

**MobiQuest: an m-learning experience, using mobile phones to
contextualise learning and encourage collaboration among
learners**

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A dissertation submitted to the University of Dublin,
in partial fulfilment of the requirements for the degree of
Master of Science in I.T. in Education

2007

Declaration

I declare that the work described in this assignment is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

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Acknowledgements

Thank you to my supervisor, Inmaculada Arnedillo Sánchez, for her patient advice and encouragement throughout my work on this research. Thanks also to my family and friends who supported and encouraged me, from near and afar. My MITE '05 classmates were always there online to share the pain and the information, answer questions and suggest coffee breaks – thank you all!

I would like to thank the principal of the school at which I carried out my research for giving me permission to do so, the teachers for welcoming me when I arrived and particularly the teacher who allowed me into her classroom to do my research. Thanks also to the pupils I worked with, for their enthusiastic and willing participation.

I wish also to acknowledge my ex-students and colleagues at Mekelle University in Ethiopia – your enthusiasm and dedication to education sent me in this direction!

Abstract

MobiQuest: an m-learning experience, using mobile phones to contextualise learning and encourage collaboration among learners

Various categories of mobile learning application have been identified; those to focus on for successful use of mobile technology are location-aware, data-collection and collaborative applications (Patten, Arnedillo Sánchez, & Tangney, 2006).

Collaborative learning takes place when learners interact socially, building understanding and transforming their existing knowledge (Facer & Williamson, 2004; Roschelle, 1992). The use of technology brings a new context for those interactions (Crook, 1994). Collaborative interactions are not guaranteed to occur in a learning situation – activities must be devised in a way that increases the chances of them occurring (Dillenbourg, 1999).

Contextualised learning takes place in an environment that contains real, physical objects. The context in which learning takes place comprises aspects such as the learner him/herself, peer learners also present and objects in the location (Falk & Dierking, 2002b; Sharples, Corlett, & Westmancott, 2002).

Combining the WebQuest (Dodge, 1995,1997) with m-learning, and using the pedagogy of collaboration and contextualisation, the MobiQuest learning experience was devised. It includes a web-based framework and a means of capturing mobile messages; it combines the use of mobile phones in a contextual environment with other activities in the classroom.

The implementation took place with a group of sixteen primary school pupils, learning about objects and concepts in the natural environment around the school. The research methodology adopted was a qualitative case study, to explore how the MobiQuest brings about collaboration and if it allows contextualised learning to occur.

The findings show that the MobiQuest provided opportunities for collaborative interactions to take place; these focused both on objects in the environment and on the mobile phones. Contextual learning took place – learners found and identified objects they recognised. They made links from what they observed, using their sensory impressions of real objects to form new knowledge to augment their existing knowledge. This was often achieved with the aid of elicitation from the facilitator, sometimes in combination with collaborative interactions with their peer learners.

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Abbreviations

CSCL - Computer-Supported Collaborative Learning

GPRS – General Packet Radio Service

ICT – Information and Communications Technology

J2ME – Java 2 Mobile Environment

M-Learning – Mobile Learning

MMS – Multimedia Messaging Service

SIM – Subscriber Identity Module (smart card used in mobile phones)

SMS – Short Messaging Service

1 Introduction

Research into m-learning (mobile learning) is showing that use of the technology for technology's sake is not itself sufficient to enhance learning. Successful use of mobile technology for learning must be founded on sound pedagogical theory. Patten et al developed a framework for categorising mobile learning applications, looking at functionality and pedagogical underpinning (2006). From this, they concluded that applications that are collaborative, constructionist and contextual are most likely to provide educational benefit. This research focuses on an m-learning experience that seeks to contextualise learning and provide opportunities for collaborative learning.

Collaborative learning is about social interactions between learners working together, whether those interactions are face-to-face or mediated by technology. Learners use their knowledge and other available resources to reach common understanding (Facer & Williamson, 2004; Roschelle, 2003). However, in a given learning situation, collaboration does not happen automatically – the situation needs to be designed to encourage collaboration (Dillenbourg, 1999). In CSCL (Computer-Supported Collaborative Learning), where learning takes place with the aid of computers, the technology should be used as a context for the collaborative social interactions that take place, and not just as the focus for them (Crook, 1994).

Contextual learning brings learning into a real environment, wherein there are real objects that are inter-connected and connected to the environment – this aids learners in making links between objects and their own knowledge (McGreen & Arnedillo Sánchez, 2005a). This context, in which the learning takes place, is not only about location but also about other aspects such as time, peer learners and objects that are present (Sharples, Corlett, & Westmancott, 2002).

The WebQuest instructional design model, which promotes collaboration and cooperation among learners, can be directly transferred to m-learning (Batista Bottentuit Junior, Cutinho, & Sternaltdt, 2006) or used as a basis for a new learning experience.

In this research, the author set out to devise a collaborative, contextual m-learning experience, the MobiQuest, based on elements of the WebQuest and features of successful m-learning applications. The research questions are:

1. How does the MobiQuest bring about opportunities for collaboration among learners?
2. Does the MobiQuest allow contextualised learning to take place?
3. What are the design principles for the MobiQuest?

The MobiQuest learning experience consists of a web-based HQ (head-quarters) which comprises a control panel, an SMS gateway connected to the mobile network and a set of mini websites covering the different learning topics used in the implementation. Whilst the MobiQuest could be used with learners of any age in any setting where there is a real-world environment that can provide learning opportunities, the time constraints and access to participants limited the implementation to members of a primary school 4th class. In total, 16 children participated in the MobiQuest over four sessions. The other 14 members of the class had peripheral involvement through classroom activities. The school is an average primary school, fairly well-resourced, in which the pupils come from a mix of backgrounds.

As the research is exploratory, seeking to establish how the learning experience allows collaborative and contextualised learning to take place, a qualitative research approach is taken. Specifically, a case study strategy is adopted because the research questions are primarily looking at *how* and *why* the identified phenomena take place.

The findings show that collaboration took place during the MobiQuest, through interactions centred on both the objects in the natural environment and on the mobile phones that were used as tools during the activity. The interactions involved the participants helping each other understand objects in the environment and also in using the mobile phones.

Contextual learning took place, as the learners were linking previous knowledge to what they were observing. They were also posing questions about the objects they interacted with and were getting sensory impressions such as touch and sight, to supplement what they may already have learned in the classroom or elsewhere.

The findings show a number of principles that should be applied in the design of MobiQuests. These include ensuring the activity takes place in an environment rich in real, physical objects related to the learning topic; knowing what objects the participants can be expected to find; allowing for the mobile phones themselves to be a focus of collaborative interactions and devising the activities so that collaboration will occur.

The structure of this document is as follows. The Literature Review positions this research as it relates to m-learning and describes collaborative and contextual learning with reference to the literature; it outlines the WebQuest and how it can cross over to m-learning. The “Design of the MobiQuest Learning Experience” chapter describes the artefact and how its design was informed by the literature. The Implementation chapter provides details on the implementation of the research. The Methodology chapter explains the research approach adopted and why it was used. The Findings and Discussion chapters present data that answer the research questions and elaborate further on those. The Conclusion summarises the findings and points to further work.

2 Literature Review

This chapter positions this research in relation to the literature, looking at m-learning, collaboration and contextualised learning and how they relate. The WebQuest and work linking it to m-learning are outlined.

2.1 Introduction

M-learning brings opportunities to promote collaboration and contextualisation in learning. The literature shows that mobile devices have been used in various aspects of the learning process, covering functions such as personal organisers, e-books, Virtual Learning Environments and on-the-move learning (Kukulska-Hulme & Traxler, 2005). However, a sound pedagogical underpinning is often lacking in m-learning applications, with the focus being more on the technology than on the needs of learners. There are limitations to mobile devices in their current state of development but strategies can be employed to minimise their effects.

Collaboration is the process by which learners build understanding with their peers. M-learning applications can provide a new context for the social interactions that take place in this process, though not replacing completely face-to-face communication.

Bringing learning into real, physical environments is referred to as contextualisation. This has benefits for learners as objects in their authentic settings can stimulate learning.

Taking the concepts of the WebQuest model of instructional design and shifting them from the virtual world of the internet into the real world, in combination with m-learning, leads to the MobiQuest.

2.2 M-Learning

M-learning is concerned with the location and context in which learning takes place. The increasing availability and accessibility of mobile technology, in the form of personal, portable devices and also kiosks that can be located almost anywhere, mean that learning can take place when and where the *learner* wants to learn. Learning can take place while the learner is moving from place to place, with a mobile phone, or while the learner is in an environment populated with real objects that prompt enquiry, such as in a museum or

in a wood (Kukulska-Hulme & Traxler, 2005, p. 1; Naismith, Lonsdale, Vavoula, & Sharples, 2005). Learners interact face-to-face but can also use the communications features of mobile devices to enhance and supplement their interactions with peers and with teachers. These interactions can then also take place no matter where the participants are situated, even if they are not physically in the same place (Nyiri, 2002).

Patten et al (2006, p. 296) categorise m-learning applications according to functionality, defining categories: administration, reference, interactive, micro-world, data collection, location-aware and collaborative. The literature reflects this, such as the administrative learning organiser for students (Corlett, Sharples, Bull, & Chan, 2005) and the savannah game, a collaborative application that also has location-aware elements (Facer et al., 2004). A self-paced language-learning application that utilised SMS messages was interactive (Levy & Kennedy, 2005). A bird-watching application reported by Chen et al (2003) included reference materials. A multimedia tour of an art gallery was location-aware (Proctor & Burton, 2003). Patten et al (2006, p. 307) conclude that the categories of data collection, location-aware and collaborative are those to focus on for “appropriate and innovative use” of mobile technology.

A problem with many m-learning education applications is a lack of sound pedagogical underpinning; they are designed with the technology in mind rather than with pedagogical and social practice theory in mind. Patten et al, citing Roschelle (2003), correctly state that the challenge now is to “create solutions that are educationally appropriate rather than technologically complex, in order to avoid the development of applications that are often let down by complex views of technology and simplistic views of social practice” (2006, p. 300).

However, a balance needs to be struck so that the benefits offered by mobile technology, such as mobility and in-built communication tools, are utilised in m-learning experiences. It is the needs of the learners that should be paramount, not the overuse of technology, as shown by Patten et al in looking at the underlying pedagogical concepts within the aforementioned categories; contextualisation and collaboration are among the concepts to focus on (pp. 300,307).

The well-documented limitations of mobile phones include the small screen size and the maximum number of characters that can be included in a text message (McGreen &

Arnedillo Sánchez, 2005a; Parsons, Hokyoung, & Cranshaw, 2006). But this does not diminish the potential of mobile phones as useful learning tools, as pointed out by McGreen & Arnedillo Sánchez (op.cit.). M-learning is often used as part of a blend with static modes of learning, such as computer-based learning materials, paper-based materials, group-work and face-to-face instruction. In the Savannah game and the Ambient Wood, for example, some of the activity took place outdoors, using mobile devices. Other activities took place indoors, where the children reflected and built on the knowledge they had gained (Facer et al., 2004; Rogers et al., 2004). They can also be used along with other technology such as laptops and overhead projectors, reflecting best use of mobile phones (Stead, 2005). Strategies that can be employed include using the different means to give learners the opportunity to absorb the lesson framework or fundamental concepts prior to using mobile devices in the activity (Ally, 2004; McGreen & Arnedillo Sánchez, 2005a). This reduces the amount of information that needs to be conveyed on the mobile devices.

Designing activities with the mobile in mind means presenting information in well-structured, small ‘chunks’ (Parsons, Hokyoung, & Cranshaw, 2006) and in ways that can be meaningfully displayed on mobile screens (Ally, 2004). This brings its own benefits to group activities, because the limited amount of information requires the designer to be economical in what is displayed; this in turn encourages learners to spend more time on team-work and collaboration (and less time reading their screens). This strategy of minimising the amount of information conveyed through the mobile devices has been found to be effective when the learners are children (Cole & Stanton, 2003).

