Designing interactive e-learning activities to engage learners - A simple classification

Tang Buay Choo
Institute of Technical Education
10 Dover Drive. Singapore 138683
Singapore
Tang_Buay_Choo@ite.edu.sg

ABSTRACT
How can we design e-learning resources that will motivate and sustain learner's engagement? Most of us would probably agree that infusing appropriate interactivity is crucial in engaging learners and providing necessary support for developing higher level cognitive skills. However, beyond this common understanding, the topic on interactivity appears to be filled with a vast array of competing, and sometimes confusing, theories and research findings. At our institution, we have developed a simple classification system to guide the design of appropriate interactive activities for our e-learning resources. In this paper, I would describe this classification system, giving examples pertaining to vocational education developed by our lecturers.

KEY WORDS
Interactivity, engaging learners

1. Introduction
In recent years, there is a strong consensus, especially among the constructivist theorists, that engaging learners in the learning process is pre-requisite for effective learning. Making learning more engaging takes us back to the basics of designing learning activities that allow active learner participation and involvement in the learning process, or in other words, integrating interactivity into learning activities.

Interactivity is a word used to describe a learner's engagement or involvement in the learning process. Today, “interactivity” is frequently linked to quality learning. Summers [1] felt that interaction was necessary to develop students into independent learners. Barker [2] contended that interactivity was necessary and fundamental in the knowledge acquisition process. Sims [3] asserted that interaction was an intrinsic factor for successful, effective instructional practice. More recently, Parker [4] stated that interaction was an essential part of the academic process and Mesher [5] highlighted that interactivity was the key to successful online learning.

Though the role of interactivity in effective learning is widely accepted, it is not so obvious exactly what interactivity is and what types of interactivity can most effectively engage learners. Laurel [6] argued that it had been difficult to define interactivity. Sims pointed out that there appeared to be no consensus of what interactivity actually represents or involves [7] and highlighted various conflicting opinions of interactivity [8]. This conflict in opinions makes it challenging to determine the type of interactivity that would actively engage learners to ensure effective learning. This paper describes a simple classification of interactivity that we developed to guide the design of our e-learning resources.

2. Defining interactivity – ITE’s perspective
Simply speaking, interactivity is the process of active learner engagement with each other, content, instructor, or software. It takes place when some response is elicited from the learner and in turn, the other learners, content, instructor or software is able to respond to the learner’s input.

Moore [9], highlighted 3 types of interaction within an instructional setting, namely:
- Learner-content interaction which was the process of learner interacting with the content, resulting in a change in the learners’ cognitive structure.
- Learner-instructor interaction which was the process of learner interacting with the instructor wherein the instructor served to guide and motivate learning.
- Learner-learner interaction which was the process of learners interacting with one another, motivating and helping one another to learn.

Similarly, McLoughlin & Oliver [10] identified two types of interaction:
- cognitive interaction which was similar to learner-content interaction; and
- social interaction which was similar to learner-instructor and learner-learner interactions.
This paper focuses only on learner-content, or cognitive interaction. In simple terms, this type of interactivity takes place when some response is elicited from the learner and in turn, the content responds to this input by the learner.

Frequently, content are considered "interactive", when all is required of the learner is to click some buttons to move from one page to another. Though consistent with the above description, this form of interaction alone is not sufficient to engage learners and promote effective learning. To do this, there is a need for reflective cognitive involvement on the part of the learner. This view is highlighted by Ehrman [11] when he defined interactivity as an internal dialogue of reflective thought between the learner and the content. Similarly, Bork [12] proffered that interactivity should be meaningful and engaging to the learner and Jonassen [13] emphasised that meaningful interactivity involved learner in a true dialogue where the response from the learner is consistent with his/her information processing need. Echoing these ideas is Sims [14] who stressed the need to empower learners to be continually and productively active while working with the instructional content.

To summarise, interactivity is an activity where learners feel in control of, and involved in, the learning process. Taking into consideration the nature of our students, to ensure meaningful interactivity, there is a need to have adequate and appropriate guidance and scaffolding to help them control and respond to the content while actively making and constructing their own meaning from the content.

