Vodcasting: A case study in adaptability to meet learners' needs and preferences

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With the rapid development of wireless networks and mobile technologies, the widespread use of mobile learning has raised the need for 'anywhere, anytime and any device' access to information and has influenced the design of learning objects. The newly emerging IMS AccessForAll and Dublin Core adaptability and accessibility standards and the proposed profiles of needs and preferences (PNP), present significant challenges to learning designers. This paper responds to these challenges for an accessible relationship between the learner and the resource and suggests a learning object adaptation framework which allows for flexibility and personalisation to learners' needs and preferences. The concept of a transformation, augmentation and substitution framework (TAS) is described by discussing a specific case study, which investigates the adaptations required for existing learning objects delivered as vodcasts (videos downloaded to an MP3 player). The case study is examined in the context of a larger research project which aims to contribute to the requirements specification for the development of an adaptable learning object authoring tool. This paper explains the rationale behind the case study, describes the research methodology and outlines the main findings of the evaluation of the learning vodcast.

Keywords: adaptability, vodcasting, mobile learning

Introduction

With the development of the Internet has come the ability to easily deliver educational materials in electronic form to anyone, anywhere and anytime. Virtually any student, irrespective of any disability, can be enabled to effectively interact with a computer (Nevile et al., 2005). Online learning can be a liberating and enabling experience for disabled students, providing that the environment is designed to meet the needs of the individual (Pearson & Koppi , 2006). The shape of learning technology is currently being influenced by a number of forces, which present significant challenges for the learning designer (Naismith et al., 2004).

Mobile learning capitalises on the increasing ubiquity of wireless networks devices such as Personal Digital Assistants (PDA), wireless phones, and video mp3 devices. With the rapid development of wireless networks and mobile technologies, learners have become more mobile and learning has become more achievable and more ubiquitous than ever before (Boulos et al., 2006). This notion of 'anytime, anyplace' learning has presented significant challenges to educators and learning technologists and an impetus for learning to be delivered at the right time, at the right place and in the right form (Bomsdorf, 2005). It is widely recognised that in the current environment where mobile infrastructure is reaching the point of being pervasive, educators need to respond to the challenges for personal, accessible and flexible learning. The focus of our research in the field of accessible mobile learning is influenced by our previous experiences in attempting to design adaptable and accessible learning objects which could be accessed on a variety of different mediums and platforms (Gkatzidou et al., 2006).

Research has shown that the integration of adaptive learning with ubiquitous learning may offer great innovation in the delivery of education, allowing for personalisation and customisation to the learner needs (Jones & Jo, 2005). The widespread development and use of digital repositories for the storage and retrieval of learning objects over the Web, the newly emerging IMS AccessForAll and Dublin Core adaptability and accessibility standards and the proposed profiles of needs and preferences (PNP), have also added new dimensions to the design of accessible learning resources. A key challenge in accessibility is the diversity of needs and it is essential to strive for e-learning to be available to all users, whatever their individual needs and preferences. In terms of access to or interaction with online learning resources, disability can be re-defined as a mismatch between the needs of the learner and the learning environment or education delivery (AccessForAll, 2004).

This paper suggests an approach for learning designers to respond to these new challenges, by presenting the concept of a Transformation, Augmentation and Substitution framework (TAS), which, incorporated within an authoring tool, could assist academics in designing adaptable learning objects. Starting from the vision of an ubiquitous learning experience, we aim to tackle the issue of adapting an existing learning object to be accessible on a mobile device, such as the PDA and the video mp3 player. The case study under discussion in this paper is part of a larger research study that aims to explore the creation of learning objects as a set of components that can be adapted to the needs and preferences of the individual learner.

The paper begins by presenting the TAS framework and discussing the case study. We go on to examine the issues and challenges of adapting for vodcast and discuss the findings of the case study. The following section pinpoints the limitations of this case study along with the challenges for this adaptation framework. The conclusion considers the broader application of the adaptation framework in designing and developing adaptable learning objects and identifies future research requirements.