2.3 Collaborative Learning

Collaborative learning is bound up in the *interactions* that take place between learners in a particular *situation*. Learners work together, sharing opinions and ideas, leading to transformation of personal knowledge into something new (Facer & Williamson, 2004). What takes place is “a process that can gradually lead to convergence of meaning” among learners, where they are seeking to build their understanding by working together; conversational interaction is important (Roschelle, 1992). In Vygotsky’s view, collaboration is an element when students work together with their peers (1978). Whereas

Vygotsky (op cit, p. 86) focussed on the importance of a more knowledgeable other, Roschelle sees collaboration as a conversation between equals (1992).

Essentially, collaboration in learning is about learners building understanding by interacting with their peers. When learners interact they are pooling resources and knowledge and coming together on a social level. Extending this into m-learning, it has been found that when a group of learners already knew each other, they did not need much encouragement to collaborate using the features on their mobile phones (Stead, 2005) . In this case, the technology was the context for social interaction, as Crook (1994) postulated.

Social interactions among peers are a means towards achieving learning outcomes while also being a skill that is acquired (Crook, 1994, p. 71). Addressing the question of whether or not computers can encapsulate that social quality of more traditional face-to-face instruction, he concludes that computers should be used as a *context* for this social interaction rather than as the focus of it (Crook, 1994, p. 79). Put another way, collaboration can take place around and with the aid of technological devices, such as mobile phones but does not have to take place solely through the technology.

But, these collaborative interactions that result in learning are not always guaranteed to occur in a learning situation. This is addressed by designing an activity to encourage such interactions – assigning roles to the participants, scaffolding their interactions with rules and monitoring those interactions all contribute (Dillenbourg, 1999, pp. 7-9).

M-learning itself promotes interaction and communication between learners (Nyiri, 2002). Various collaborative learning activities that utilise mobile devices have been implemented (Colley & Stead, 2003; Facer et al., 2004; McGreen & Arnedillo Sánchez, 2005a, 2005b). A common feature of these activities is that they encouraged collaboration by building it into the activities or artefacts. In the Savannah game, children realised that the way to succeed was to work together and share information with their fellow group members (Facer et al., 2004). In the Ambient Wood, children were encouraged by a facilitator to discuss what they were finding in the wood (Rogers et al., 2004).

Grounding, the means by which mutual understanding is achieved between participants, is an essential aspect of collaborative interactions that leads to more effective

communications. Children who have learned together in the same class group in the same school will already have some common understanding which needs to be extended to encompass the particular activity being undertaken. This includes further understanding related to the setting, goals and tools involved. Furthermore, this grounding needs to be maintained throughout the activity (Baker, Hansen, Joiner, & Traum, 1999).

2.4 Contextualised Learning

The idea of contextualised learning is to bring learning into real environments relative to the learning, rather than it happening in an environment where learners are divorced from the actual real-world context of the concepts being learned. This can be done by engaging in field trips to actual physical locations or through virtual field trips which simulate the physical environment under study (McGreen & Arnedillo Sánchez, 2005a).

In their ‘Contextual Model of Learning’, Falk & Dierking (2002b, p. 37) argue that there are three contexts involved in the learning process – that of the individual, that of society and culture and that of the physical environment. This recognises that learning begins with the individual, that learning involves other people and interactions with them and that learning takes place in a physical environment. They go on to emphasise that “the more appropriate the physical setting to what is being learned, the more meaningful the learning that results” (ibid., p. 55). Learning in a rich physical environment that contains real-world objects and connections helps learners to meaningfully contextualise the concepts with which they are presented (Falk & Dierking, 2002a). McGreen & Arnedillo Sánchez (2005a) refer to this as ‘physical contextualisation’. Sharples et al also recognise that the context in which learning takes place is not just about location – it also comprises other aspects such as time, the learner him/herself, peer learners who are also present and objects in the location (2002). This can be extended to include also tools that learners are using, including mobile phones.

However, it is not always logistically possible for a teacher to bring a group of learners, particularly children, out of the classroom and into the real physical environment, even to a location close to the school. Constraints on supervision, time, transport and finance can make it difficult to achieve. Virtual field trips can provide a substitute as a context for learning through simulation of real-world objects (McGreen & Arnedillo Sánchez, 2005a). But, such computer-based field trips lack in real physical objects that learners can actually

interact with (Hurst, 1998) and do not allow learners to discover information for themselves in ways that are not designed into the virtual experience.

Where real field trips can take place, m-learning has the potential to enhance contextualised learning (Sharples, Corlett, & Westmancott, 2002). Mobile devices provide a convenient, portable means of quickly recording information and experiences. By capturing that data in an appropriate format, it can extend learning from a real physical environment back into the classroom. Where there are constraints on the number of learners that can partake in a field trip, m-learning applications can be devised that allow the few to share their experience with the many and to help bridge the gap between the real environment and the classroom.

Nyiri argues that knowledge is information in context and that m-learning is well-suited to the building of any knowledge that is location-dependent or situation-dependent (2002). If learners can see a real, physical context for the information they have been given and gather more information from their environment, then they are better placed to gain knowledge. For example, in the Ambient Wood (Rogers et al., 2004), it was evident that children were carrying out scientific enquiry into objects in their surroundings.

2.5 *The WebQuest Model*

The WebQuest model of instructional design, pioneered by Dodge (1995,1997), allows educators to create structured, inquiry-based activities for learners, utilising web-based resources. Typically, learners are guided through a task and a process from which they build their own knowledge. The defined stages of a WebQuest are shown below; it is implemented as a website with interlinked pages for each of the stages.

| Stage | Brief Description |
|--------------|---|
| Introduction | Sets the scene and indicates what the main activity or output is. |
| Task | Describes what needs to be achieved. |
| Process | Gives guidance through the stages the learners will go through, with a list of useful electronic Resources. |
| Resources | Sometimes separate from Process. |
| Evaluation | Explains how the resulting work will be evaluated. |
| Conclusion | Summarises the learning and may also encourage reflection and extension of the learning into other areas. |

Figure 1 – table showing stages of WebQuest

WebQuests are a popular way to give learners a structured means of accessing data on the internet, with various web sites providing templates and guidelines on how to use them¹. Reported benefits of the use of WebQuests include: facilitating a range of learning styles, promoting team work (Hopkins-Moore & Fowler, 2002) and shared learning experiences (Goodwin-Jones, 2004).

The WebQuest model promotes learning on the basis of inquiry, where the learner gathers information from designated sources, thus avoiding having to waste time trawling through and evaluating for accuracy the massive amount of resources on the internet. It also allows for collaboration and cooperation to be built into the activity by requiring that learners role-play or work in groups to find and analyse information (Goodwin-Jones, 2004).

For some subject areas, the internet is an appropriate place in which to *contextualise* learning but for others, it does not put learners into the *real world* where the knowledge actually applies. If learners have access to internet-enabled mobile phones, a WebQuest can be combined with learning in a contextual environment, as attempted by Batista Bottentuit Junior et al (2006).

¹ Examples of web sites about WebQuests include <http://webquest.sdsu.edu/>, <http://webquest.org/> and <http://bestwebquests.com/default.asp>

2.6 Conclusion

Innovative m-learning applications are those that include data collection, are location-aware and collaborative; they should be founded on pedagogical principles rather than over-emphasising the technology. M-learning is best used in combination with other modes of delivery such as other ICT and paper-based materials.

Collaborative learning interactions are of a social nature, taking place between learners as they seek to build common understanding using their knowledge and resources available to them. Mobile phones are objects that can be a context for collaborative interactions. However, not all social interactions in a situation are collaborative and the likelihood of collaboration taking place needs to be increased by designing learning activities accordingly.

Contextualised learning occurs when learning takes place in a physical environment that contains objects related to the learning. The learners themselves, their location and the tools they use form part of the context in which the learning is taking place. With the WebQuest model, learning takes place in a virtual context that is lacking in real, physical objects that learners can touch and feel.

The guiding principles of the WebQuest can be combined with m-learning concepts to create a learning experience that does not rely on internet access. This learning experience takes place partly in a classroom and partly outside the classroom, shifting the focus of inquiry to objects in real environments, allowing for greater contextualisation of learning. By designing the learning activity to encourage interactions (Dillenbourg, 1999), the probability of collaborative learning taking place can also be increased.

The next chapter shows how the MobiQuest learning experience is designed with collaboration and contextualisation in mind.

3 Design of the MobiQuest Learning Experience

The literature shows collaborative, contextual m-learning applications as being likely to provide educational benefit. In m-learning, the limitations of mobiles need to be addressed while a sound pedagogical underpinning is necessary to ensure that the technology does not overtake the learning.

This chapter shows how the pedagogical principles from the literature support the design of the MobiQuest learning experience.

3.1 Overview: *The MobiQuest*

The artefact designed and built for this research is an m-learning experience named the ‘MobiQuest’. It uses mobile phones that have a built-in camera and are enabled for SMS and MMS messaging. The phones are used to communicate with the ‘MobiQuest HQ’, which stores all messages it sends and receives, and is located in a classroom or other central location. The MobiQuest participants leave the classroom to visit a contextual environment relevant to the learning topic. While there, they use mobile phones to take photographs and send and receive messages

3.2 Collaboration

3.2.1 Grounding

In order to establish grounding (Baker, Hansen, Joiner, & Traum, 1999), some pre-requisites are factored into the experience. Prior to it taking place, the learners have knowledge of fundamental concepts related to the topics, which are selected in consultation with their teacher. If they have been learning together for some time, they already have a certain amount of social and cultural common understanding. Successive implementations of the activity with the same group of learners provides grounding in the use of the mobile phones and the structure of the activity: they become more familiar with the mobile phones supplied to them and with the activity itself.

3.2.2 Increase the chances of collaboration occurring

The learning experience was devised with the aim of increasing the chances of collaboration occurring (Dillenbourg, 1999). Activities are based both inside and outside the classroom so that the learners have to use mobile phone messaging to bridge that gap.

Objectives are set so that the participants need to work together to achieve them. For example, they need to provide information required by their peers back in the classroom (to complete a worksheet) or they have to find certain objects based on clues they receive as text messages. See for example Figure 2.