3. A simple classification of interactivity

Figure 1 below depicts the classification developed by us to guide our design of interactive activities.

![Types of Interactivity]

There are 4 types of interactivity in this classification, namely, Control, Response, Manipulate and Co-construct. In general, the level of cognitive effort required from the learners differs for each type, with Control type requiring the least effort while Co-construct requiring the most.

Control interactivity is similar to the Acquisition stage in Ohl’s [15] Interactive-Centric Learning Model where the learner actively determines the content he or she receives. This is the same as the type of interactivity described by McLoughlin & Oliver [16] when they argued for interaction in the sense of providing the learner with control over the pace, sequence and form of the instruction. The other 3 types (Response, Manipulate and Co-construct) roughly correspond to the Production stage of Ohl’s model [17], which is characterized by active manipulation of the content by the learner, to create new knowledge that are meaningful to the learner.

The following sections offer a more detailed discussion of each type of interactivity citing examples of interactive activities developed by us to illustrate the characteristics.

Control

Control interactivity allows learners to determine what content he/she wants to pay attention to, and the pace (Figure 2), flow (Figure 3) and/or depth (Figure 4) at which the content is presented. The purpose of this type of interactivity is to allow learners to take charge of their own learning. Providing learner control has been the subject of research and many researchers have confirmed that learners can be more motivated and engaged when allowed to self-regulate their own learning. Providing learner control also enables learning to be more individualized, thus increasing the likelihood of more enhanced learning outcomes.

![Control interactivity (Pace)]
In this activity, the working principle of the EDM process is broken into manageable chunks. Learners can determine the pace of the content through the number buttons on the right of the screen which serve to activate each chunk of text and the corresponding animation.

![Control interactivity (Flow)]
In this activity, learners can learn about the different CP5 clauses for electrical cables and conductors in any sequence by clicking on the relevant button on the left of the screen.
Taking into consideration the purposes of Control interactivity discussed above, the following guiding questions were used to help determine when and where to include this type of interactivity:

- Is there a need to allow learners to control the pace of the lesson so that learners with different reading and learning ability can have control over the pace of the lesson?
- Is it possible to break bigger chunks of content into smaller segments? If so, is it desirable to allow learners to control the pace at which these smaller chunks are presented?
- Must learners learn the content in a fixed sequence? Is it desirable to allow learners to determine the flow of the lesson? Do learners possess sufficient prior knowledge or cognitive ability to make appropriate sequence choices? If not, what structure of cues can be incorporated to guide learners?
- Do learners’ knowledge of the content differs? If so, is it desirable to allow learners to decide the depth of the content they want to pay attention to?

**Response**

In this type of interactivity, a question or activity that requires learner’s response is used to encourage learner involvement and hence promote learner engagement in the learning process. The response from the learner is analysed or evaluated by the computer which then provides a feedback to the learner to guide or reinforce learning. This is somewhat similar to the Update interactivity described by Sims [18].

**Response** interactivity can take the form of simple questions such as MCQ or T/F questions, or activities that require manipulation of the elements on screen such as drag-and-drop or matching activities. This type of interactivity can be used to trigger relevant prior knowledge (Figure 5), scaffold learning (Figure 6), check learners’ understanding (Figures 7 and 8), summarise learning (Figure 9), extend learning (Figure 10) or evaluate learning (Figure 11).
In this activity, after learning about the characteristics, operations and systems design of roller conveyors, learners are guided to summarise their learning in the form of a concept map.

In this activity, learners are encouraged to extend their learning on the characteristics of RAM and ROM by creating a graphic organizer to compare the two types of memory.

This is an example of a game-based quiz at the end of an e-learning lesson to evaluate learners’ learning of the content.

Taking into consideration the purposes of \textit{Response} interactivity discussed above, the following guiding questions were used to help determine when and where to include this type of interactivity:

Can questions or other activities be used to elicit responses from learners:
- at the beginning of a lesson or a chunk of content to activate relevant prior knowledge?
- when teaching a particular chunk of content to scaffold learning by focusing learners’ attention on important points, getting them to think about the content or guiding them to arrive at the appropriate conclusion?
- after teaching a particular chunk of content or at the end of the e-learning lesson to check learners’ understanding or summarise/extend/evaluate their learning?

