SOME QUALITY CONSIDERATIONS IN THE DESIGN AND IMPLEMENTATION OF LEARNING OBJECTS

By

TOM PAGE* G. THORSTEINSSON**

* Department of Design and Technology, Loughborough University, UK.
** Department of Design and Craft, University of Iceland, Iceland.

ABSTRACT

This paper presents the reflections of teachers regarding the use of ICT in teaching and their implications for students' quality of learning as well as on quality of teaching behaviours. The research data was collected in the frame of FISTE-project, A Future Way for In-service Teacher Training across Europe. It is argued that ICT is a key factor for positive changes in teachers' pedagogical thinking and skills. The question of different manner of ICT use in education is analyzed together with their impact for different other components of the educational process.

Keywords: Pedagogical use of ICT, Educational Beliefs.

INTRODUCTION

Information and communication technology has a ubiquitous presence in schools throughout Europe. Nevertheless, there are questions regarding their effective use in the classroom. The impact of ICT depends greatly on how it is used. Traditionally, it was generally considered as an educational resource that mediated the transfer of educational content. However, more recently ICT is considered to comprise real learning objects that carry inner content. The term learning object represents, in an illustrative way, the complexity of an ICT based teaching product that not only facilitates the transmission of knowledge, but also require a reconsideration of other variables of the teaching situation. Teachers must develop new pedagogical skills in order to manage, create and effectively use such complex learning situations. This article refers to the pedagogical design of learning products created by 45 teachers from Reyjavik (Iceland) and Loughborough (UK) who attended the FISTE on-line course on effective implementation of ICT tools in classroom settings created in the frame of the Comenius 2.1. Their task was to explore different ICT tools and to produce a complex learning material by using one of the presented tools. Consequently, they integrated the created learning tool or object into a teaching / learning situation (Page, Lehtonen, and Thorsteinsson, 2006).

Relationship between ICT Tools and Possible Types of Learning

Development of a large variety of means and instruments that aim to optimise classroom teaching and learning based on the educational use of ICT tools determined a number of reflections regarding the actual added-value that the use of ICT provides teaching and learning. While most educational software and ICT tools aim to improve students learning, they propose different innovative teaching approaches.

The drive to continuously improve their effectiveness in using ICT tools in teaching, and reflecting on the specific and pedagogical background of such tools, teachers question their understanding with regard to teaching behaviours and beliefs, type of relationship with students, role of the contents and curriculum requirements and the role of evaluation in learning. Thus, the effective implementation of ICT tools in the classroom has the potential of becoming a support for a paradigm change in education, due to its influence on teachers' general beliefs regarding teaching and learning.

There is research evidence to state that that there is a positive correlation between views of the teachers and their respective educational practices (Page, T. and Thorsteinsson, 2007). Consequently, it can be expected that classroom implementation of ICT tools, will positively

influence their general teaching behaviour. In fact, as it is depicted in the table below, different types of ICT tools support different types of learning which directly implies that each ICT tool has a specific teaching and learning potential and it will be used for meeting specific learning objectives. Table 1 integrates the most frequently used in education ICT tools and resources.

While web-based and multi-media resources, electronic libraries and databases are focused on knowledge content it is nevertheless important to define the expertise and role played by the teacher. Teachers facilitate through guiding the student through the body subject knowledge content. Here one can adopt other ICT tools like, video production and analysis tools, computer based assessment and streaming video to focus on attaining specific learning objectives. Other computer based tools, such as conferencing and videoconferencing systems, integrated learning environments, discussion lists and newsgroups, learning platforms, student web publishing focus on creating deep learning processes, promoting the adaptive, transformative learning.

Teachers tend to use these tools and invite students to use them in project and discovery based learning situations and learning contexts still considered that innovative in most of the European countries. In this study, we attempt to elicit views of the teachers regarding the characteristics of efficient learning situations in relation with the use of ICT tools as facilitators of learning.

ICT tools and resources	Emphasizes	Tutor as …
Web-based resources Electronic libraries & databases Multimedia resources	content	Expert (adoptive learning)
Productivity and analysis tools Computer-based assessment Streaming video	objectives	
Integrated learning environments Discussion lists & newsgroups Learning platforms Student web publishing Conferencing and videoconferencing systems	processes	Facilitator (adaptive learning)

Table 1. ICT tools and types of learning

Computer screen movements recorded with Camtasia

The authors used Camtasia to record video of the computer screen activity. He also used a camcorder to make video recording showing both individuals working in the classroom and their work in the VRLE. To use a camcorder is probably the simplest method to record screen activities. The camcorder is set up on a tripod, pointed at the screen and a record made. Although simple, the resulting video is usually unclear and hard to read. This technique is useful for getting an idea of what the user did, but it can be difficult (sometimes impossible) to read small text (Goodwin, 2005). Sometime the frequency of the screen does not match to the video camcorder when it is recorded and the images of the computer screen movement are unclear.