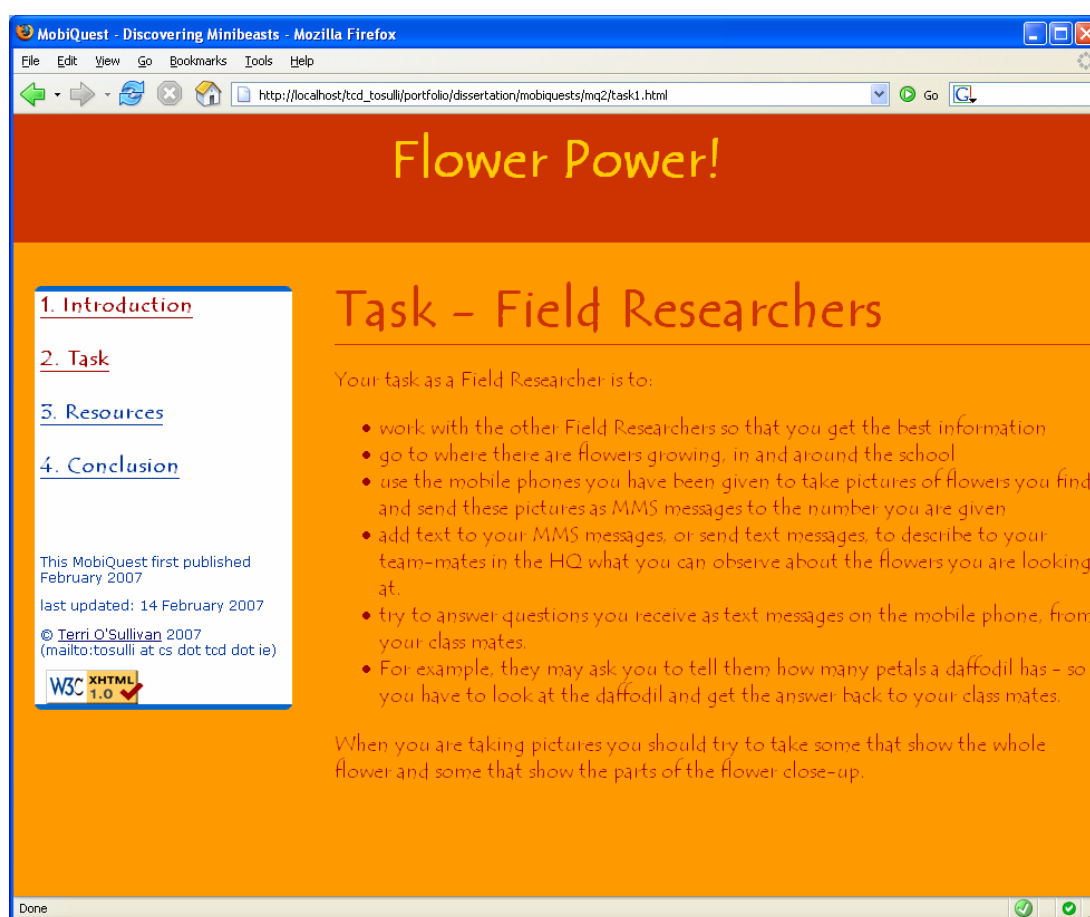


Figure 2 – task description for Implementation 2

The children inside the classroom who work on completing a worksheet are able to send messages to those outside using either a mobile phone or a web page (Figure 3). The messages they send are prompted by the worksheet (Figure 4) or elicited by the teacher.

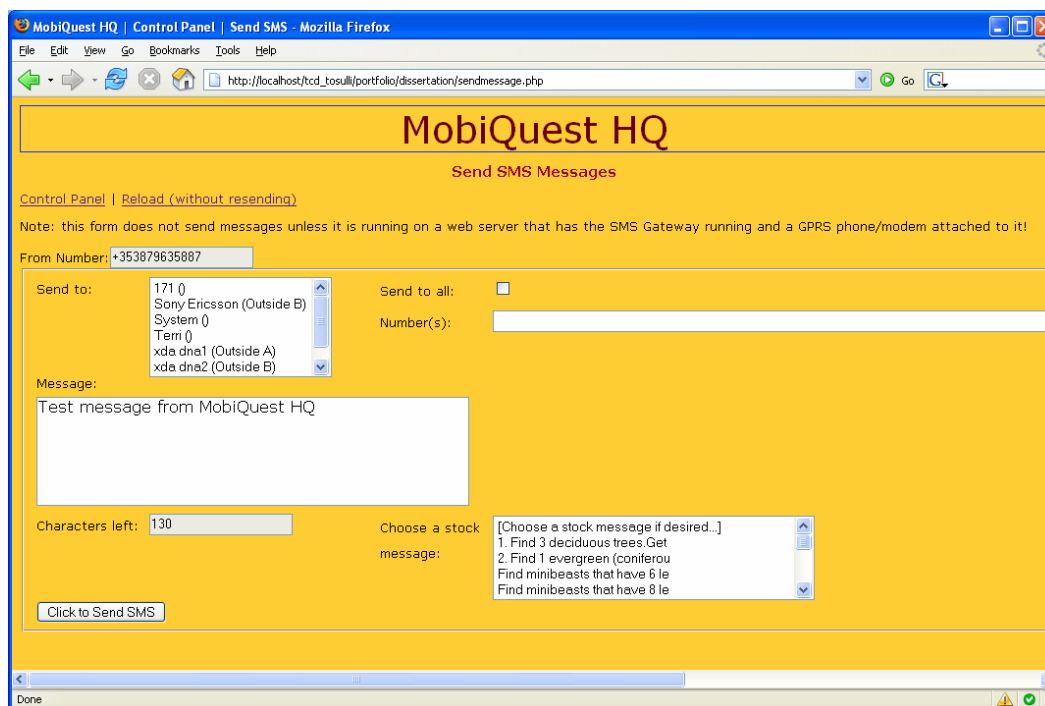


Figure 3 – MobiQuest control panel – send SMS messages

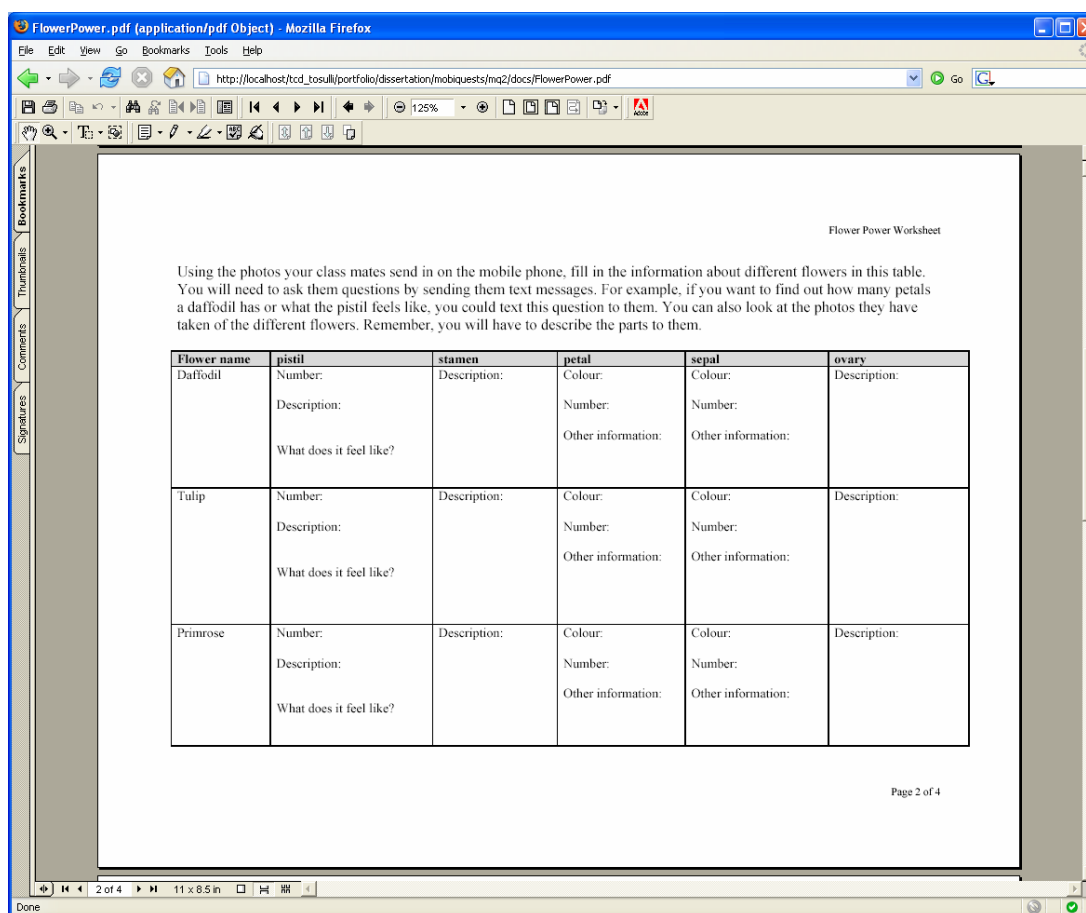


Figure 4 – extract from worksheet (Implementation 2)

The facilitator also has a role in encouraging collaborative interactions by eliciting knowledge from the participants in ways that could lead to further interactions.

3.2.3 Technology as context for interactions

Mobile phones provide a link between the usual learning environment of the classroom and the contextual learning environment. Mobile phones do not replace the verbal communications that inevitably take place, but they do provide a context for social interactions (Crook, 1994).

3.3 *Contextual Learning*

Contextual learning is about taking learning out into real environments, on field trips, where learners can observe and interact with real-world objects. The context comprises not just this physical location but also the learners themselves and the tools they are using.

3.3.1 Bridging the Gap

The MobiQuest learning experience allows the learners to bridge the gap between the classroom and the contextual environment - mobile phones are a convenient way to capture information while outside, for use back in the classroom. All messages sent are captured and stored in the artefact (Figure 5).

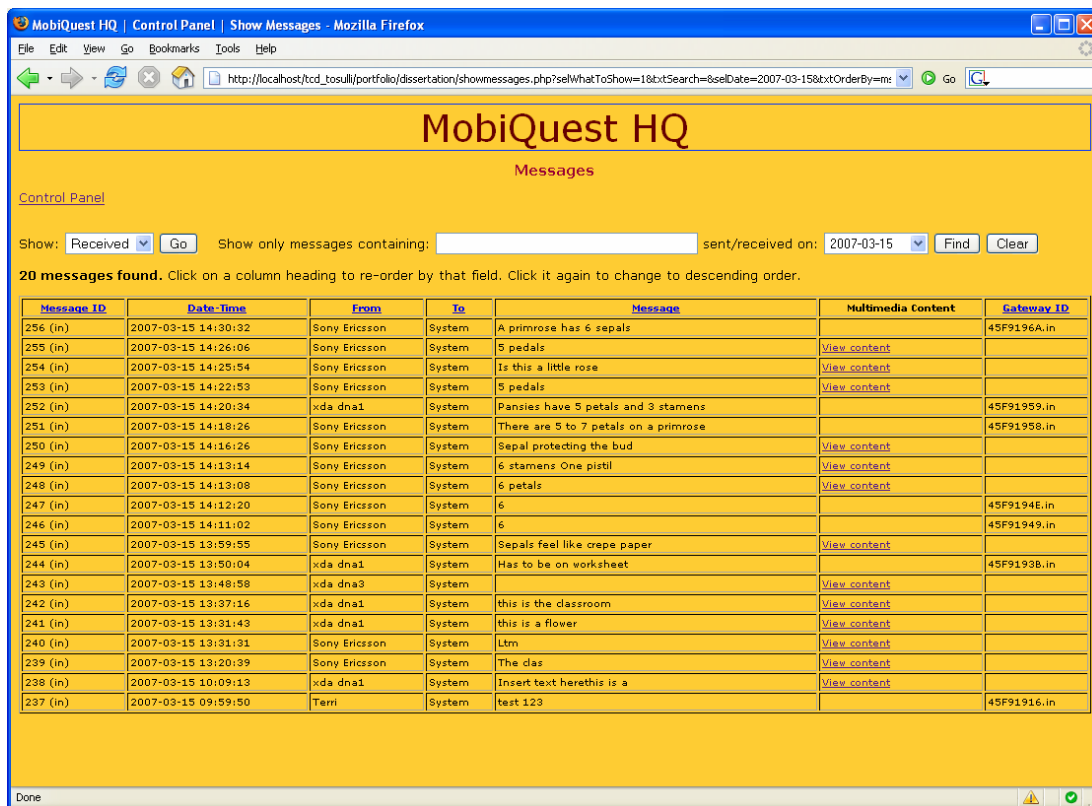


Figure 5 – MobiQuest HQ, showing messages received during Implementation 2

Rather than simply seeing the messages in chronological order (Figure 5), the artefact also allows learners to view the pictures and text, move them around and edit them (Figure 6).

