistic of the device through overall appearance

With this guide, each pages or screens of the existing interactive science courseware were carefully checked and reviewed in terms of these 5 principles and 25 characteristics posed. The detail discussions on each principle were presented in the following section.

**Principle 1: The consistency of the style and standard elements used:**

Consistency is a principle that emphasizes the importance of standardization in appearance, placement, and actions throughout the interface. With this regards, the developers of this existing interactive courseware been declared that they were designed this existing interactive courseware to be flexible use to the students and teachers where the courseware is enable them to learn what, when and how they want, whilst this flexibility will facilitating their teaching and learning process. Consequently, by reviewing this existing interactive courseware, on the whole, it had been indicated that the current style of the screen layout of this interactive courseware are greatly consistent. It can be seemed clearly through the use of the same style of introductory montage, the parallel placement of the navigation bar, the standard title for main menu and the same icon tool on navigation bar. Therefore, these consistencies are not greatly appearing in term of color used. Evidently, these differences can be identified evidently in the *Tutorial page* section with the different color theme that had been used for presenting the different lesson topic. Fig. 2 showed the screen shot for the similar styles of screen layout with different color theme for different lesson topic in employed in the *Tutorial page* section.



**Fig. 2:** The similar styles of screen layout with different color theme for different lesson topic.

While, in term of the text style and characters been used, analysis been revealed that these entire components are also extremely consistent throughout the courseware. For example, the same human characters for the boys and the teacher (shown in fig. 3) are been used again and again within the lessons. With this regularity offered, it can be noted that the principle of consistency are seem greatly been used in this existing courseware. Thus, it should be concerning further that this principle potentially could be use for the future development of Malaysian interactive science courseware.



**Fig. 3:** The same human characters been used again and again within the lessons

***Principle 2: The flexibility of elements and commands use in accommodating different user preferences:***

The principle of flexibility is more connected to ensuring that all elements and commands that been used will accommodating the different preferences of the intended users. In other words, flexibility is the capability of the system to respond to the individual differences between users. With this flexibility offered, it's presumed that the intended users will understand the content easily and the courseware itself will be easy to use by the users. Accordingly, from the analysis thought-out this existing science courseware, this principle had been revealed were significantly fitting in. This can be definitely appearing on the design of the text characters, human characters and the icon characters. The features of all these characters were considered highly prepared for the age group concerned where this courseware is targeted for the year 3 students consist age of 9 years old (fig. 4). Moreover, for the visual images, the colours that had been used are able to be considered really suitable to the intended user. Concurrently, this kind of design features were noticed as the unique characteristic requirement stated in the existing Ministry standard courseware guideline which each character must be presented by considering on some particular aspects of cultural and moral values. By looking more on the suitability of the colours used for each images, most of the colors that had been used adequately appropriated. As per shown in fig. 4a, the colors that been used for the explanation text are greatly contrasted against the background image on the screen. Besides, the typeface that had been chosen for the body text and the size used can be accurately considered will be easy to read by the targeted user. Hence, this will contribute to the enhancement of the users in understanding of the content.



**Fig.4:** The design features of the text, human characters and graphic images are fitting with the age of targeted users.



**Fig. 4a:** The colors used for the text are greatly contrasted and easy to read

Therefore, in term of the flexibility of commands on responding to the individual user's differences abilities and preferences, this interactive courseware was shown its interface capability by providing the users with a multiple choices of action buttons. In example, in some section, most of the images are been presented and accompanied by the explanation words or audio effects (Fig. 5). By offering this, it does not mean that images cannot delivered content and always depends on words and the audio. In this case, however, the word or text is presenting as additional information while the still images has already shown part of the demonstration. Although the images play more important roles for the users in understanding the content of the material, it been identified before that some users may be will see the importance of the text elements. Thus, by providing this availability, user will understand better. Concurrently, the buttons on the navigation bar also been providing the user with the flexibility on navigate to the next and previous activity. The users also can pause the activity by clicking on the pause button and exit the activity. Therefore, this flexibility was presents just on some buttons either with the audio effect or mouse over effect.



