Interactivity – the Good, the Bad and the Ugly

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Abstract

Ever since digital technology began to play a role in education, elearning products have been sold by using the term “interactivity”. Interactivity was one of the most important buzzwords in the multimedia heyday. A closer look on different elearning solutions makes clear that interactivity seems to be different things to different people. In this paper I would like to give a definition of the term and show different examples of interactive elearning content. These examples will be classified using the taxonomy of interactivity in multimedia developed by Rolf Schulmeister.

The goal of this paper is to give an idea of what interactivity can mean in an elearning context and how different levels of interactivity can be distinguished. Furthermore criteria for good interactive elements are introduced.

1. Introduction

Many educators believe that digital technology has the potential to fundamentally transform and improve the learning process [1]. In the mid-nineties of the previous century the term “interactivity” had developed into one of the favourite buzzwords of the computer industry [2] and almost any educational software was tagged with the term “interactive” in order to boost sales. This fact makes it worthwhile to take a closer look at this term, to try to specify the meaning of it in a variety of different context and furthermore to try and distinguish different levels and/or qualities of interactivity.

2. Definition

Although it has been around for many years now and although it is being still under continuous debates over its meaning” [3] as there are several conceptual views of it. The UNESCO defines interactivity as the “reciprocal process of information exchange between two or more "players" in communication, or more specifically learning. "Players" can be pupils, facilitators, peers but also automated learner resources, like databases and other CAL devices” [4].

But this process – orientated view is usually subsumed under the term “interaction”, not “interactivity”. The terms “interaction” and “interactivity” are sometimes used to describe the same thing, and sometimes one of these terms is used to describe two different things, which adds to the confusion.

Su et al. report “considerable debate” in the literature over the definition of interaction and come to the conclusion that the words “interaction” and “interactivity” describe the same thing from different angles. Whereas “interaction” can be regarded as more process-oriented and focused on dynamic actions, “interactivity” is more feature-oriented and describes the characteristics of a software system or the degree of interaction that a software system makes possible [5].

Anderson and Garrison [6] distinguished between three types of interaction:

- Student <-> Teacher
- Student <-> Student
- Student <-> Content

In the context of this paper I would like to concentrate on the interaction between student and content and define “interactivity” as the level or quality of a Student <-> Content interaction in which “content” stands for a piece of educational software (CBT, WBT, Applications, Simulations).
3. Types and Levels of Interactivity

If we take this feature-oriented approach to define interactivity the question arises what different “levels” or “qualities” of interactivity can be distinguished. Just counting the number of times learners are actively engaged with the content to differentiate between “high” and “low” levels of interactivity (as suggested by Anderson [6]) reduces interactivity to a quantifiable attribute and can not be regarded as a satisfying approach.

The IEEE Metadata – Standard [7] differentiates between three types of interactivity according to the flow of interaction between the content and the user:

- Active
- Expositive
- Mixed

“Expositive” in this context means that the information flows mainly from the content to the learner. The standard describes expositive learning as learning that occurs “when the learner’s job mainly consists of absorbing the content exposed to him”

“Active” in this context is referred to as “content that directly induces productive action by the learner”

This classification scheme is confusing as it remains unclear where there is interactivity in absorbing content that you are exposed to. As there is no reciprocal process or information exchange involved there also is no interactivity according to our definition. It also remains unclear what “mixed” could mean in this context.

The taxonomy of interactivity developed by Rolf Schulmeister [8] is a more precise model and defines six levels of increasing interactivity. Schulmeister defines interactivity as learners’ possibility to actively manipulate the content, causing deep thinking and stimulating the actual learning process. Actions learners undertake to navigate through elearning content are not regarded as interactions, thus applications which only offer “next” or “previous page” buttons to click on are not considered to be interactive at all. Especially in the early days of elearning these so called page-turners were often wrongly labelled interactive.

3.1. Observing Content

The first and lowest level of interactivity according to Schulmeister is reached if the learner can watch or play back content without having any influence on the representation of the content. The typical example of this level of interactivity is the learner clicking on a play-button which results in the display of a movie or an animation:

Pic1: Interactivity level I - playing a movie

The didactical functions of these components are information, instruction or illustration.

3.2 Observing multiple Representations

On the second level of interactivity the learner still cannot really influence the
content but he can choose between a variety of different alternatives of the representation of the content. Typical examples for this level of interactivity are so called rollover-pictures with hotspots. As learners interact with the content, the content changes, but all changes have been predefined.

3.3 Varying the representation

On this level of interactivity the learner can actively influence the representation of the content, for example by scaling or rotating it. It is however not possible for the learner to change the content itself. This level of interactivity is important in motivating learners and getting them involved with the subject.