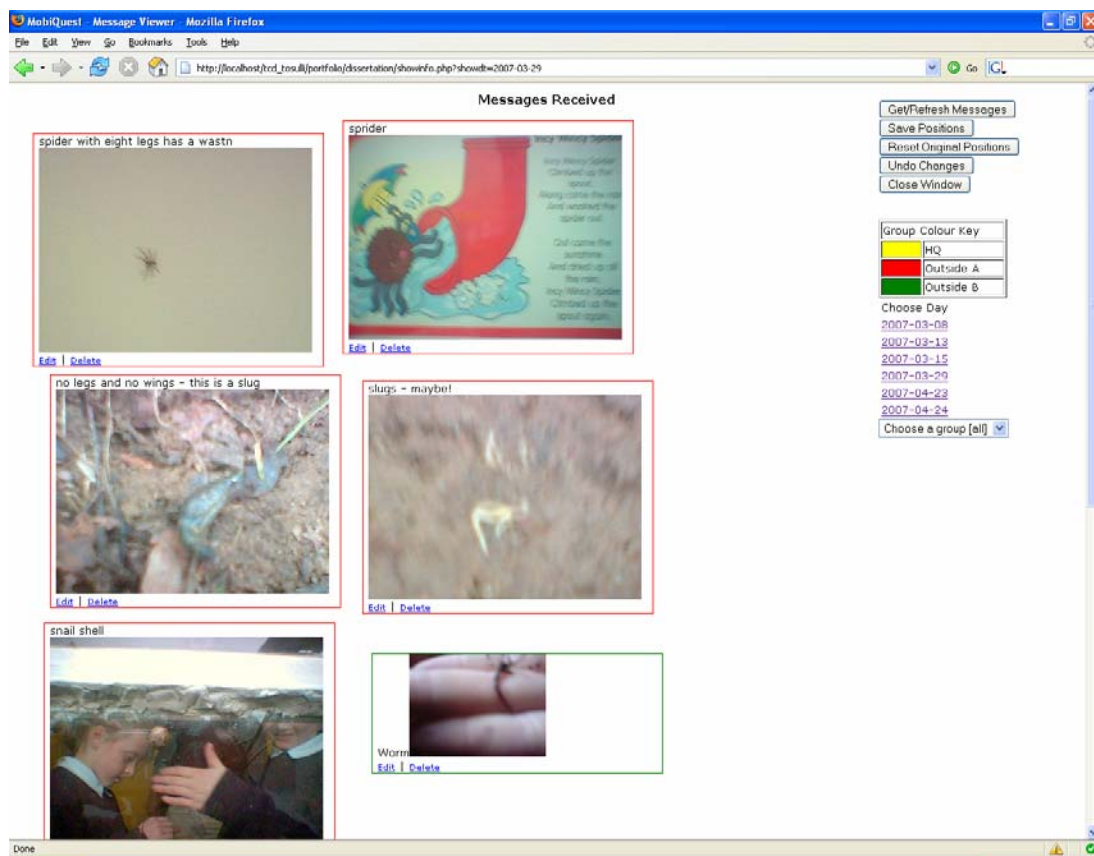


Figure 6 – viewing the text and pictures in the artefact

3.3.2 The contextual environment

According to the literature, an environment in which numerous real physical objects relevant to the learning are present enables learners to put what they are learning into context (Falk & Dierking, 2002a; McGreen & Arnedillo Sánchez, 2005a). For this research, nature and environmental topics from the Irish SESE (Social, Environmental and Scientific Education) curriculum² were selected as the subject of the MobiQuests. These were chosen because the school surroundings provided an easily accessible environment containing relevant objects. Here, the learners could observe and interact with real physical objects relevant to their learning.

3.3.3 Tools

Whilst immersed in this environment, the learners use mobile phones to capture some of what they experience in photographs and text and send those into the MobiQuest HQ. There, they are stored for use either by peer learners back in the classroom or by the participants themselves when they return back inside.

² Available from <http://www.curriculumonline.ie/index.asp?locID=343&docID=-1>

3.4 Lessons from M-Learning Applications

3.4.1 Blend with other modes

As suggested by the literature, m-learning activities should be implemented in a way that blends the use of mobile devices with other tools (Ally, 2004; McGreen & Arnedillo Sánchez, 2005a; Stead, 2005).

The MobiQuest incorporates the use of paper worksheets that revise or introduce knowledge relevant to the learning topic (Figure 7). They also provide cues for those in the classroom to send questions or clues to the participants outside (Figure 8), using the artefact.

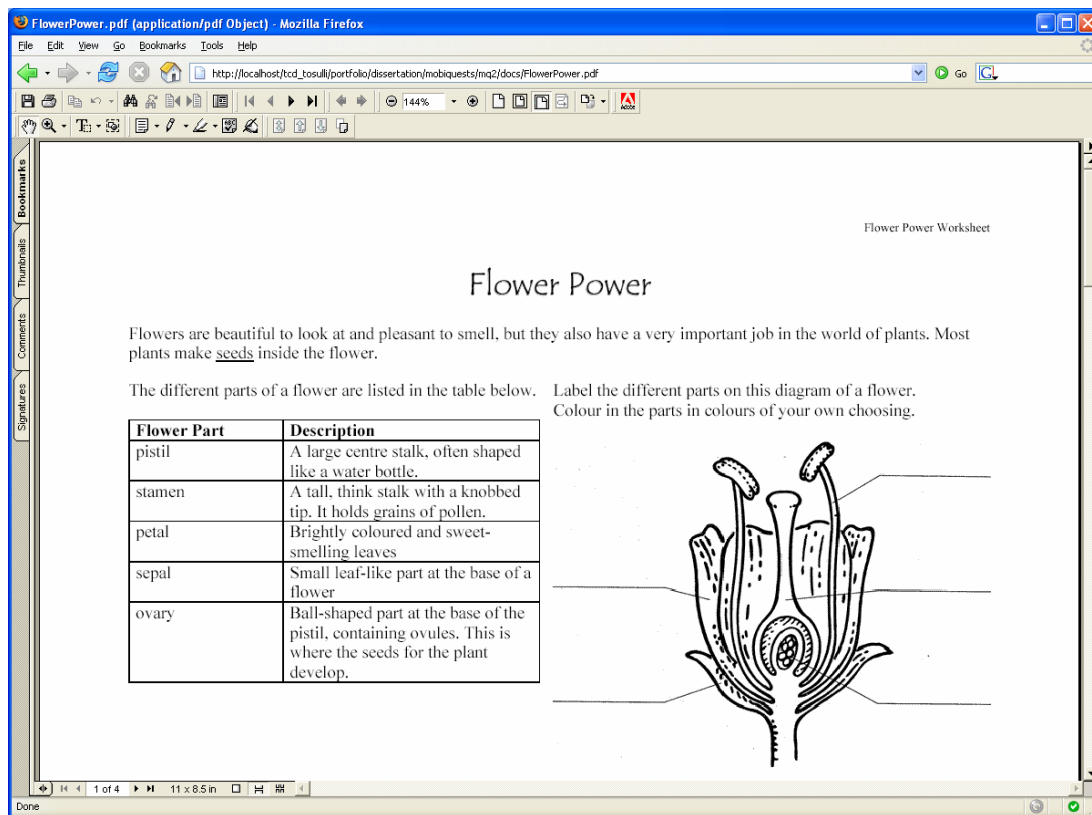


Figure 7 – part of a worksheet used in Implementation 2

A minibeast key

bugs

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____ HABITAT: _____

DESCRIPTION: _____

BEEYLES

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____ HABITAT: _____

DESCRIPTION: _____

minibeast

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____ HABITAT: _____

DESCRIPTION: _____

NAME: _____

HABITAT: _____

DESCRIPTION: _____

NAME: _____

HABITAT: _____

DESCRIPTION: _____

Figure 8 – part of a worksheet used in Implementation 1

Information in the artefact that needs to be seen by the participants is shown to them by connecting a laptop to an LCD projector in the classroom. This is used to introduce the topic and the task for each MobiQuest (sample in Figure 9).

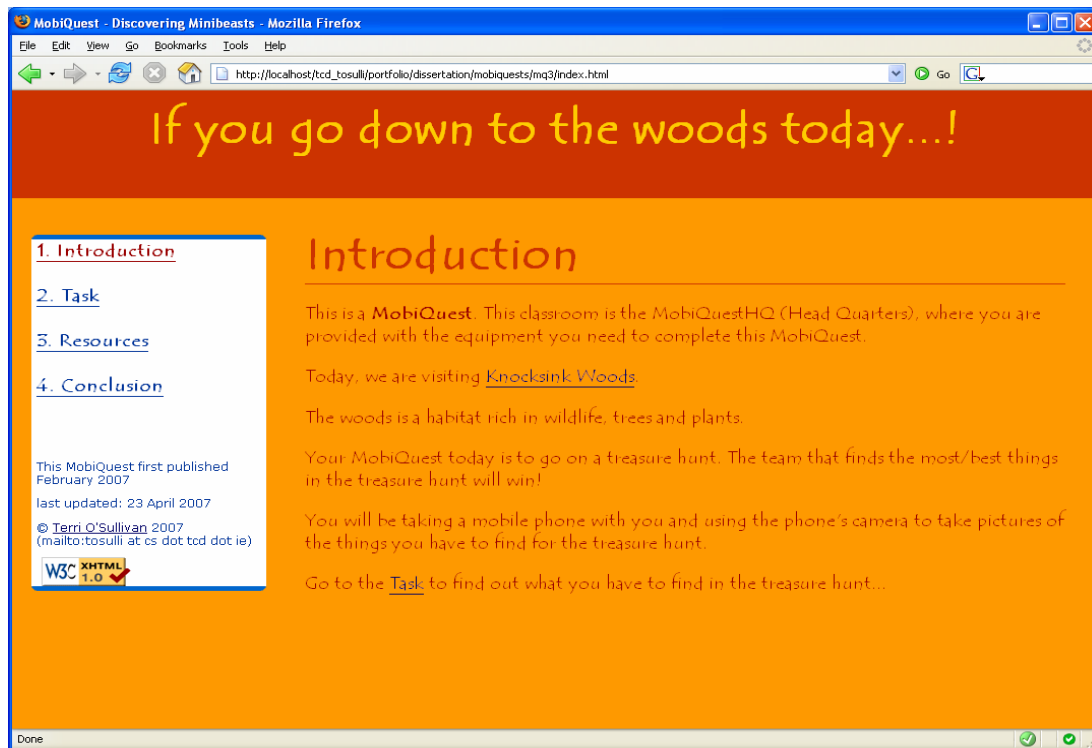


Figure 9 – introduction to the MobiQuest used in Implementation 4

Mobile messaging has limitations in terms of the size of messages sent - this forces the learners to send only pertinent pieces of information (for example, the picture message being composed in Figure 10).



Figure 10 – a picture message being composed

3.5 WebQuest

In a manner similar to the WebQuest, a mini website was built for each MobiQuest (Figure 11 below). This helped to overcome the limitations of mobile phones in imparting large chunks of information to the participants. Each mini website consists of Introduction, Task, Resources and Conclusion pages. The Introduction and Task are used as visual aids when introducing the activity to the class. The Resources could be used in the classroom, to help identify objects found in the environment, but some require an internet connection. The Conclusion is a simple page to wrap up the activity.

