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Is the expression "Instructional Engineering" justified?

Sylvie Doré
École de technologie supérieure
1100, Notre-Dame Ouest
Montréal (Québec), Canada H3C 1K3
sylvie.dore@etsmtl.ca

Josianne Basque
Télé-université
4750, avenue Henri-Julien, bureau 100
Montréal (Québec), Canada H2T 3E4
jbasque@teluq.quebec.ca

Abstract: In this text, we explore the similarities between engineering and instructional design, in terms of methodology, tools used and emerging trends (growing consideration for the client, research of quality, prototyping, concurrent approach). We conclude that the expression “instructional engineering” is amply justified.

Introduction

In recent years, instructional design (ID) is more and more often equated with instructional engineering (Paquette, Crevier and Aubin, 1999). Engineering is a process covering the whole life-cycle of a product. The engineering process is generic as is applied in all fields where one has to image a solution that will satisfy the needs of potential customers whether those needs be educational, financial, medical, etc. When this process is put to use to solve a problem industrial in nature, it is said to be applied to the *field* of engineering. Similarly, the ID process has been traditionally defined as this whole cycle of analysing, designing, producing (or developing), evaluating, implementing and revising a learning system. In this sense, the expression “instructional engineering” is well justified. As we will see throughout this presentation, it is not the only reason.

Tools

In both fields, engineering and education, introduction of computers has greatly increased the productivity of the designers by easing the creative process, by facilitating modifications, by performing simulations more rapidly. But what about supporting decision making within the engineering process?

In 1992, Spector and his colleagues predicted that the automation of the instructional engineering process (through the use of expert systems) would evolve in much the same way as word processors have. Unfortunately, the passage of time has not proven them right. The use of expert and other knowledge-based systems is much more frequent in engineering. This may be explained by the fact that a large portion of the body of knowledge is rooted in “hard” science as opposed to “soft” science, much more open to debate, in the field of education. Furthermore, the rules included in educational expert systems are much more difficult to formulate.

Quality

One usually associates quality with a lack of defects, with reliability. In engineering, nowadays, a quality product is one that responds to the needs of the customer. One can therefore never overemphasize the importance of the first phase of the engineering process: problem definition. This is true irrespective of the field.

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Traditionally, problem definition has been performed through analysis. A growing number of companies developing new engineering products rely on Quality Functional Deployment (QFD), a method devised to clearly identify customer needs. The method rests on a graphical tool called the House of Quality. While developing a technology-enriched course, we used this tool and found it to be a highly effective communication and design tool.

Another mean of achieving quality in engineering is through a prototyping approach as proposed by Smith (1991), which is also an emerging trend in education (Moonen, 1996; Tripp and Bichelmeyer, 1990). Needs and requirements are no longer viewed as input but as output of the design phase. The goals of the prototypes are to solicit, to elucidate, to define customer needs and requirements. The method is useful if a prototype can be easily and quickly produced, thus the expression “rapid prototyping”. In general, the more specific the tool used (from general programming languages to learning systems shells), the more quickly the prototype is produced. Merrill (1996) does warn however that education authoring tools do require some type of programming, that they are not neutral with regard to instructional theory and that the user must have some knowledge of ID. Ignoring these warnings may result in an inadequate product, that is one that lacks quality!

Concurrent engineering

The classical work organization is sequential. This type of organization is often referred to as “over-the-wall” or “waterfall” since each team works independently of one another, with minimal communication. This lack of true communication results in multiple errors, increase in development time and cost. *Concurrent engineering* was devised to overcome these shortcomings. The proposed solution is simple : create a single multidisciplinary team, whose members work concurrently on different aspects of the product. A mounting body of literature is available to document the effectiveness of the concurrent engineering process when applied to the field of engineering. Meanwhile timid incursions are observed in the field of education. Most classical ID models have a bias for sequential engineering with numerous feedback loops providing for iterations, very few incorporate task parallelism. However, there exists a few attempts to embed concurrent engineering in ID (Paquette, Crevier and Aubin, 1999).

Conclusion

Our analysis shows that the expression “instructional engineering” is amply justified. The similarities between engineering and ID, in terms of methodology, tools used and emerging trends (growing consideration for the client, research of quality, prototyping, concurrent approach) are quite amazing. Up to now, there have been very few occurrences of borrowing engineering principles to shed new light in the field of ID (Teslow, 1997; Yang, Moore and Burton, 1995). Our own experience of combining ID and engineering expertise to the task of developing a computerized learning environment and to reflect together on the theoretical underpinnings of both fields has been an experience which gains to be repeated by others and become a practice more widely spread.

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