**Fig. 5:** The images are presented and accompanied by the explanation words

***Principle 3: The familiarity of the standard design features given to the difference intended user:***

The degree to which user recognizes the interface design is more relying on the consistency of the concept of the screen appearance or by the standardizing of the command used. With this, the

principle of familiarity had been presented. In relation to this principle, throughout the analysis, it can be seemed that this interactive science courseware had been providing users' familiarity. This principle been used particularly on the selection of some visual images that been used either as an icons button or as a background. As shown in fig. 6, the developer was used "Sang Kancil" across the courseware as one of the animal character in explaining the lesson content. This character is the most recognizable animal character that been used in numerous Malaysian's children bedtime stories and very synonym to the Malay ethnic group. Additionally, this animal character was replicate used within the courseware. Yet, by using the same symbols and icons, it is potentially influenced the familiarity of the user with this interactive courseware.



**Fig. 6:** The use of "Sang Kancil" as a recognizable animal character across the courseware

**Principle 4: The efficiency of clear and immediate feedback given to the user:**

Users commonly rely on the feedback given by the product when they used the product. Therefore, feedback is a principle that emphasizes the importance of keeping users informed while they interact with the interface. Towards this, the feedback is to let the user know and ensured that the application received the input that had been given by them. If the user does not receive any action on what they had done, they may do it again and again. Thus, when a user performs an action, interface should notify the user with a clear and understandable way of those relevant actions either in visual, audio or both. From this courseware analysis, it been revealed that most of the action performed by the user in using this existing interactive courseware had been provided with some feedback immediately. For example, the action that been given when clicking on a menu bar in *Tutorial page* (shown in fig. 5). By just pushing on any text button on the menu bar, a response is given to the user action within a few second. In this sample, the response was given in form of sound/audio effect, visual images and explanation text. Beside, in some pages, the response was just provided in form of visual image or text.



Fig. 5: Sample of immediate feedback when pushing the active button

Furthermore, when dealing with the interactive learning material, one of the uniqueness is the possibility of the material continuously give the learners an appropriate and encouraging feedback. With this intention, analysis was revealed that this interactive courseware had been offer an efficient confirmation dialogue for recognized the actions done by the user. This can be looked particularly in the *Test* section as per shown in fig. 6. Additionally, the same confirmation dialog had been use in the different lesson topic within this interactive courseware when user chooses to leave from the current page. Therefore, by providing a simple visual images or audio effect on action that user performs, this interactive courseware is highly provided an accurate responses to the intended user on what the courseware doing and what they had been done.



Fig. 6: The same confirmation dialog in different page

**Principle 5: The aesthetic pleasuring of the overall screen appearance:**

The ideal interface is easy to learn and easy to use by the user. In a holistic view, the user's satisfaction and their experiences with an interface considered as an aesthetics pleasuring. Therefore, applying aesthetic principles is not simply a matter of making the interface "prettier" or attractive to the user. Instead, aesthetics pleasuring should contribute to a more effective relationship between the user and the application. In examining the aesthetics pleasuring of this courseware appearance, it has shown that the overall interface design of this courseware had been used an aesthetic principle. The aesthetic dimension can be seemed through the proofs of the consistent elements provided in this courseware and the flexibility of the system. Indeed, consistency of the element used would enable the user to focus on the information task. With this, user will satisfy with the interface.

## CONCLUSION

In order to ensure the effectiveness and appropriateness of these 5 compatible principles from the end- user perspective, it will be take into further step in the research study undertaken on the development of a new doable set of interface design principles that is currently being completed. These 5 principles moreover will be examining through classroom observation and focus group discussion with the teachers and students. Therefore, the new potential set of interface design principles presuming will help as a way of guiding the interface designers' in designing the quality interactive learning material. In addition, it also can be consider as an appropriate way of validating the quality of interactive courseware that can improve the possibility of better learning experiences towards interactive courseware.

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