Learning object adaptation framework

Meeting the diverse needs of disabled students requires an approach which supports transformation, augmentation or substitution of the resource at the point of delivery (Gkatzidou & Pearson, 2007). Multimedia learning objects delivered in distributed formats differ from standard web pages in that they may consist of rich content each of which may need to be adapted in different ways, in order to make them accessible. For example, a learning object may contain a mixture of content types, including text, images, video and audio, and each of these content types may be in a variety of formats. In order to make this rich online content match individual needs and preferences, this approach requires a basic resource to be created from existing or newly authored components, and the appropriate adaptations (transformations, augmentations and substitutions) need to be identified. Examples of these adaptations are:

Transformation: Transformation may occur where text is rendered visually, as characters, or a sign language, or aurally, perhaps by a screen reader, or transformed into a tactile form as Braille or simply changed in colour, size and other display features.

Augmentation: Augmentation involves the optional addition of a feature to a primary resource, for instance a textual caption could be added to a video when required by a user with a hearing impairment or in a noisy environment.

Substitution: Substitution might occur when a user requires a vision-free access to the resource, for instance if the user was accessing the learning object on a PDA on a field trip and be accessible it is necessary to replace the visual element of the learning objects with components that match the user's preferences of vision-free access. Alternatively, an interactive exercise requiring a mouse for operation could be substituted by one that can be controlled using a keyboard or keyboard emulator for a user with a mobility impairment (Pearson & Jones, 2006).

Accessible learning vodcast case study

In order to investigate the requirements specification of the TAS framework it was necessary to examine a specific use case, which explored the requirements for the delivery of a learning object in different mediums. This case study was funded through the Higher Education Assistive Technology (HEAT) scheme administered by TechDis, the JISC educational advisory service on accessibility and inclusion.

This work is part of a larger research project in collaboration with the Learning Technology Research Institute (LTRI) at London Metropolitan University, which has carried out considerable work in the field of learning objects, placing a pedagogical emphasis on the design and development of multimedia learning material. The LTRI has developed a number of award winning learning objects and their successful use is well documented as part of innovative blended learning approaches to the teaching of programming to first year Computing students (Boyle, 2003).

This particular case study has a twofold aim, first to identify and model the TAS framework in terms of requirements for delivery of a learning object in different mediums – starting with a learning object originally designed for web delivery and adapted first for delivery on a PDA and then for delivery with accessibility enhancements on a video MP3 player as a vodcast and secondly to explore the potential of mobile learning ,by investigating whether vodcasting technology can support flexibility and accessibility in the learning environment.

Background research

Podcasting is a fairly new method of Web-based broadcasting that may be used for automatically transferring digital audio or video (vodcasting) to portable media players. Vodcasting uses the enclosures of Real Simple Syndication (RSS) feeds for distribution of video content that can be downloaded to mobile devices.

There is a growing body of evidence of podcasts being used effectively in education (Maag, 2006). Various universities have been 'iPod-enhanced' to include a diverse range of audio material ranging from lectures and audio books to language study. Georgia College & State University (2005) provide audio material ranging from lectures and audio books to language study and Drexel University which distributed iPod Photo players to its first year Education students, encouraging the students to discover their advantages as a learning and teaching medium (Read, 2005). In 2004, Duke University distributed iPod devices to its commencing students, pre-loaded with orientation information, with evaluation results revealing a positive reaction and great adoption rate by the students (Duke University, 2005). However, the existing educational uses of vodcasting are considerably limited; Carleton University is carrying out a vodcasting project, where students can download video recordings of Chemistry lectures onto their portable video players (Carleton University, 2006), but the results of this study have yet to be published. Vodcasting may enhance learning and deepen levels of learner's engagement and collaboration (Boulos et al, 2006), but empirical research is needed in order to compile pedagogical evidence about the use of vodcasts in the educational context and their potential in terms of accessibility.

Research methodology

The preliminary stages of the project involved the analysis of the existing learning objects which had been developed by LTRI with focus on the navigation, interactivity, design and content issues. Once this had been completed, the vodcast adaptations were defined and the learning objects were then re-developed taking into account the technical considerations of the portable media players. The prototype vodcast was then converted to an appropriate format and loaded onto the portable devices, and evaluated by students. This evaluation process consisted of semi-structured interviews on an individual basis with participants. The results of this study will contribute towards our research work on developing tools for the creation of adaptable learning objects.