Camtasia is a software solution or a program that runs in the background, silently capturing everything that appears on the screen and saving it to a video file. The result is recording with no loss of detail. Each frame of the resulting video can serve as a screenshot and the video can be seen at different speed. The software is not intended to facilitate live interaction between multiple computers. As the name implies, Camtasia mimics the behaviour of a video camera. As a result, it shares many of the benefits of videotaping while avoiding several of the pitfalls (Goodwin, 2005).

Camtasia consists of three pieces of software: the Recorder, the Player, and the Producer. The Recorder must be set up on the computer to be used. Before the video recording begins a test administrator sets the software to record. From that time forward Camtasia records all activities on the screen. Recordings are saved in avi file format. Sound can also be recorded.

The Camtasia Recorder can record the whole screen or a particular window. It can also be set to highlight the mouse clicks. For instance, a highly visible red circle can appear around the mouse pointer as it clicks, making it easy for the observer to see essential actions on the

screen. However, these highlights also occur on the user's computer, so it may be disruptive to use this feature while attempting to gather data in a natural situation (Goodwin, 2005). The recorded file is explored with the Player. The player includes standard controls to pause, fast forward, and rewind the recording. The Producer enables the observer to edit the video. The work can be saved in different formats.

Method: Using grounded theory for analysing video data

The primary author collected screen capture video data with Camtasia and based analysis on grounded theory. Grounded theory consists of a systematic inductive strategy for collecting and analysing data in order to construct theoretical frameworks that describe the collected data (Denzin and Lincoln, 1994). This enables the researcher to identify emerging categories in a set of data and then to develop initial hypotheses which can be tested iteratively. It focuses on obtaining an abstract analytical schema of a phenomenon related to a particular situation (Creswell, 1998). However, Strauss and Corbin (1998) explicitly pointed out that the value of grounded theory lies in its ability not only to generate the theory but also to ground that theory in data. This inductive method is particularly helpful in identifying patterns of behaviour or thought in a particular group of people as in this enquiry.

Four characteristics of Grounded Theory, (Glaser (1978):

1. A theory must have fit: A grounded theory is loyal to the everyday realities of a substantive area or must be carefully brought out from various data.

2. A theory must have relevance: Grounded theory arrives at relevance because it permits central problems and processes to appear.

3. A theory has to work: A theory should be able to explain what happened, predict what will happen, and interpret what is happening in an area of substantive or formal inquiry.

4. A theory must be readily modifiable: The generation of grounded theory is an ever-modifying procedure.

The core of grounded theory data analysis is a continuous coding procedure. Analysis will start with open coding - the data are examined step by step to define actions or events within the data. This coding analysis will likely lead to "refining and specifying any borrowed existing concepts" (Strauss and Corbin, 1998). Next, there is axial coding, which is meant to build conceptual relations between a category and its subcategories. Then, concepts and sub-concepts are further defined by selective coding, "an integrative process of selecting the core category, systematically relating it to other categories, validating those relationships by searching for confirming and disconfirming examples, and filling in categories that needed further modification and development" (Strauss and Corbin, 1998).

Codes and categories will be sorted, compared, and contrasted until all the data are accounted for in the core categories of the grounded theory model, and no new codes or categories can be formed, i.e. saturation is reached (Bernard, 2002). The researcher also needs to write analytic and self-reflective memoranda to document and enrich the analytical procedure, to make understood thoughts clear, and to expand the data quantity. Analytical memoranda consist of questions and speculation about the data and emerging theory.

Sample

The educational use of ICT implies a reconsideration of views and practices regarding teaching and learning. This fact became obvious when we analysed the educational project scripts obtained as products of the on-line courses we delivered within the FISTE project. The ways in which teachers create and integrate ICT into a lesson scenario results in an innovative way of looking at the lesson itself. Either if teachers aim to familiarise the students with the use of ICT tools or if he/she uses a ready made ICT product for presenting new information or skills, the specific learning situations become more relevant for the students. The study is based on the reflections on teachers' experiences in designing ICT-based teaching and learning situations, and in developing ICT based teaching sequences in the classroom.