3.4 Modifying the Content

This level of interactivity allows the learner to actually produce the content within certain restraints. Through the learners input of certain variables or parameters different representations of the content are generated. This level of interactivity facilitates discovery learning as introduced by Bruner [11].

The picture above shows a detail from an application designed to help students grasp the concept of correlation. In different tasks learners are asked to produce a desired coefficient of correlation by placing dots (representing values) on a data matrix. Students can watch how the coefficient of correlation changes as they place their dots and get instant feedback on their actions through the slide bars (bottom-right) in the application. This level of interactivity clearly triggers deep thinking and enables learners to discover coherences.

3.5 Creating the content

The fifth level of interactivity is reached when learners have the possibility to actually create content themselves. This level of interactivity can usually only be reached by applications which offer the necessary complexity. This level often is implemented in programming environments where
users can experiment with the basic concepts of programming, as shown in the example below:

```
1 program
2 |
3 | nowrobot testbot(1,2,3,5)
4 | testbot.move()
5 | if testbot.front_is_clear
6 |   testbot.move() |
7 | |
8 | else
9 |   testbot.turn_left() |
10 |
11 |
12 | |
13 |
```

Pic5: Interactivity level V – programming environment [13]

This picture shows a detail from a programming environment designed to help novices of computer science get an idea of the most important programming concepts. The learners can produce content, meaning “program” robots with the help of an interface which makes it easy for them. The code which is produced is displayed on the left side. It can also be executed to see the results.

3.6 Creating content, manipulate it and get intelligent feedback from the system.

The highest level of interactivity involves the possibility for students to create the content and the ability of the software to give meaningful feedback which enables learners to modify the content according to their goals. This is about as close you can get to a teacher-to-student relationship in a student-to-content context.

Schulmeisters model offers a feasible guideline to determine the interactivity-level of specific elearning contents. However, it should be noted that the edges between the levels are blurred; most of the implementations of elearning vary between different levels of interactivity and sometimes contain components which are between two levels.

4. Criteria for good interactive Software

The quality of educational software depends on many factors and there are many different quality guidelines and checklists. In this paper I just want to give few criteria on an abstract level. These criteria are partially based on the work of Hartmann and Reichert [1].

4.1 Appropriate Level of Interactivity

It is important not to confuse "high" interactivity with "good" (or "low" with "bad") interactivity. Although a high level of interactivity is basically desirable as it usually offers more possibilities for learners to actively engage with content and thus allowing for more processing depth, it is more important that interactivity levels correspond with the learning goals.
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Video, for example, should only be used if it is important to convey emotion, depict a fact or show a natural movement. If this is not what you want an illustration or a still image might be the better choice as it gives you the possibility to eliminate unnecessary detail that might distract learners [15].

4.2 Support learning

Sometimes educational software features interactive elements (e.g. animations) which have little to do with the learning matter. These elements are often justified with loosening up the learning process, bringing a fun element into learning or motivating learners.

4.3 Support different cognitive levels

According to the well-established taxonomy by Benjamin Bloom [16] there are six cognitive learning levels of increasing complexity (knowledge, comprehension, application, analysis, synthesis and evaluation). Good interactive software also addresses and supports higher cognitive levels e.g. it do not only convey knowledge but it also allows learners to apply and analyze the learning matter.

4.4 Meaningful Feedback

Good interactive software gives feedback that assists users in the learning process. Ideally, the feedback does not only give information whether an action was right or incorrect, but also additional information which helps learners realize where and why they went wrong.

4.5 Design / Usability

The user interface of any software should be as self-explanatory as possible, since it is not the subject but only a means to give learners access to the content. Quite often the design is dominating the Screen in a way which distracts learners form the learning matter.

4.6 Good cost-value ratio

Most of the time elearning content does not reach higher levels of interactivity. This is clearly so because there is a correlation between the level of interactivity and the developing cost which is why the denoted developing costs for one hour of elearning vary a lot (e.g. between 25,000 and 75,000 Euros) [17]. “Cost” in this context not only relates to money, but also to know-how and time it takes to develop the content and also the effort the learners have to undertake to use an interactive element. Often learners also have to “pay” for higher interactivity with increased data volume (which results in slow downloads) and increased technical complexity (e.g. installing a plug-in) making the interactive element hard to use. This is why it is essential that interactive elements have a good cost-value ratio meaning the added didactical value must justify the costs – in every aspect – of the interactive element.

5. Conclusion

“Interactivity” is a somewhat imprecise but nevertheless important term when it comes to describe the characteristics of elearning software. The taxonomy developed by Schulmeister offers a viable way to classify the level of interactive elements, whereby “higher” not necessarily means “better”. There are some characteristics which help us to judge not only the level, but also the
quality of interactive elements. However, there is no determinated set of criteria suitable for all kinds of interactive elements, and so we have to take a closer look at the element and its context to come to a reliable judgement.

References