The sample learning object used for this project was developed by LTRI and designed to help first year undergraduate students at London Metropolitan University learn JAVA programming. The 'While' loop learning object was chosen to be used in the study; it is a short, self contained resource authored in Macromedia Flash which contains a single learning objective and explains an abstract programming concept that students find difficult to comprehend. A number of multimedia techniques were employed to engage the students in the subject matter and to help them understand these complex and abstract programming concepts, such as animations and interactive simulations to provide visual examples of Java concepts and program code (Bradley & Boyle, 2004). The learning object had already been adapted to be usable on a Personal Digital Assistant (PDA), whilst retaining the multimedia richness and pedagogy of the original, but offering a more flexible, mobile alternative (Bradley et al, 2005). The While loop learning object consists of an introductory page, three pages with examples and an interactive quiz at the end.

Adaptations for vodcasting

Two portable media players have been used during the project; the Apple Video iPod and the Creative Zen Vision M, both of which have a capacity of 30GB and support a variety of different file formats. A number of adaptations were required for the PDA version of the 'While Loop' learning objects to be accessed on the portable mp3 devices.

Format compatibility

The current generation of portable media players do not support Flash movies. Therefore it was necessary to convert the Flash movie learning object into a format which is compatible with the media players. Although Macromedia Flash has the capability to export to .AVI format, we encountered compatibility problems when using QuickTime. The video iPod and the Creative Zen media players support a number of different formats; the only file format which is support by both is MPEG-4. It was therefore necessary for the Flash movies to be converted into a video format such as AVI or MPEG.

Design adaptations

Since the While loop learning object had already been adapted to a PDA version the number of design adaptations required for viewing on a portable media player were small. The screen layout remained similar, the only content which was changed were the navigation buttons which were removed, and the title 'While Loop' and progress indicator were moved from the bottom to the top of the screen to accommodate captioning at the bottom for the caption version. The screen size of the PDA is larger than that of the portable media players, both the iPod and the Creative Zen screens measure 2.5 inches diagonally. When using Flash to adapt the learning object, the canvas size was changed to match the screen size of the portable media player.

Pedagogical adaptations

Navigation of the PDA version of the learning object was facilitated through buttons activated by the device's touch screen. Neither of the portable media players used in the study features a touch screen. As a result, interactive elements of the PDA learning objects would be unusable on the portable media players. This could have a significant impact on the pedagogy of the learning object when considering factors such as navigation, which the user would have limited control over. A navigation mechanism could not be provided through the learning object itself, but the user could still use the general controls built into the device, such as play, pause and stop. The implications of this were that a previously interactive learning object, the delivery of which could be controlled by the user, would be converted into a linear, movie which would be viewed as a single entity. Changing the pedagogy in this way may impact on the effectiveness of the learning object in terms of usefulness of the learning objects to the students. Evaluation of the pedagogical impact of the lack of interaction, though, was beyond the scope of this current study.

The PDA version contained an interactive quiz. This took the form of an activity which required the user to construct an example while loop by selecting lines of code in the correct order. Audio feedback was given after each selection. The removal of the quiz element has implications in that the student does not have the opportunity to test or reinforce their learning. The inclusion of a quiz in some form was examined, but it was decided it could not be effectively implemented without support for interaction within the timescale of this project.

Accessibility enhancements - captioning

In order to increase the accessibility of the While loop vodcast, the potential to use captions to supplement the audio content was explored. The inclusion of captions can benefit specific user groups, such as those who are deaf or hard of hearing and those whose first language is not English. Captions are text versions of the spoken word in audio or video media files and can be provided through multimedia players such as QuickTime, Real Player, or Windows Media Player; however the considerations are different when viewing vodcasts on portable media players as no such software is used.

There are two different techniques for captioning video; closed captioning and open captioning. Closed captioning is the technique of displaying the captioned text only when it is desired; this is the kind of captioning displayed by televisions. Open captions include the same text as closed captions, but the captions are a permanent part of the picture, and cannot typically be turned off. For video on the web, captions can be open, closed, or both. Portable media players cannot read or decode captions and it was necessary to utilise the open captioning technique to provide text for the While loop vodcast. The current generation of portable media players cannot read a separate text-based caption file in the way that media players can with web based video, this meant that the use of Synchronised Multimedia Integration Language to caption (SMIL) to caption the vodcast was not possible. Therefore the captions were created with Apple's QuickTime Pro media players and were added to the vodcast with the aid of Media Access Generator (MAGpie). Once the While loop vodcast had been captioned using MAGpie, a text document was generated which can be read by QuickTime. This text document also contained basic information, such as text size and justification. This text was then added to the While loop vodcast as a separate text track, and the vodcast exported as an .m4v file, in order to combine the caption text with the video file, so it could be displayed on both media players (Gkatzidou et al., 2007).