The data is taken from the reflection of the 45 educational

project scripts describing different ways of implementing classroom learning products created with the aid of Camtasia Studio software. As an outcome of the course, the sample of 45 teachers in this study, created lesson project scripts. This course was a pilot research investigation within the FISTE project, A Future In-service teacher training across Europe. The participants in the course created an ICT resource with one of the ICT tools (Camtasia Studio, IVisits) provided the course. They described the use of these tools within a specific teaching and learning context. The reflection section of the project lesson script included the following instructions:

? Write shortly your self-reflection regarding the quality of your designed project. Here you have some questions that could guide your reflection:

? What do you think are the strong / weak points of this project?

? What added formative value brings the use of the ICT tools in the designed lesson?

? What adaptation would you need in the school/ class you work in for successfully implement this project?

These questions were intended to guide teachers reflections at the end of the lesson design process, as well as after the implementation of these projects into the classrooms.

Results and Comments

After analysing the reflections given by the teachers they were grouped into two main categories: one regarding the positive outcomes of ICT tools for students learning and the other regarding the difficulties anticipated for the implementation of these tools in the classroom. The general view of the teachers regarding the educational use of ICT is that computers and educational ICT resources must contribute to an optimisation of teaching and learning conditions. Furthermore, that ICT must encourage active (interactive) learning i.e. learning through understanding and transferable learning.

76% of lesson scripts included at least one hands-on exercise or learning action such as: group discussions, decision-making, argumentations, modelling of recorded computer actions and creating original products using the newly learned software for improving their work, co-operating. Learning through understanding was also mentioned by the teachers (better understanding of contents is mentioned in 46% of teachers' reflections) as one of the benefits of ICT based educational situations. Enhanced understanding of knowledge was assured through:

? presentation of contents through multiple sensorial channels (multimedia tools allow identifying multiple reference points and clues for learning),

? possibility for the students to go back to the support materials as many times as needed, and

? the ICT support materials represent contextualized contents and use of skills.

The development of students' autonomy and independence in learning situations was a frequent reflection of the teachers and this correlates with the those project scripts that placed students' learning contextually in computer software. Specific learning objectives related to the development of autonomous learning skills were usually set in these cases.

Most of the teachers that intend to integrate ICT tools in the classroom will offer students ready-made ICT resources. Further to this, they will observe, support and create learning situations that place students in direct interaction with the computer and specific software. This was also the case in FISTE on-line course, as 84% of teachers explored the formative consequences of students' active interaction with ICT tools or products. This took the form of:

? ICT based exercises, such as correcting one printing setting in MS Publisher

? Interactive exploring of screen recording or narrated slides Camtasia products

? Modelling of screen recording Camtasia products indications.

One conclusion that became obvious in the FISTE project was that ICT has advantages and disadvantages (Page, and Thorsteinsson, 2007). Provided that teachers intend to place students directly with the computer, they must be sure that the quality of hardware and software is appropriate and also that there is an alternative plan in

the event that the technology fails to work (Page, Thorsteinsson, Uden, and Lehtonen, 2008). In a more detailed manner, the positive outcomes identified by the teachers that created ICT teaching products focused on cognitive benefits that provided an improved understanding due to visual support, easier exemplification and better retention rate. Social benefits were identified in enhanced communication regarding the subject and improved learning environment and motivational benefits.

Positive comments were made in terms of type of cognitive benefits that the ICT based learning situations provide for the learners. 41 % of the teachers mentioned the benefits that ICT tools offer for improving students content dependent skills and knowledge. In terms of increased knowledge and understanding as well as good practice in the repetitive use of ICT based learning materials transferable skills and knowledge were identified as follows:

? an ability to use alternative information sources

? an understanding of usability of ICT tools beyond its technical inner use

? development of a positive attitude towards knowledge and science

? development of initiative and disponibility of approaching diverse learning situations.

A significant percentage of participants (22%) recognised possible aesthetic benefits using Camtasia Studio products in teaching students about the aesthetic rigours of presentation, use of colours, sequences of slides and management of artistic elements incorporated in the narrated slides or screen recordings created by the teachers. Figure 1 presents a statistical view of teachers' comments and reflections.

Apart from all the above mentioned benefits, the great majority of teachers identified certain specific difficulties that are inherent to implement ICT tools in the classroom (listed below and depicted in Figure 2).

? Technical difficulties: lack of technical skills, lack of technical assistance, lack of computers (highly performing computers) (34%).