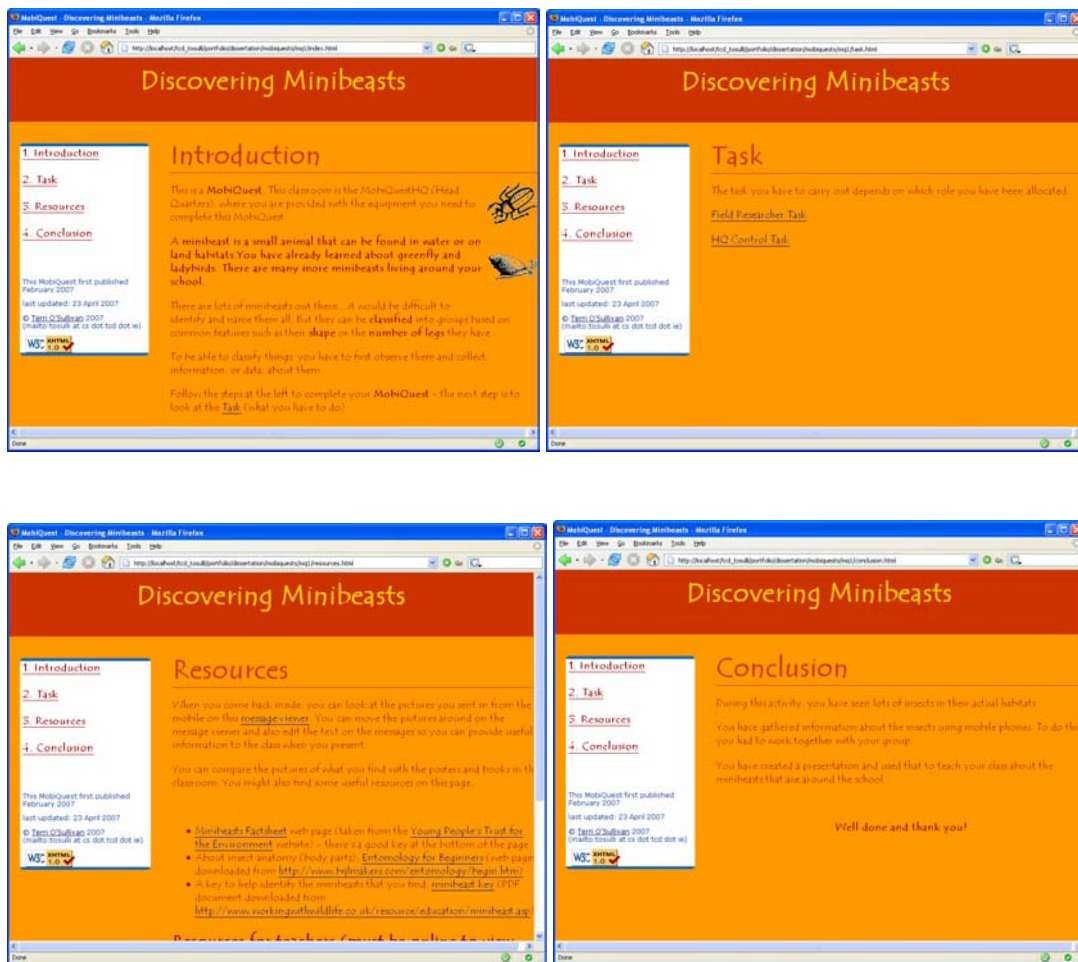


Figure 11 – a MobiQuest mini website

3.6 The Technical Artefact

A web-based framework supports the MobiQuest. Mobile phones with built-in camera and SMS/MMS messaging are used.

Text and picture messages sent during MobiQuest activities are sent to or received by an SMS Gateway that is capable of receiving text and picture messages and of sending text messages. The gateway was customised by integrating it with a number of web scripts to process messages, store them in a database and trigger response messages.

During the MobiQuest, a laptop computer and an overhead projector are used to allow the participants and their classmates work with messages sent to the gateway during the activity.

Figure 12 shows the elements of the artefact; descriptions follow.

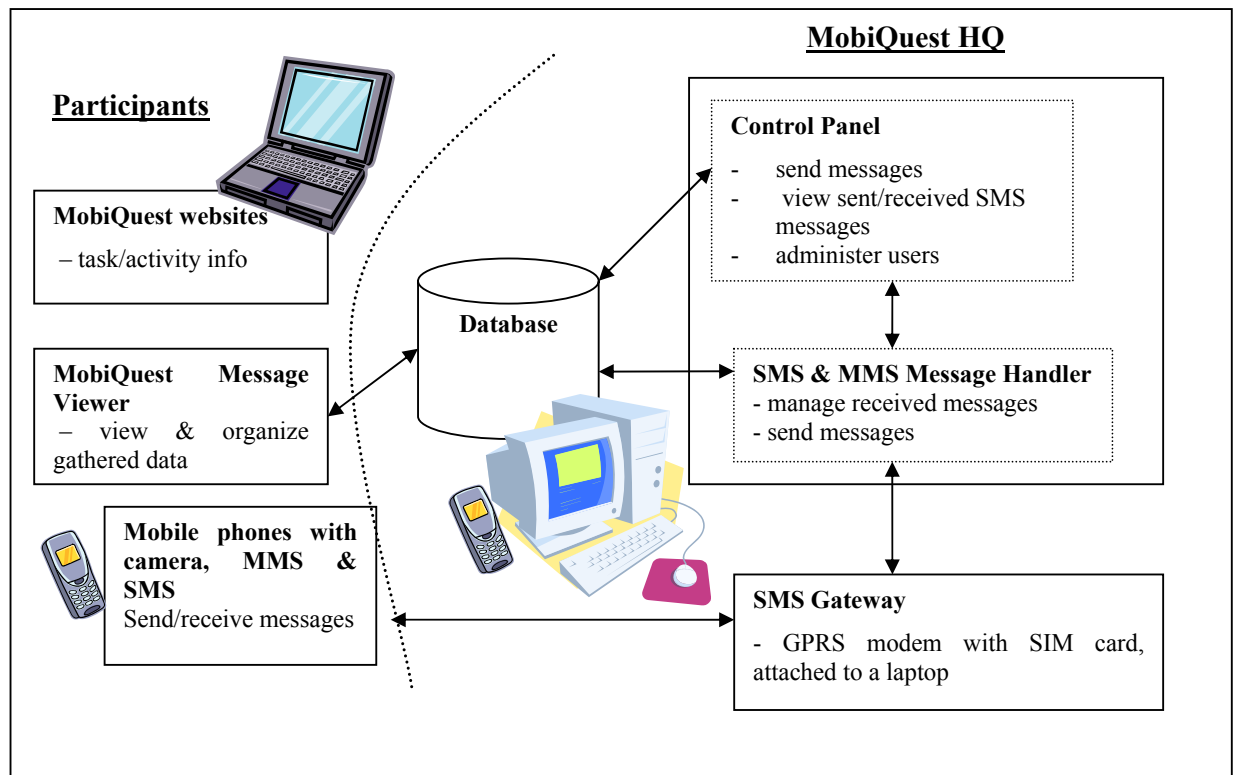


Figure 12 – diagram showing the elements of the MobiQuest artefact

The **SMS gateway** runs on a laptop; it receives all messages sent to a SIM card installed in a special modem connected to the laptop. The gateway also sends messages submitted from a web page or triggered by sending the gateway a message beginning with a specific keyword.



Figure 13 –laptop with GPRS modem connected

The **MobiQuest HQ** comprises the web-based **control panel** (Figure 14) and **automated message handlers**. On the control panel, the phone numbers of participating mobile phones can be registered along with user names. Groups can be created and phones assigned to different groups. Incoming and outgoing messages can be monitored; there is a web page for composing and sending text messages (Figure 15).

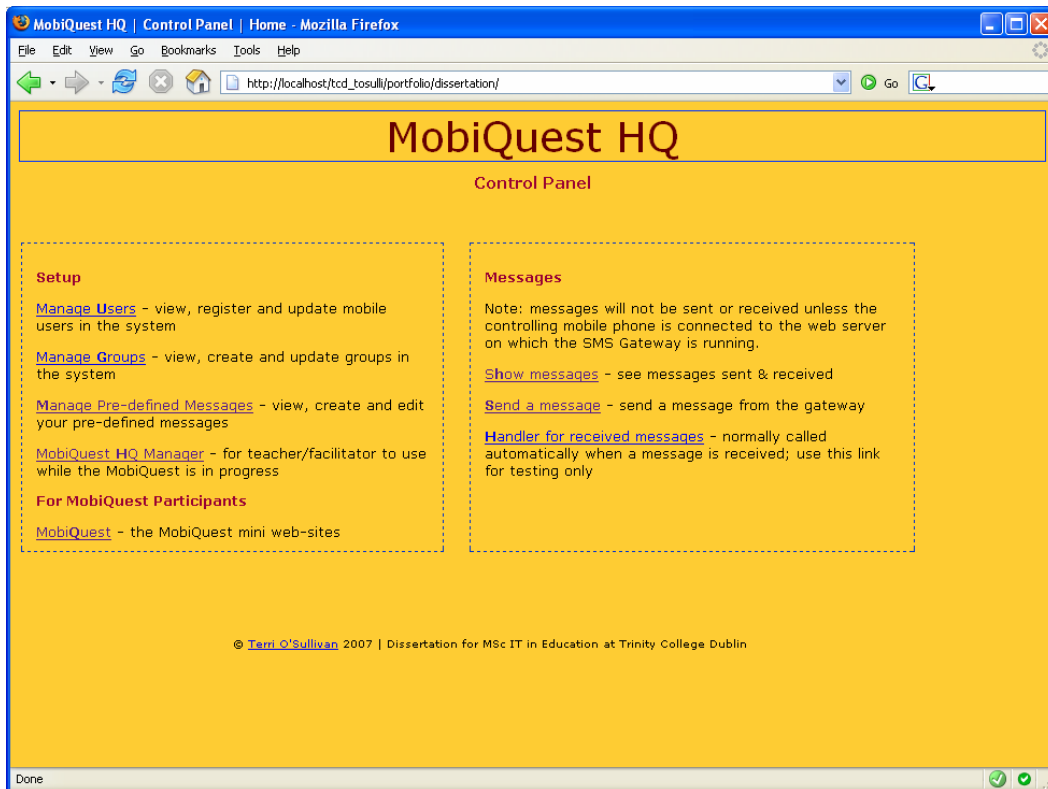


Figure 14 – the MobiQuest HQ Control Panel

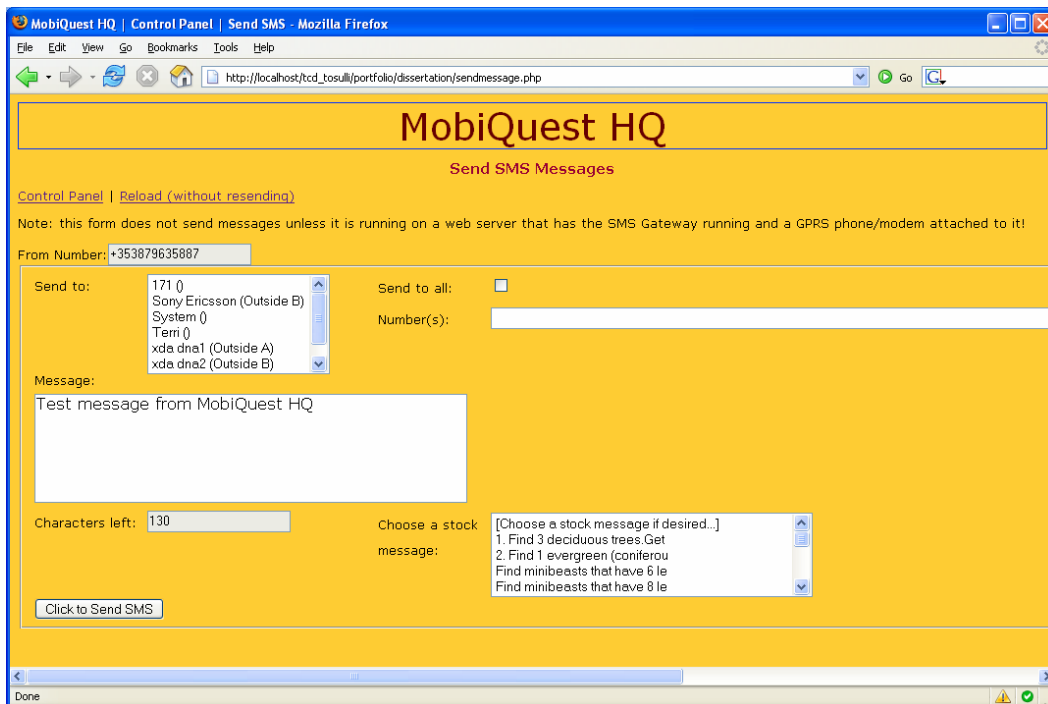


Figure 15 – MobiQuest Control Panel - send an SMS text message

The **message viewer** (Figure 16) displays text and picture messages received by the gateway. Each message is displayed in a colour-coded box. Text can be edited and a message can be deleted from the view if it is not required. Messages can be viewed by group and by date received.

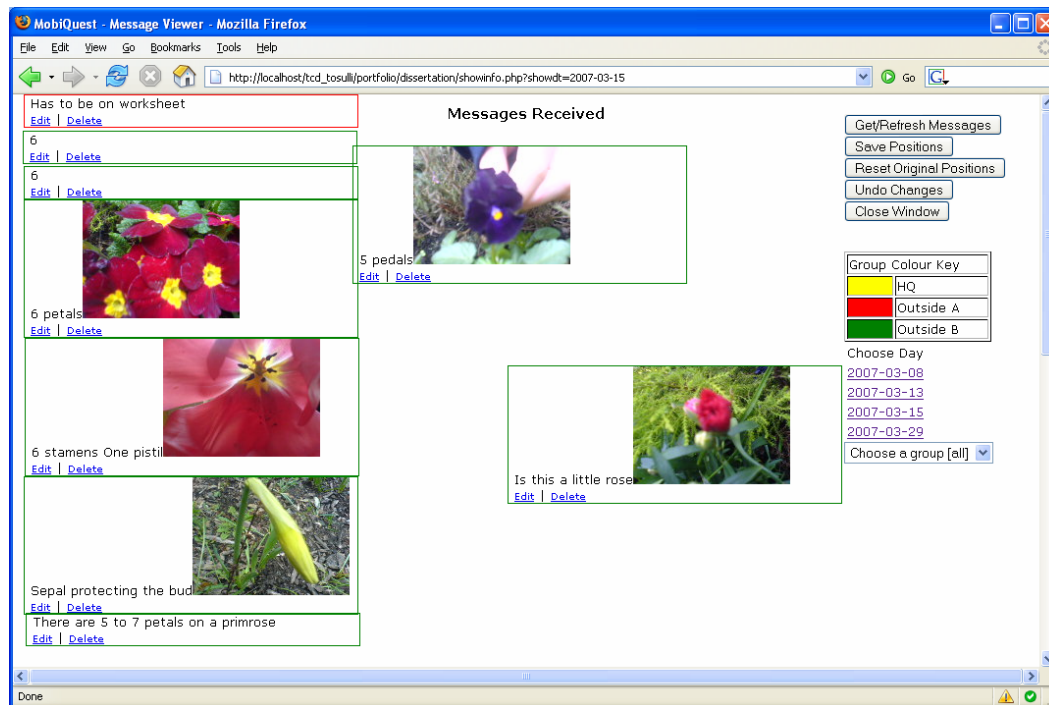


Figure 16 – the MobiQuest Message Viewer

For each activity, a separate **MobiQuest website** was built (Figure 17), providing information and resources for the task being undertaken. These are not core to the experience but are a repository for information that the teacher/facilitator can use.

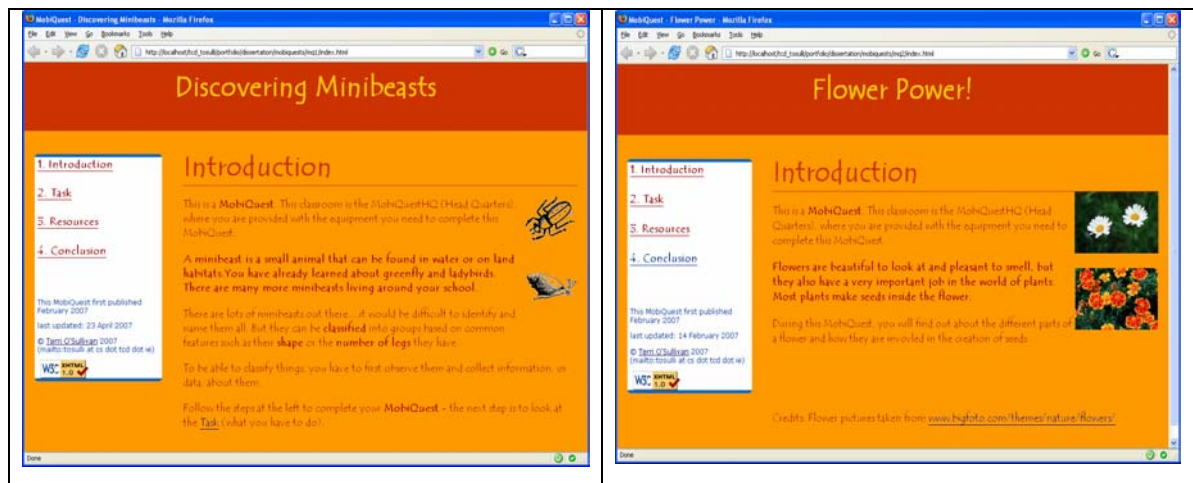


Figure 17 – samples pages from two of the MobiQuest web sites

The participants are given **mobile phones** to use during the activity – in this instance, a Sony Ericsson K750 and an XDA II.

The central **database** is used to store users and messages. This enables the display of messages on the message viewer and in the control panel.

Any number of mobile phone numbers can send messages to the gateway. All incoming messages are stored in a database, enabling them to be displayed on the message viewer. As messages can be edited and deleted on the message viewer, the original messages are also retained for data collection purposes.

The technologies employed in building the artefact are outlined in Appendix B: Technology Used.

4 Implementation

This chapter describes what a MobiQuest is and how and with whom the research was implemented.

4.1 Introduction

The pedagogical foundation for the MobiQuest is collaborative and contextual learning, taking advantage of the portability of mobile phones and incorporating elements of the WebQuest model.

The chances of collaborative interactions taking place are increased by the design; grounding is also important. Physical objects in the learning environment and the tools used provide contexts for collaborative interactions. Contextual learning is about the location, learners and tools being used. The learners interact with and observe real physical objects in the location.

This research aims to determine how the MobiQuest learning experience brings about opportunities for collaboration among learners and how it allows contextualised learning to take place. It also seeks to determine what the principles of design are for the MobiQuest.

In this chapter, the phrase ‘MobiQuest’ refers to one of four implementation sessions, for which there were varied topics.

4.2 What is the MobiQuest?

The MobiQuest is a learning activity that takes place mainly in a contextual environment related to the learning topic and partly in the classroom. Mobile phone messages are used to capture images and text about objects in the environment and send them to the ‘MobiQuest HQ’ for later work. The MobiQuest can be outlined as follows:

- The MobiQuest HQ is set up in the classroom.
- The facilitator introduces the activity to the learners in the classroom, using the MobiQuest website as a visual aid.

- Initial text messages are sent from the HQ to participant mobile phones, if required, by the facilitator.
- Participants leave the classroom to go to the contextual environment, with a facilitator and the mobile phones.
- The selected participants spend some time (varying from 30 minutes to an hour) in the contextual environment, finding and interacting with objects and sending mobile messages about them.
- In the classroom, the messages sent from the contextual environment can be used as a resource by other learners while the participants are still outside or used after the participants return to the classroom.
- On their return to the classroom, the participants may do further work with their messages, such as organizing them or identifying objects.

4.3 Participants and Procedures

The research was carried out with 4th class pupils (aged 10-11 years) at a primary school in County Wicklow in Ireland. The school is situated in a village, with the school grounds and a nearby wood providing a contextual environment for learning about nature.

The class teacher volunteered to have her class partake in the research; a parental consent form was prepared and issued (Appendix A: Consent Form). Sixteen of the class were subjects for the research while the other fourteen were involved but not in the core activities; as such, their participation did not form part of the research study.

A questionnaire was administered before the implementation took place, to ascertain the participants' exposure to mobile phones. The data from this questionnaire indicated a mixture of levels of usage of mobile phones in the class. The data is summarised in section 4.5 below.

The implementation took place over four separate afternoon sessions between March 8th and April 24th 2007, for about 1.5 hours each time.

For the first three MobiQuests, different participants were selected by the teacher. For the fourth, a selection of the previous participants was chosen by the researcher as by then they were familiar with the activity and the mobile phones.

4.4 The Implementation Process

The researcher met with the class teacher to discuss the MobiQuest and how it could fit into class work. School rules would not allow the entire class to leave the classroom without a number of adult supervisors, which resources did not permit. However, the MobiQuest could benefit the whole class by creating a worksheet for the class to complete while the participants left the classroom to go to the contextual environment. This would provide an objective for the participants – to send in messages that would help their peers complete the worksheet.

The table in Figure 18 below shows key information for each of the implementation sessions. The roles are described in Figure 19. See Appendix D: The Implemented MobiQuests for full descriptions.

| Implementation Details | | | |
|-------------------------------|-------------------------|------------------------------|--|
| No. | No. Participants | Selected By | Roles |
| 1 | 4 | Teacher | 1 camera person (later taken over by facilitator while he participated fully) 4 x Field Researcher Additionally, 2 children in classroom as 'HQ Controllor'. |
| 2 | 6 | Teacher | 6 x Field Researcher, in two groups of 3. Additionally, 2 children in classroom as 'HQ Controllor'. |
| 3 | 6 | Teacher | 6 x Field Researcher, in two groups of 3. |
| 4 | 6 | Researcher, from previous 16 | Two groups of 3. |

Figure 18 – table outlining the implementations

| Roles | |
|------------------|--|
| Role | Description |
| Field Researcher | <p>Direct participants who went outside the classroom were allocated this role. Involved:</p> <ul style="list-style-type: none"> • locating physical objects relevant to the learning topic • discussing them with the aid of prompting and scaffolding from the facilitator • photographing them using the mobile phones • composing text and picture messages and sending them into the HQ for use in the classroom |
| HQ Controllor | <p>Used in Implementations 1 and 2. Two learners in the classroom nominated by the teacher.</p> <ul style="list-style-type: none"> • Responsible for sending messages using the MobiQuest Control Panel • Others in the classroom given a worksheet that prompted them for clues or questions about particular objects – these used to compose messages that were sent by the HQ Controllors. <p>For implementations 3 and 4, this role was eliminated and the activity was not reliant on MMS messages being delivered to the HQ immediately.</p> |

Figure 19 – table describing roles

The participants were given time to familiarise with the mobile phones being used. The researcher participated in the activities as facilitator, scaffolding interactions through elicitation and providing guidance on the use of the mobile phones.

Those outside then had to work out the answer to each clue or find out the answer to a question, and send a picture of the appropriate object back into the class using MMS. They added text to the picture messages to include details they observed.

4.5 Profile of Participants

Figure 20 and Figure 21 below show how many of the class owned or regularly used a mobile phone. Figure 22 shows that most of those phones had SMS, MMS and camera functions. Most had used SMS in the previous month while only 6 had used MMS and 12 had use the camera (Figure 23).

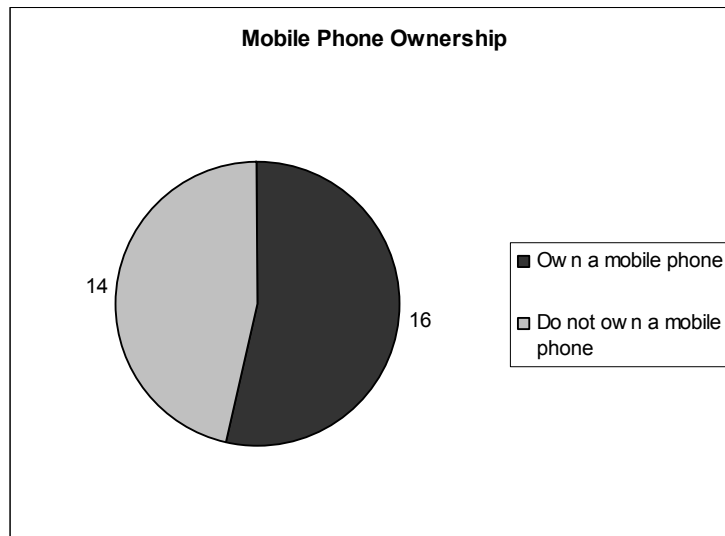


Figure 20 – chart: Mobile Phone Ownership

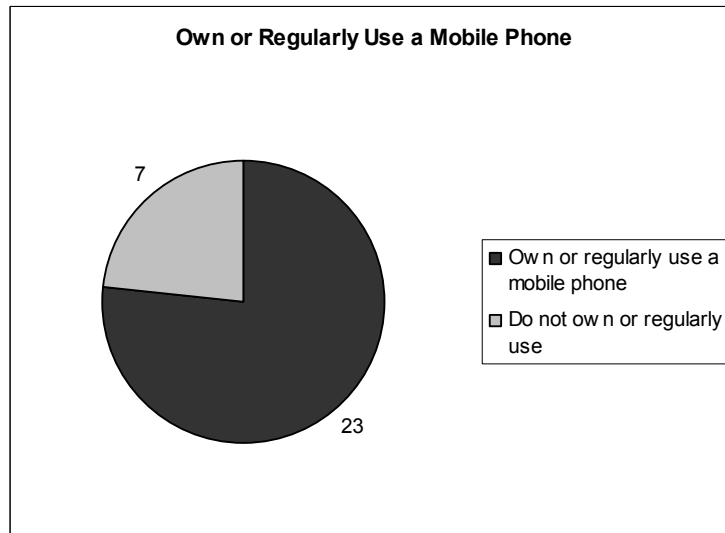


Figure 21 – chart: mobile phone ownership/usage

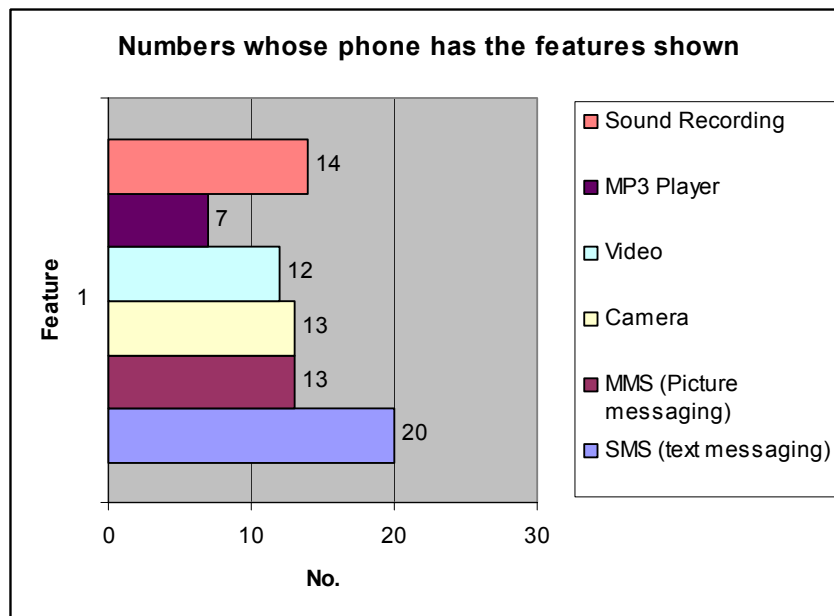


Figure 22 – chart: mobile phone features

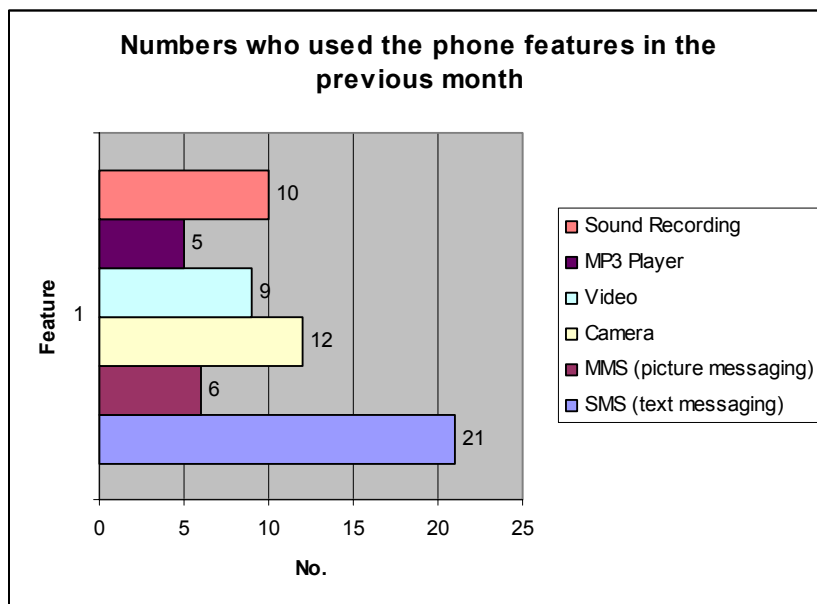


Figure 23 – chart: mobile phone features usage

5 Methodology

This chapter discusses the methodology used for this research, showing what approach was adopted and why.

5.1 Research Strategy

In seeking to explore how the MobiQuest learning experience brings about collaborative learning and if it enables contextualised learning, a qualitative research approach was adopted. The objective in qualitative research is to gain an understanding of the identified research problem, for which a suitable site and participants must be selected.

There are a number of research methods that can be used in qualitative research, such as action research, grounded theory and ethnography. A researcher applying action research is seeking to solve a specific problem (Cohen, Manion, & Morrison, 2000, pp. 226-227; Cresswell, 2005, p. 550). Grounded theory is used to generate a theory based on collected data, with successive iterations of the data collection process feeding into the next; this is used where there is not already existing a theory that explains the problem being researched (ibid., pp. 396-397). Ethnography involves the study of groups of people in order to answer research questions about those people (ibid., p. 436).

Another method is case study, seen by some as a type of ethnography (Cresswell, 2005, p. 439) and others as being itself a valid strategy (Yin, 2003) with which a researcher can seek to understand the activities of “real people in real situations” (Cohen, Manion, & Morrison, 2000, p. 181).

Case study was most appropriate to the research questions posed in this dissertation, as they are exploratory and of a ‘how’ and ‘why’ nature (Yin, 2003, pp. 3-9). Research by case study involves focusing on the activities of the participants over a particular time-frame in a particular situation - a “bounded system” (Cresswell, 2005, p. 439), through in-depth exploration and analysis of their activities in order to show and interpret what happened in the system (Cohen, Manion, & Morrison, 2000, p. 79; Cresswell, 2005, p. 439).

This research seeks to determine how the MobiQuest brings about collaborative learning and how it can contextualise learning – these are dependent on and interlinked with the

context in which the MobiQuest takes place. This reflects Yin's definition of a case study being an investigation into a phenomenon in its "real-life context" when the "boundaries between phenomenon and context are not clearly evident" (2003, p. 13).

The research participants were chosen through a personal contact of the researcher. Teachers at the school were asked if they were interested in having their class partake in the research; one teacher responded positively. This is known as a 'convenience sample' for a case study. As such, the findings of this research cannot be said to apply to all 4th class primary school children. However, the findings will provide answers to the specific research questions posed (Cohen, Manion, & Morrison, 2000, pp. 102-103; Cresswell, 2005, p. 149).

5.2 Data Collection Tools & Data Analysis Techniques

A number of methods of data collection can be employed in qualitative research. These include direct observation, participant-observation, interviews, documents, physical artefacts and audiovisual materials (Cresswell, 2005, pp. 209-221; Yin, 2003, pp. 85-97). Interviews and audiovisual materials were the primary methods adopted for this research. Activities and interviews were video-recorded; messages were stored in the MobiQuest HQ.

Whilst the researcher participated in the activity and could thus be seen as a participant-observer, she was also responsible for video-recording and facilitating. This did not allow time to focus on close observation of any participants.

5.2.1 Audiovisual – video recording

As the participants were moving around during the activity, a hand-held video recorder was used to record each activity. This allowed the researcher to later review what happened.

Videos were organised into short clips and then transcribed. The transcriptions were imported into NVivo 7 software³ for coding (Figure 24). The assigned codes were then

³ Downloaded from <http://www.qsrinternational.com/>

grouped into broad themes (Appendix L: Codes), reflecting the research questions; the segments associated with the codes provided evidence used in the Findings chapter.

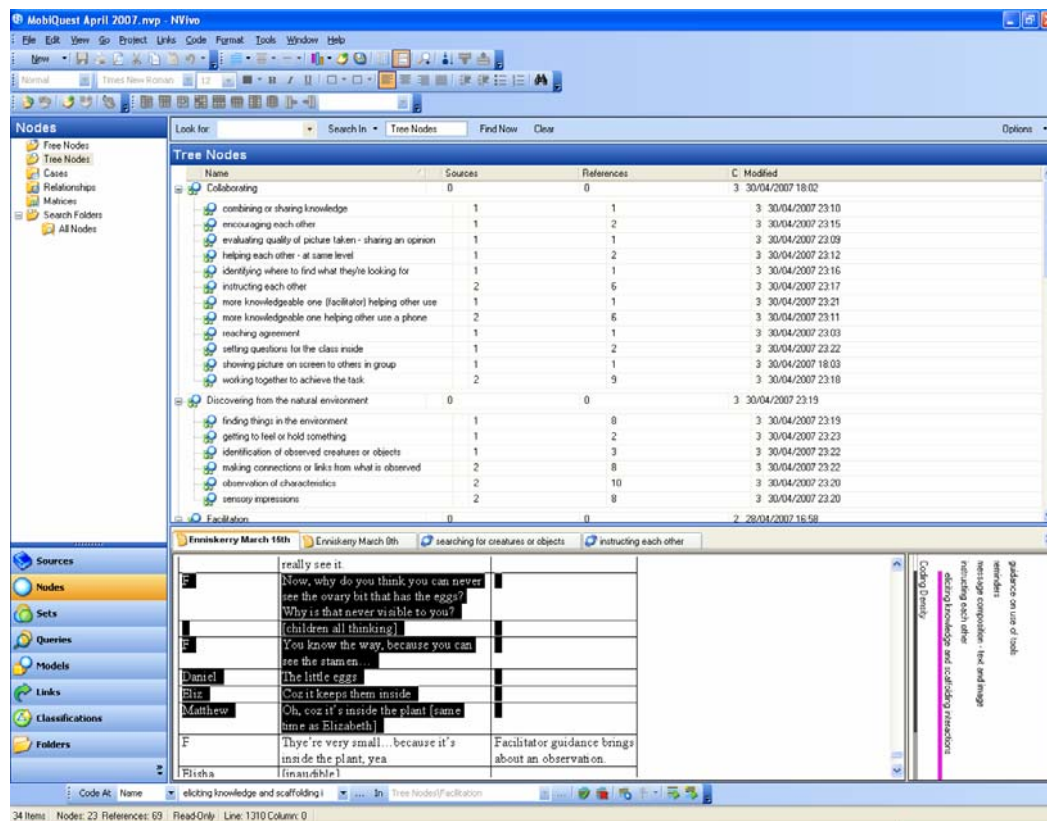


Figure 24 – sample of coding process in NVivo

5.2.2 Physical Artefacts – stored messages

Messages sent to and from the MobiQuest HQ were stored in a database, along with the date and time they were sent or received. These could later be linked to coded segments in the video transcripts, based on the time and date.

Both the video transcripts and the messages allowed the researcher to seek evidence of collaboration and contextual learning - the idea of ‘zooming in’ on collaborative interactions (Dillenbourg, 1999, p. 17).

5.2.3 Interviews

A brief interview was conducted with three of the participants after the final implementation. This was a semi-structured interview (see Appendix I: Semi-Structured Interview Protocol). Time constraints at the school did not allow for more interviews to take place. A short, more informal interview was also conducted in the classroom, during

which some of the class gave their opinions on the MobiQuest experience and how it could be improved. Both of these were recorded and transcribed (Appendix K: Data – Interview Transcript).