Discussion

This project is part of a larger research study which aims to support the design of adaptable learning objects, through the concept of a TAS framework, which incorporated within an authoring tool could assist academics in designing fully inclusive learning materials. In order to model the framework and

identify its vocabulary, a first step is to define the possible adaptations to the different components of a learning object.

For this example of TAS, we consider the Web based version of the While loop learning objects as our original learning resource. This resource comprises of a number of components: Flash animation, audio, text, interactive quiz. The following table uses the TAS framework to categorise the adaptations that were required for the Web based learning object to be adapted to a PDA and to a vodcast version. We have included the requirements for a podcast version of the learning object for completeness, although that particular adaptation has not yet been implemented:

Table 1: Learning object adaptations categorised as TAS

Learning object	Transformation	Augmentation	Substitution
Web based version			
PDA version	▪ Screen layout ▪ File format ▪ Quiz screen layout		▪ Audio (to replace the text)
Vodcast version	▪ Screen layout ▪ File format (Flash to mpeg4) ▪ Interactive to linear	▪ Captions (to supplement audio) ▪ Audio (for the captioned version)	▪ Audio (to replace the text)
Podcast version	▪ File format (for video audio delivery)	▪ Sound effects/Audio description (to replace visual effects)	▪ Audio (replacement for visual elements)

This research suggests that the solution relies on learning object authoring tools which would support the author in creating fully inclusive materials by suggesting correct behaviours and sometimes imposing the completion of all additional information needed to ensure accessibility. This case study has enabled the classification of the adaptations required for different forms of delivery in terms of the TAS framework. Such a classification is important in terms of the capabilities that need to be built into an authoring tool to support the development of adaptable learning objects. By identifying the requirements of transformation, augmentation and substitution in this specific case study, the aim is to translate these to a requirements specification for other learning objects and to inform the development of learning object authoring tools and personal profiling mechanisms.

Evaluation and preliminary findings

The Web based version of the learning object and its use as part of an innovative blended learning approach to the teaching of programming has been thoroughly evaluated by over 600 first year Computing students (Bradley & Boyle, 2004). The main findings of this study indicate a very positive reaction to the learning object and an improvement of the pass rates. As a result, this work has culminated in the achievement of a European Academic Software Award (EASA) in 2004. The PDA version of the learning object has also been thoroughly evaluated by a number of students, receiving positive comments for the 'interactivity' and 'multimedia elements' of the resource as well as for the added dimension of 'flexibility' the PDA device has offered in their learning (Bradley et al., 2005).

Evaluation methodology

The While loop vodcast has been evaluated in depth with representative users in order to provide feedback on their experience of using the vodcast and how this experience could be improved ,as well as the potential of video mp3 players as a learning tool. It has been evaluated by 13 users, 10 males and 3 females, all students over the age of 20; with four participants being overseas students, three deaf and one with mobility impairments. Half of the users had some prior experience of using a portable video mp3 device, and two of the participants were studying Java programming.

The evaluation sessions were carried out by a researcher who was not heavily involved with the project, in order to adopt a more ethical approach. The evaluation instruments that have been used were structured interviews and questionnaires. The participants attended individually and after being briefly introduced to the case study, were given an iPod with the vodcast installed and a set of headphones and invited to take as much time as they needed to work through the learning object (which is about four minutes long).

Afterwards, each student was interviewed using a standardised set of questions; while the deaf participants completed a questionnaire. Data collected from the interviews and the questionnaires was analysed and revealed a number of recurrent themes that are common to the three different user groups and their respective learning scenarios on their views of using the vodcast.

Student opinions of the learning vodcast

In terms of the content of the learning vodcast 70% of participants have commented on the high quality of the multimedia components. The combination of these components received more varied responses. Some users enjoyed the combination of multimedia content: 'being able to see the animation of the concept of the While Loop, together with the bit of code', while others felt 'distracted' by it. The participants who were studying Java have provided positive feedback on the use of animated examples to explain the concept of the While loop. All the users have agreed that the text size was appropriate (though none had vision impairments); the vodcast was not too lengthy. In terms of access control of the device only the participant with mobility impairments commented that 'it was hard to use the scroll wheel to control the volume', but the rest of the participants had no problems in accessing the vodcast.