\textbf{Manipulate}  
This type of interactivity engages learners by encouraging exploratory learning whereby learners are guided to arrive at a concept, rule or principle. A well designed interactive manipulative allows learners to be engaged in interactive hands-on exploration of the concept leading to deeper understanding. Broadly speaking, there are two types of manipulative activities:

- \textbf{Concept-development}: This type of manipulative activity allows learners to manipulate different elements of an object or different objects to discover the underlying concept, rule or principle as illustrated in Figures 12 and 13.
- \textbf{Computation-illustrating}: This type of manipulative activity typically presents a formula and allows learners to vary the variables in the formula to arrive at a deeper understanding of the formula, as illustrated in Figures 14 and 15.
In this activity, learners can vary the number and observe how the formula is used to calculate the BCD code.

In this activity on statistics, learners can vary the number of objects selected and the way the objects are arranged to observe how these variations affect the final answer, thereby gaining a deeper understanding of the formula used for dynamic partition.

Taking into consideration the purposes of **Manipulate** interactivity discussed above, the following guiding questions were used to help determine when and where to include this type of interactivity:

- Can learners manipulate certain variables to arrive at a concept or gain a deeper understanding of a concept?
- What are the variables and how can the variables be manipulated?
- What guidance would learner need to arrive at the appropriate conclusion?
- How can their conclusion be reinforced and/or extended?

**Co-construct**

This is similar to the **Construct** interactivity described by Sims [19], which requires learners to manipulate objects or content elements to achieve a specific goal. It allows learners to work together with the computer to perform a certain task or create a certain product, such as constructing a circuit (Figure 16) or drawing up a Profit and Loss Statement (Figure 17). Such interactivity engages learners by making learning more purposeful and hence meaningful for the learners. Appropriate and adequate scaffolding or guidance is provided where necessary to help learners complete the task.

In this activity on Applied Pneumatic Control, learners are guided to construct the circuit for a four-air-group cascade design, with adequate scaffolds in the form of the Help feature.

In this activity, learners are guided to draw up a Profit and Loss Accounts, performing the steps an expert would go through when doing the same task.

Taking into consideration the purposes of **Co-construct** interactivity discussed above, the following guiding questions were used to help determine when and where to include this type of interactivity:

- Can learning be made more purpose and meaningful by requiring learners to perform a task that leads to an observable product?
- What support or tools would learner need to complete the task?
- What prompts or cues would learner need?

4. Guiding lecturers to use the classification

To guide our lecturers to use this classification effectively, an eCourseware was developed. This eCourseware highlights the need for interactivity and
describes each type of interactivity in the classification. Examples are used to illustrate the characteristics of each type and guiding questions on when and how to use each type are provided.

A group of 7 lecturers went through the eCourseware in July 2004. An informal group discussion was held to gather feedback on the usefulness of this classification. The following questions were asked:
- Does the classification help you to have a better understanding of interactivity?
- Will it help you to design quality interactivity that promotes active cognitive engagement?
- How does this classification help you to design quality interactivity that promotes active cognitive engagement?
- Can this classification be improved upon?

Feedback gathered was encouraging. In general, the lecturers felt that the classification and the examples help to expand their perspective of interactivity from that of “point-and-click” to include those that promote active student involvement and cognitive engagement. They were positive that the classification could serve as a scaffold for them when they started designing interactive activities for e-learning. They felt that it would make them more conscious of designing a wider spectrum of interactivity activities, ranging from those that engage students in making decision on the sequence, pace and depth of the content to those that involve high cognitive effort in making meaning from the content. To verify whether this classification is indeed useful, the first e-learning resource developed by the lecturers in October 2004 were reviewed. The review showed that the lecturers were able to include a wider spectrum of quality interactivity activities that promote effective learning.

5. Conclusion

Many educational institutions are investing heavily in e-learning but find it a challenge to develop resources that engage learners. Engaging learners in the process of learning involves designing interactive learning activities that foster active participation and meaningful interaction with the content. This classification of interactivity can provide a clear understanding of interactivity and encourage the design of interactive learning activities that will engage learners thus promoting effective learning.

References: