Developing a system to assure the quality of ICT learning materials to enhance lifelong learning

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1   Introduction

This paper reports on a research project that aims to develop a system for identifying 'quality' computer based learning materials. Hence, the research is of an applied nature. Computer based learning materials, those using information and communication technology (ICT), are defined as encompassing both 'online' (web-based) or 'stand alone' (CDROM) products. The purpose of this research is to design a comprehensive yet flexible system providing a series of evaluation tools and information to assist users judge the quality of these products. This project, one of a suite of interrelated projects, focuses on the pedagogical quality of computer based learning materials.

In the UK, the University for Industry (Ufi) has been established to help enhance the competitiveness of British industry by stimulating demand for lifelong learning among businesses and individuals and improving access to relevant high-quality learning resources (DfEE 1998, http://www.ufiltd.co.uk). The Ufi aims to develop the skills of the workforce and encourage lifelong learning by drawing upon developments in education and training technology. However, the success of the University for Industry and the success of computer based training schemes depends on developing learning materials that are engaging and efficient in promoting learning, skills development, knowledge acquisition and understanding. Yet, when selecting an information and communication technology (ICT) based course, it is difficult for a learner or even an experienced trainer to judge pedagogical quality. This research intends to help overcome this barrier to learning.

The aim of this paper is to share our findings based on research carried out to date. The main theme is an examination of three different perspectives on quality – quality as articulated by the Ufi in their Endorsement Criteria for Qualified Suppliers, quality as perceived by subject experts evaluating computer based learning materials, and quality as perceived by a sample of online learners.

In Section 2, we briefly describe the research methods employed. In Section 3, we briefly review the quality literature, which provides a theoretical framework for a critical evaluation of the Ufi Endorsement Criteria. We present findings from the two empirical studies, exploring the perceptions of subject experts and learners, in Section 4 and discuss these findings in Section 5. Finally, in Section 6 we conclude with a critical evaluation of the research and its potential impact on addressing the diversity of quality perspectives related to computer based learning materials.

2   Research Methods

Researchers at the Centre for Learning Development at the University of Wales Bangor (UWB) are involved in a two-year project, funded by the Welsh Assembly, to establish an approach to quality standards for computer based learning materials. Rather than attempt to define absolute quality standards, the team has interpreted this research objective to mean developing a quality assurance system. Thinking of quality, one might consider ISO 9001 or BS5750 quality standards. Already, there exist standards for IT based courses, such as IMS and ERMES

(http://www.ermesnet.org), and there are numerous quality criteria sets for educational programmes. However, this research focuses on the quality of learning materials designed to stimulate lifelong learning – that is materials developed for adult learners, who could be learning at home, at work or in one of the Ufi's Learning Centres.

One might ask – why another quality system? What we propose is not another BS5750 or similarly bureaucratic system. Neither do we propose a reductionist system, like the NVQ approach, where a body of knowledge is broken down into its smallest, component parts, somehow missing the elements that create, or link together, the whole (Stewart & Sambrook 1995). In the UK, the government (through Ufi) has set its quality standards for computer based learning materials in the form of the Endorsement Criteria. However, defining quality is a complex and subjective process. Perspectives on quality vary according to whom might be using the computer based learning materials, for what reasons and how. Different users might have different requirements of quality standards. For example, what is quality when one refers to a stand-alone, off the shelf training package and how might this differ from an online, live and potentially networked resource? The quality assurance system being developed by researchers at UWB will address these diverse perspectives. The system, designed for multiple user groups and uses, will enable producers, trainers and learners to understand and use criteria for judging the quality of computer based learning materials. These criteria, taken collectively, form quality standards that can be used in a contingent and flexible manner, to suit the needs of the users. However, initially, the system will focus on ICT 'courses,' that is, those with structured content, which learners can go through individually, perhaps in the form of a distance learning programme, or as part of a group. Constructing a multi-perspective system requires analysing the needs of the diverse stakeholders, and this has been achieved through a multi-paradigmatic approach.

The research design incorporates both quantitative and qualitative methods. The research includes a critical review of literature on pedagogical and quality issues associated with computer based learning, and three empirical studies. The first study involved subject experts and the research team evaluating a sample of computer based courses to identify the characteristics of 'quality' learning materials. The second study focused on the perceptions of a sample of learners (n=20) who were asked to use and evaluate two computer based training packages, to enable the researchers to investigate the relationship between good quality materials and learning outcomes. The aim of the third study is to pilot the online evaluation tools and guidance materials. This will be achieved through a large scale study involving at least 150 trainers and learners in small and medium sized organisations who currently use online learning materials.

The findings from these studies have informed the development of the 'quality assurance system,' intended as a practical tool to enhance lifelong learning. This draft system, illustrated below in Figure 1, is now accessible on the project web site (http://sd68.bangor.ac.uk/draft.html).

Figure 1 Developing a Quality Standards Approach
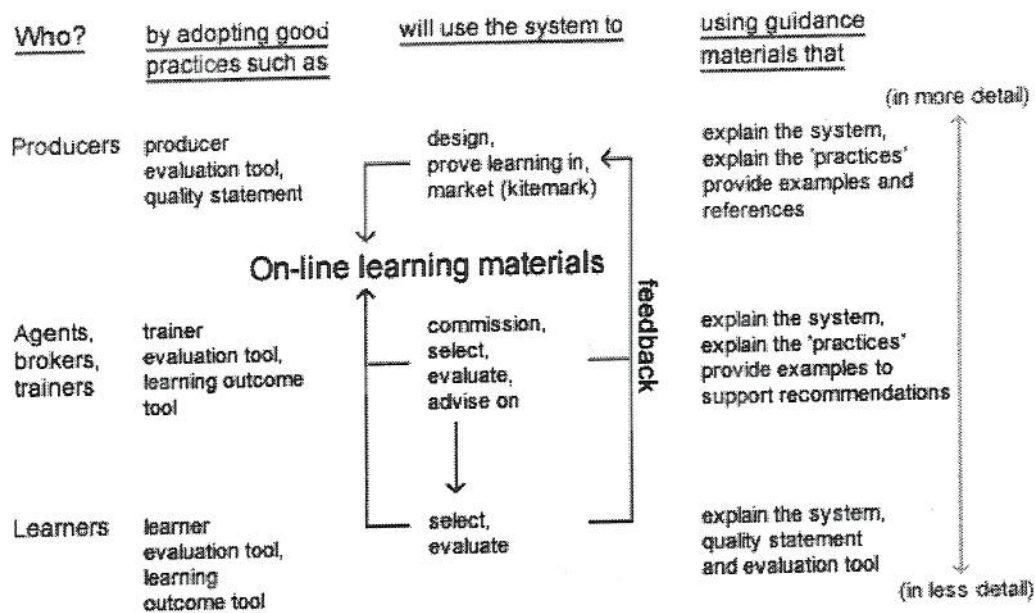
This diagram represents the draft design of what is intended to be a flexible, yet comprehensive, quality assurance system. The system can be used by producers, agents, brokers and trainers and learners. It comprises four online evaluation tools and online guidance materials. However, it is not our intention to describe these in detail here. The purpose of this paper is to explore different perspectives on the quality of computer based learning materials.

In recognition of the different perspectives on quality, the system addresses the needs of the multiple stakeholders in computer based learning, noting their different requirements. The system considers the *inputs* to online learning by devising quality criteria that enable producers to design quality learning products. It addresses the needs of trainers and learners by providing guidance (*outputs*) on how to evaluate and select online learning materials. In addition, the system provides a mechanism for *feedback*, enabling trainers and learners to generate feedback, which producers can use to further improve their products. The key feature of this system is that all components are *online*, establishing a direct link (or *connection*) between the various stakeholders – that is, producers, trainers and learners. The opportunity to provide feedback presents an opportunity to *learn* and *share* learning, thereby creating a virtuous, continuous feedback network. However, the ultimate utility of the system will be tested in our final empirical study.

3   Defining quality

Quality can be defined as fitness for purpose as expected by the relevant stakeholders. More explicitly, quality can be defined as, 'The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs,' (BSI 1991:2). Identifying the features and characteristics of computer based learning materials has been the focus of this research. However, there are particular problems defining software quality. As Gillies reports, 'Kitchenham (1986b) refers to software quality as 'fitness for needs' and claims

quality involves matching expectations. This definition specifically recognizes the two features of a piece of quality software: conformance to its specifications and fitness for its intended purpose,' (Gillies 1992:7). Gillies (1992:12) cites the work of Garvin (1984), who suggests five different views of software quality:

- Transcendent – quality as innate excellence
- Value based – provide what the customer wants at a price they can afford
- Product-based - the economist's view – the higher the quality, the higher the cost
- User-based – fitness for purpose, not technical correctness
- Manufacturing based – conformance to requirements.

Thus, the quality of learning software could be defined quite differently depending upon which perspective is taken. In attempting to define quality learning materials, there is also the need to distinguish between the process and product of learning. As Freeman (1993:60) states, 'the product of training and education is in two distinct parts: process (the experience of learning); product (what you have achieved at the end).' The aim of this research is to develop a system where it is possible to predict that quality learning experiences – as judged against validated criteria – lead to greater learning outcomes, or achievements.

In terms of existing computer based learning materials, 'Quality is highly variable, even though the efforts of bodies such as the British Association for Open Learning and the Open and Distance Learning Quality Council have led to significant improvements. The patchy use of existing products, high costs and low sales volumes are preventing the UK from deriving the maximum benefit from open and distance learning... Ufi has a key role in setting standards of materials design and production,' (A new way of learning: 13).

The University for Industry criteria

The project is funded by the Welsh Assembly, with the objective of preparing for the Ufi in Wales. Therefore, the starting point for the literature review was to determine the origins of the Ufi Endorsement Criteria, which Qualified Suppliers must meet to allow their products to be used in Ufi Learning Centres. An investigation revealed two key sources for the endorsement criteria – the Institute of IT Training (IITT 1998) and Technology for Training (http://www.tft.co.uk/products.design.html) standards. However, little research appears to have been conducted to validate these criteria. The Ufi appear to take a user based perspective on quality as it relates to computer based learning materials. This means ensuring materials are fit for their intended purposes – to stimulate lifelong learning – rather than technical correctness. In addition, the Ufi's perspective could be value based – that is, providing what the customer wants at a price they can afford.

The initial review addressed literature relevant only to the Ufi Endorsement Criteria. However, during this review, two additional and important criteria were identified. These were special needs and transferability. Special needs refers to how the needs of potential learners with various difficulties, such as partial sight, are accommodated in the design of computer based learning materials. This is a significant addition to the Ufi criteria, which, if addressed, can improve and widen access to computer based learning. This again suggests a user based perspective to quality. Transferability refers to the ease with which the learning acquired from computer based learning materials can be transferred from that specific context into other areas of life, such as work, leisure and society. The ability to use the learning acquired from computer based resources will increase its relevance and utility, and further promote this approach to lifelong learning, a key aim

of the Ufi. This could relate to a more value added approach to the quality of computer based learning materials.

During the literature review, various sets of criteria were identified (see, for example, IITT 1998, McAteer E & Shaw R (1995), (http://www.geminfo.org/Workbench/quality.html), (http://beth.canberra.edu.au/OldUnits/idhci/flexeval.htm), (http://www.sosig.ac.uk/desire/q1cont.html), (http://www.curriculum.org/eval.htm). The team analysed these to determine similarities and differences in the various criteria sets, identifying consistently mentioned criteria, and constructed an online cross-referencing tool (http://sd68.bangor.ac.uk/crit.html).

4   Empirical studies

This section reports on the two empirical studies conducted to date, and investigates expert and learner perspectives on quality.

The results of the literature review informed the design of two evaluation tools to be used in the empirical studies – the Expert and Learner Evaluation tools. To help make sense of the list, as presented in the Ufi criteria, the researchers grouped the criteria into more meaningful sections, for example, access, navigation, presentation, learning quality and outcomes. In the first two studies, the tools were paper based. However, these are now being developed online.

4.1   Study 1 – Expert evaluation
The first empirical study focused on experts' perceptions of quality. Seven subject experts were asked to comment upon the quality of computer based educational courses with which they were familiar. Analysis of these unprompted comments suggest that the subject experts focused on issues relevant to 'standard' courses, such as content. This might suggest a manufacturing based perspective to quality, evaluating computer based learning materials against their conformance to traditional learning product requirements. The experts failed to explicitly consider issues specific to computer based learning, such as navigation or presentation. Their evaluations were compared to the Ufi criteria. The most frequently mentioned Ufi criteria included: enable learners from diverse backgrounds to relate to the content, provide motivation and take the trainee from the unknown to the new in small logical steps. The least frequently mentioned criteria included: clear method of exiting the course and book marking facility, self-contained, technical specifications and ease of use.

The key finding from Study 1 was that even experienced educators did not explicitly consider the ICT dimensions of quality when evaluating ICT learning materials. This suggests that trainers and educators need considerable guidance and information to assist them evaluate and subsequently select computer based learning materials. Such guidance and information will be provided in the quality assurance system being developed in this research project. Results from this study suggest that the Expert Evaluation tool needs to be detailed, and provide supplementary information when producers or trainers require more knowledge about specific quality criteria.

Study 2 – Learner evaluation
The second empirical study focused on learners' perceptions of quality. Two tools were developed specifically for this study – a Learning Outcome tool and a Learner Evaluation tool. The Learner Evaluation tool enables learners to judge the quality of computer based learning materials against criteria similar to those used in the Expert Evaluation tool, although in less detail. This enables comparisons to be made between experts' and learners' evaluations of a learning resource. In addition, one aim of this research is to determine whether materials

evaluated positively by experts result in greater learning outcomes, thus offering a predictive dimension to the quality assurance system.

In this study two courses were evaluated - the first section of an introductory accounting course, focusing on double-entry book-keeping, and a section of an Internet course relating to eCommerce. For each course, the learning outcome was measured by the improvement in the score of the participants in a test after they had completed the course, in comparison with a similar test prior to taking the course. The evaluation questionnaire comprised twenty-five questions, designed to yield quantitative data on the views of the learners regarding the quality of the packages, and a section for learners' comments, designed to gather qualitative data. A sample of learners was also given a semi-structured interview and these interviews were recorded on tape for later transcription.

The results of Study 2 proved to be inconclusive in being able to predict learning outcome from learner and expert evaluations. One of the main limitations of the study was the sample size. Few significant differences in quality judgements were obtained from the quantitative data. However, expert evaluations proved effective in predicting the quality of the learning experience, that is, the process aspects of learning, as measured by the qualitative data. Analysis of this data suggests that learners' judgements focused on presentation and motivation issues. It could also be argued that this study was limited as it used two closed packages, which had no external links. This can be a factor limiting the navigational potential of a particular course. The most striking result of the study was the difference between the quantitative and qualitative evaluations. The findings have enabled the research team to significantly improve the evaluation tools to gather more qualitative data.

5 Discussion

Research findings suggest that learners focus on presentation and learning process issues when making quality judgements about computer based learning materials. Statistical analysis revealed that features such as technical issues and flexibility in navigation are less likely to be associated with quality judgements than are process, planning, transferability and presentation issues. It is possible that the former are a group of criteria that are necessary but not *sufficient* for learning, whereas the latter group are not necessary but when present do *facilitate* learning. The first group could be conceived as potential *barriers* to learning, whilst the second group could be *facilitators* of learning. However, further research is required. The analysis revealed both consistencies between learners and differences between learners. The preliminary system was successful therefore in providing an overview of quality issues and access to individual cases.

6 Summary and conclusions

Perspectives on the quality of computer based learning materials vary according to the diverse range of stakeholders, such as the Ufi, trainers and learners. They each have their own purpose for promoting, evaluating and using computer based learning materials, which influence perspectives on quality. The research studies described in this paper have indicated the different features identified by learners and educators. Therefore, it seems futile to design a quality assurance system that prescribes absolute quality standards. Instead, there is greater utility in constructing a system with multiple uses and user groups, enabling the user to determine whether a particular computer based learning materials meets their quality requirements, basing that decision on well researched and validated quality criteria, and explained in appropriately presented guidance materials.

The aim of this project has been to develop an approach to quality standards for computer based learning materials. This approach takes the form of a quality assurance system, informed by an extensive literature review and two empirical studies. However, the ultimate utility of the system will be tested in our final empirical study. In addition, it is recognised that this system focuses on off the shelf learning materials, and, as such, misses other forms of computer based learning. Further research would be required to address quality issues related to other forms of online learning such as networked learning, where ICT is used to promote connections between learners and tutors and learning communities and interactions between people and online learning materials.

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