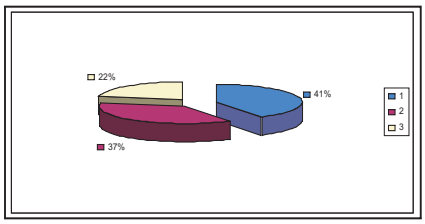

Figure 1. Positive disciplinary and transferable outcomes

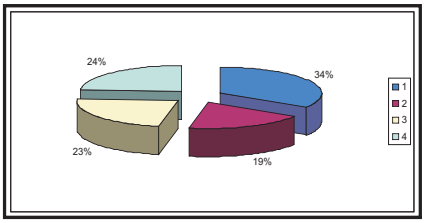

Figure 2. Difficulties and limits

? Access to ICT: limited access to computer rooms or video projectors (24%).

? Time limitations: time consuming tools in terms of designing learning objects; time consuming in terms of delivery, insufficient time allocated to this type of lessons(23%).

? Extra time needed for designing the lessons and the learning objects (19%).

The percentage of teachers that mentioned lack of technical skills or help as a possible barrier towards the ICT tools implementation enable us to reflect on the further needs for general teacher training on the effective use of ICT tools from technical perspective. Nevertheless, the use of these new technologies in the classroom implies multispecialised team cooperation.

Conclusions

Education is very sensitive to society changes, as, in one hand, the beneficiaries of the educational services are part of the society and its ongoing development and, on the other hand as the school promotes and works with knowledge of the society. With regard to actual needs of the community such as professionals working in challenging and cooperative settings, youngsters are able to find and effectively use information and knowledge to construct their understanding of the world and to solve problems in a creative manner. This has led the curriculum team to study changes in the ways in which

we consider teaching and learning, the role of the teacher and the sense of the school itself (Lehtonen, Page, Thorsteinsson, and Hepburn, 2007).

One particular motivation for these changes proved to be the large scale use of Information and Communication Technologies (ICT) in present society and its extraordinary development. If educational use of ICT became very soon a reality of the schools the relevant use of these tools registered a constant evolution, from the initial phase of developing skills and knowledge in the actual use of the new technologies to integrating ICT as part of ordinary teaching as well as part of the school systems and educational reforms. The manner schools decide to implement ICT tools into their educational activity always depends on numerous factors such as:

? the general view they share regarding the quality teaching and learning, educational goals and values,

? educational aims they target,

? their motivation and opportunities,

? institutional style and methodology,

? the existing expertise regarding ICT, and

? social context and personal issues.

In practice, the way in which we decide to integrate new technologies in school is dependent of the particular configuration the above mentioned factors take. This article presented the view a limited group of teachers had regarding the classroom impact of ICT based learning tools (Thorsteinsson, Page, and Lehtonen, 2007). The group of teachers we worked with were part of a community where the new technologies are still a novelty as used in education. Their enthusiastic involvement in designing ICT based learning tools and objects was doubled y a real concern regarding the possible impact that these tools would have at the level of students' learning (Page, Thorsteinsson, Lehtonen and Niculescu, 2008).

Generally, these teachers appreciate and understand that ICT becomes a real learning tool in educational settings and that it is useful for the training of certain transferable skills for both teachers and students alike (Thorsteinsson, and Page, 2007). While teachers have the capacity to reflect honestly and realistically about the possible impact that ICT will have in the classroom, their work determines us to think that there is an obvious need for continuing teacher training and support in effective use of ICT in education.

Acknowledgements

The article is made in the frame of FISTE project: A Future In-Service teacher Training across Europe No. 118766-CP-1-2004-1-COMENIUS-C21. We thank all the teachers who enthusiastically involved in the on-line course and offered their experiences and reflections.

References

[1]. **Bernard, R., H., (2002).** *Research Methods in Anthropology: Qualitative and Quantitative Methods.* Walnut Creek: AltaMira Press.

[2]. **Creswell, J. W. (1998).** *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: Sage.

[3]. **Denzin, N. K., & Lincoln, Y. S. (1994).** (Eds). *Handbook of Qualitative Research.* Thousand Oaks, CA: Sage Publications, Inc.

[4]. **Glaser, B. (1978).** *Theoretical sensitivity.* Mill Valley, CA: Sociology Press.

[5]. **Goodwin S., (2005).** Using screen capture software for web site usability and redesign buy-in. *Library Hi Tech* Vol. 23 No. 4, 2005 pp. 610-621. Emerald Group Publishing Limited, Texas University.