The use of captions has received a mixed response from the different participant groups. Captions were essential for the deaf participants in order to access the vodcast, and therefore their feedback was very positive. Comments included 'I have never seen anything like that before', 'This is great, I didn't know I could have captions on iPod'. One deaf participant has however commented on the speed of the captions, saying that there was 'not enough time to read the captions'. The overseas students also expressed positive comments towards the use of captions, for example: 'The captions helped me understand the concept better', while the rest of the participants found the captions distracting.

How students would use the learning vodcast

In terms of the potential use of learning vodcasts, the responses indicated that on average 85% of the participants agreed that they would use the vodcast as a form of learning material. Typical comments were: 'I would use this as part of my independent learning' (overseas student) and 'I would use this to help me with my exam revision' (deaf student). The aim of this evaluation was also to explore in what learning context the student would be most likely to use the vodcast. The results indicated that many students would use the vodcast for revision, but also as part of their weekly learning material and part of their independent learning and reinforcement of lecture. Typical comments were: 'This would be very useful when revising for my exams' and 'during lectures, I concentrate on my signer and I miss something the lecturer had said so the vodcast can supplement the lecture'.

However the participants also identified a few disadvantages of using the iPod for learning; these were centred on the device itself, with cost being the main barrier. Only one participant has mentioned that adjusting to a smaller screen could be a problem. However the responses from the deaf students were more encouraging: 'Until now, I thought that iPods were for hearing people, but now I can see that I could use one for my classes'.

Although this was a preliminary evaluation study, the main messages coming from students is that the learning vodcast overall is worthy of further study. The majority of students, including all the deaf participants have welcomed the idea of learning vodcasts and were willing to incorporate this form of learning aid to their learning and only one participant commented on the implications of small screen size.

Limitations and future work

Several limitations within this study must be taken into consideration when interpreting these initial findings. The small sample size of the results, the data that was collected in a snapshot of time and the limited exposure to vodcast limits the generalisation of these findings. In spite of these limitations, there are several key findings that may be helpful in designing a more rigorous research approach, in order to better understand the effectiveness of accessible vodcasting in education. A longitudinal evaluation would be helpful in establishing a set of metrics for measuring the effectiveness of vodcasting in an exclusive learning environment. In depth evaluations are also needed to examine whether the adaptations have compromised the pedagogical value of the original value of the original learning object, and the adaptations required for accessibility. Further evaluations are planned with disabled students and with students studying Java Programming to explore these issues in more depth.

A central issue that has emerged from this project is the need to change the pedagogical structure of the learning object to make them usable on portable media players. This is a result of the technology of portable media players which do not support the same level of interaction that can be experienced using Flash movies on Personal Digital Assistants (PDAs) with touch sensitive screens, or on a PC. Such adaptations may not be necessary when future generations of portable media players are released. Apple's new iPhone which will be released in the coming months, will feature a touch screen which may support interactive applications such as the While loop learning object. The appropriateness of the learning objects for these devices requires further research.

One of the limitations of adapting learning objects for the MP3 player is the lack of interaction and the linear navigation system afforded by the wheel mechanism. The research group is also exploring an alternative approach to adaptability whereby a different operating system is installed (Linux) on the iPod to support improved interaction and input methods otherwise not available on this device. This kind of adaptation enables the inclusion of elements in the learning object such as a drag and drop quiz. It also facilitates alternative input methods such as text prediction and a version of sign language. This research is however, at an early stage and beyond the scope of this paper.

Conclusion

In order to respond to the challenge of providing truly- learner-centred, accessible, personalised and flexible learning, this paper discusses the concept of a transformation, adaptation and substitution framework (TAS) by examining a specific use case, which explored the requirements for the delivery of a learning object in different mediums, by adapting a web based learning object to a PDA and vodcast version as well as including enhancements for accessibility. The concept of a learning object as a vodcast has been well received, especially by deaf learners using captions, but further evaluation is required in order to determine its pedagogical effectiveness and more complex accessibility requirements.

By identifying the requirements for transformation, augmentation and substitution in this specific use case we can then translate these to a requirement specification for other learning objects and to inform the development of learning object authoring tools and of personal profiling mechanisms. The results from this study will be valuable in terms of exploring the requirements for re-purposing learning objects for mobility and flexibility.

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