[6]. **Lehtonen, M., Page, T., Thorsteinsson, G. and Hepburn, M. (2007)** An Application of a Virtual learning Environment in Support of Teaching and Learning for Design and Technology Education, *International Journal of Learning Technology*, 3(2), pp 133-151.

[7]. **Page, T., Lehtonen, M. and Thorsteinsson, G. (2006)** The web-orientation agent (WOA) for simulated learning in technology education, *International Journal of Learning Technology*, 2(1), pp 62-76.

[8]. **Page, T. And Thorsteinsson, G. (2007)** Practitioner-Based Approach to Virtual Reality Learning Environment Research, *i-managers' Journal of Educational*

Technology. 4(1), pp 53-65.

[9]. Page, T. and Thorsteinsson, G. (2007) Implementing the FISTE Educational Technology for Electronic Design and Technology Education Using BSCW at Loughborough University. *i-managers' Journal of Educational Technology*. 4(3). pp.39-45.

[10]. Page, T., Thorsteinsson, G., Lehtonen, M. and Niculescu A. (2008). A Pedagogical Consideration of Technology Enhanced Laboratory Work in Technology Education, *Journal of Studies in Informatics and Control*, 17(1), pp.85-94.

[11]. Page, T., Thorsteinsson, G., Uden, L. and Lehtonen, M. (2008). A Methodology for the Evaluation of Online Learning Resources". *i-managers' Journal of Educational Technology*. 4(4), pp.16-27

[12]. Strauss, A., & Corbin, J., 1998, *Basics of qualitative research*. Thousands Oaks, CA: Sage Publications.

[13]. Thorsteinsson, G. and Page, T. (2007). FISTE: A European Project for In-Service Teacher Education, *CETA Magazine, Jornadas Pedagógicas Para La Enseñanza De Inglés, Cordoba. 9th Edition*, pp 30-35.

[14]. Thorsteinsson, G., Page, T. and Lehtonen, M. (2007). Pedagogic Development of Computer Applications and Learning Tools in Design and Technology education". *Educatia 21, Colectia Stiintele Educatiei*, *University of Babes-Bolyia, Cluj-Napoca, Romania*, 4(1), pp.97-115.

ABOUT THE AUTHORS

Tom Page, Ph.D., is a lecturer of Electronic Product Design in the Department of Design & Technology at Loughborough University, England. He graduated from Napier in 1988 with a degree in 'Technology with Industrial Studies' and started employment with Ferranti Defence Systems Ltd., as a design engineer from 1988 to 1990. In 1990, he returned to Napier Polytechnic as a Research Assistant and worked between there and the Engineering Design Research Centre (EDRC) at the University of Glasgow. In 1992, he attained a M.Phil by research in engineering design methodology for his work at the Engineering Design Research Centre. On completion of this work, Tom took up a teaching post in Computer-Aided Engineering at the University of Hertfordshire. In 1995, he became a Chartered Engineer with full membership of the Institution of Electrical Engineers (IEE) and was promoted to senior lecturer in Computer-Aided Design and Manufacturing. Whilst at Hertfordshire, Tom pursued his research interests in Electronics Design for Manufacturing and Assembly which led to the award of a PhD in 2001. He is also a full member of the Institute of Learning & Teaching (ILT). His research interests include electronics design tools, electronics design for manufacturing and assembly and engineering/ technological education. To date he has over two hundred research publications in these areas.

Gisli Thorsteinsson is working as an Assistant Professor at Iceland University of Education, in the Department of Design and Craft Education. At present, he is also a Ph.D student at Loughborough University in England, where he is exploring the pedagogical values of using Virtual Reality Learning Environments for improving ideation in the context of Innovation Education in Iceland. He was also the Chair of "The Icelandic Design and Craft Teachers´ Association" from 1995-2005 and the Chair of the NST "The Nordic Sloyd Teachers´ Association" from 2001-2004. From 2000-2004, he was on the Board of 'Nordfo', the "Nordic Academic Research Association in Sloyd". From 2001-2003, he coordinated the European Minerva project InnoEd and has been rewarded with numerous of grants from different sources for various educational activities. In 1999, he was involved in the development of the National Curriculum Area for Information Technology and Technology Education in Iceland and wrote the curriculum for "Design and Craft Education". He has written numerous articles on Innovation Education, Design and Craft Education and the use of ICT and ODL in education. He was one of the originators of the pedagogy for the new Icelandic subject area of Innovation. He has published several textbooks for the elementary school on Innovation Education.