5.2.4 Other

As described in the Implementation chapter, a questionnaire was used to collect profile information about the participants. This data was inputted to and analysed in Microsoft Excel, with which the data was summarised and charts were produced.

6 Findings

This chapter summarises the findings of the research, using extracts from the data⁴. The findings are organised according to the themes that emerged from the coded data, reflecting the research questions.

The primary data source is the transcripts of the MobiQuest videos, complemented by messages that were sent during the MobiQuests. Full listings of the messages are shown in Appendix J: Data – Messages Sent/Received, as are transcripts of the interviews (Appendix K: Data – Interview Transcripts). Video clips and transcripts are on the accompanying CD.

6.1 Collaboration

Collaborative interactions took place in a number of forms. Examples of each are given below.

6.1.1 Identifying Objects

Learners shared their opinions as to the identity of things they found (Facer & Williamson, 2004), often elicited by the facilitator (Dillenbourg, 1999, pp. 7-9).

MobiQuest 1, Discovering Mini-beasts

L3:There's...see its legs...

L2:see, there it is [pointing to the object]

Facilitator:Show... Is that an earwig? No?

L3:Eh yeah, I think it was

L2:No, it had too much legs

L2:It's a millipede

Facilitator:Why, how many legs did that thing have?

L3:I don't know...it had

L2:It had like...

L3:I think it was an earwig

L4:It was like a big millipede

⁴ Aliases are used rather than real names. The aliases L1, L2 etc. indicate Learner 1, Learner 2 and so on. The specific MobiQuest implementation in which each extract occurred is indicated. Comments in square brackets ([...]) are comments added during transcription to describe events occurring.

MobiQuest 4, If you go down to the woods today...

Facilitator:And do you think ivy is – what type of plant is ivy, do you know anything about it or -

L1:It's converse, converse, coz...

L7:It tries to choke trees

Facilitator:yeah

L1:Oh no, it's evergreen, it doesn't....

L7:It tries to choke the trees

MobiQuest 4, If you go down to the woods today...

L7:What's that stuff growing on it? On the rocks?

L3:Moss stuff. [growing on the rocks in the stream]

6.1.2 Tools as Context for Interactions

The mobile phones themselves provided a context for social interactions to take place (Crook, 1994, p. 79). Often, a learner who had already used the mobile phone helped another learner to take a picture or compose a message – the more knowledgeable one helping the other (Roschelle, 1992; Vygotsky, 1978). The facilitator also provided guidance.

MobiQuest 1, Discovering Mini-beasts

L4:Can you see it? [to L3, who is trying to take the picture with the phone]

L3:There [pointing, to help the child who has the XDA take the picture]

L2:Yeah [has the XDA, trying to get the picture]

...

L2:Where is it?

L3:Don't move so fast [advising about using the phone camera]

...

L3:Try and clear it...yeah [advising on the picture-taking]
[picture is taken]

...

L3:Hey, what did I do [having a problem on the phone with sending the MMS message, asking his peer for help]

L1:No...I'll do....will I do it for you?

Facilitator:You tell him how to do it...that's it, just click and drag..yeah...and now, backspace. Now you have to do the whole thing in one go.

L1:Yea, you put [indicating on the phone]...no, you just let that go and then [helping L3 use the stylus] you go like [doing it for him] and then you just kind of ...

L2:Highlight it [also looking on and providing verbal assistance]

MobiQuest 3, Mini-beasts

L12:What do I do

Facilitator:You do it with that phone

L12:What do I do here? [about the XDA phone]

Facilitator: You just close off that thing

L14: You pull it back down. [telling his group-mate what to do with the shutter on the Sony phone]

6.1.3 Group work

It was emphasised to the participants that they should work together and take turns using the phone. The children were reminding each other of this during the activity.

MobiQuest 1, Discovering Mini-beasts

L2: Let L4 do it, because L4 hasn't done it

L1: Yeah, I know, I'm getting it for him

L2: D'you wanna see, L3

In some cases, a learner complimented their peer on the photo they had taken with the mobile phone – they were working as a group, paying attention to what each was doing.

MobiQuest 2, Flower Power

L8: Oh that's a good one [to L9, who is taking the picture]

.....

L8: Oh that's such a good picture

MobiQuest 4, If you go down to the woods today...

L1: I got the best picture, look at that!

L7: Let's see....cool!

L3: Let's see

To complete the task, the learners had to feed information back to the classroom; they needed to identify or describe what they found and put this in picture and text messages. This led to interactions as they worked together to complete the task - taking photographs, working out what they had found and composing the messages.

MobiQuest 2, Flower Power

L10: Take a picture there [bending the daffodil head down to show the sepals underneath it]

L5: Hold it at the bottom!

?: You never stop [off-camera]

L8: Yeah, hold it here [helping to hold it]

L9: I'll hold it here

L9: Hey hey hey [something was getting in the way]

?: Wow

L5:I got it [taking the picture with the Sony phone]

Each group had one mobile phone; they took turns using it. Sometimes, the one who had the phone composed messages while the others were continuing their discovery of objects. At other times, two or more children worked together to compose the message.

MobiQuest 2, Flower Power

Facilitator:So what did we establish there? What about the primrose, how many petals?

L5:5 or 8

Facilitator:Do they have different numbers?

L10:Yeah...wait, I'll check these red ones

Facilitator:Yeah, check those. Well, what we could tell them anything from, we could say 4 to 6...we could say 5 or 6

L5:That one has 5

L5:We could say different numbers...

L10:One has 5 and one has 7 [having checked]

The above exchange resulted in the text message "There are 5 to 7 petals on a primrose" being sent to the MobiQuest HQ.

The learners also worked together to complete their task, with group members helping each other get photographs:

MobiQuest 3, Mini-beasts

L14:Did you get him yet? [leaning in to see]

L15:Oh no...there..yeah

[L14 and L16 looking at the phone]

Facilitator:Did you get him? Ooohhh. Aw, don't kill him.

L15:Didn't

[L14 now holding the bug in his hands, L16 trying to get a picture]

L16:Can't see him

...

L15:Did you get him?

L14:He likes to jump!

...

L14:There, he's on my finger

.....

L16:Where is he?

...

L14:It's on L16's head!

...

Facilitator:Can you see, he's got – oh, there he is, on my hand.

...

L14:If he jumps, I'll catch him!

MobiQuest 4, If you go down to the woods today...

L4:Can't get them [trying to get picture of the tadpoles]

L4:They're under water...they're all [inaudible]

L10:Here, will I get it. I know....

[L4 gives the phone to L10]

L2:No, you can't get them because it's under water

L4:I could see them a bit, but

...

L4:He's [inaudible] moving

[L10 is lining up the phone to take the picture]

6.2 Contextual Learning

Contextual learning took place in various ways. The participants found objects in the environment, identified them or characteristics of them and made connections and links from what they observed. They also saw objects close up and got their own sensory impressions by touching and feeling.

6.2.1 Discovery

The data showed incidents of the learners discovering objects, with the children expressing excitement at their discoveries.

MobiQuest 1, Discovering MiniBeasts

L4:Ooh, there's a beetle, a beetle [pointing to something else on the ground under the rock]

.....

L2:Look there [pointing]

L2:What's that?

L3:It's a dead woodlice by a web [the woodlice is caught in a spider's web]

.....

L3:There's something [holding a large piece of bark in his hand, looking at insects on it]

Facilitator:Don't take it away

L3:and there's – I don't know, there's something with wings and there's a centipede, I think

There was evidence of the learners making discoveries for themselves by being able to get sensory impressions of the objects they found in the natural environment. For example, having identified the sepals on a daffodil, the children felt the sepals and described them as feeling like 'crepe paper'.

MobiQuest 2, Flower Power

Facilitator: So are you going to tell them what it feels like? Tell them...

L10: Soft

Facilitator: Sepals feel soft and feel like paper – who said it was like some kind of paper?

L7: Silky

L6: I did!

A few voices: Crepe paper

This picture message was then sent into the HQ.



Figure 25 – picture message

Later, a link was made to the role of the sepals when the children found a daffodil still in bud, as shown in this picture message.

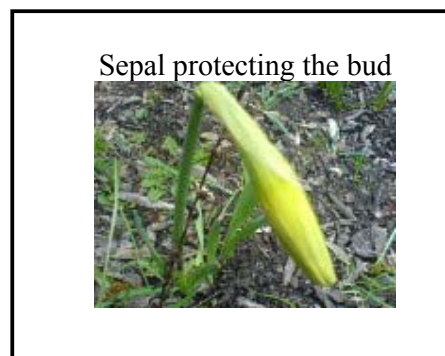


Figure 26 – picture message

6.2.2 Making Links

Scaffolded by the facilitator, the learners were also able to deduce facts by thinking about what they could see and feel (Falk & Dierking, 2002a; McGreen & Arnedillo Sánchez, 2005a). For example, here they work out why they cannot easily see the ovary of a flower (by feeling, they had established it was there).

MobiQuest 2, Flower Power

Facilitator:Now, why do you think you can never see the ovary bit that has the eggs?
 Why is that never visible to you?
 [children all thinking]
Facilitator:You know the way, because you can see the stamen...
L5:The little eggs
L9:Coz it keeps them inside
L6:Oh, coz it's inside the plant [same time as L9]

Earlier, they had established that the ovary was present by feeling for it:

Facilitator:Yeah, now, can you see where the ovary is on this flower? Where do you think the ovary is?
L6:[pointing]
Facilitator:That's the pistil – it sticks up
 ...
Facilitator:Who wants to tell me: where do you think the ovary is, the bit that has the eggs in it?
L10:Oh, oh, in there
L6:In there
Facilitator:Well, that's the pistil, the bit that sticks up
L8:Is it inside the pistil?
Facilitator:Yeah, maybe it's at the bottom of the pistil [all are looking closely at the flower, inside it and under it, L8 is touching and holding it]
L6:Yeah, it probably is
Facilitator:....See, maybe it's at the bottom.
 ...
Facilitator:So how would you - we can't really see it to describe it, can we
L8:We can feel it though [she's feeling down inside the flower]...it's big and lumpy.
Facilitator:It's lumpy. Ok, tell them it's lumpy
L8:Say it's lumpy [turns to give instruction to the person who has the phone - L9]

During MobiQuest 4, the learners noticed moss on rocks in a stream. The physical surroundings enabled them to suggest why the moss was brown in places – location-dependent learning (Nyiri, 2002). See the picture taken in Figure 27.

MobiQuest 4, If you go down to the woods today...

[at a running stream; A is leaning over to get a picture]
L3:Don't drop it...
L7:What's that stuff growing on it? On the rocks?
L3:Moss stuff. [growing on the rocks in the stream]
L7:Why's it brown?
L3:Because it's underwater
L7:You mean, if you take it out, it's going to be green?
L3:No, it's just, it's been under water for so long. Think so.
L7:Or do you think it just needs sun?
L3:It has plenty sun

L7:No, it doesn't sometimes, the trees

L3:Uh, that has loads of sun [pointing at a stone in the water]

L1:I got the best picture, look at that! [meantime, L1 has been getting in over the water to get a picture]



Figure 27 – picture message of moss on rocks in a stream, from MobiQuest 4

The learners were able to make inferences from observed behaviour, such as when a worm curled up in a hand:

From MobiQuest 3, Mini-beasts

L11:Poor little guy, he's all shrivelling up. [something under a stone]

L13:That's, that's an [indistinct] yoke

Facilitator:Why do you think he's shrivelling up? Maybe he doesn't like the rain.

L11:Or maybe he doesn't like me poking him!

From MobiQuest 1, Discovering MiniBeasts

Facilitator:And why is he curling up? Don't hurt him!

L2:Because he's ...he feels threatened

Whilst the MobiQuests were not explicitly devised to follow on from each other, there were some opportunities to recall learning from previous sessions, although in this instance, one of the participants could not recall everything.

From MobiQuest 4, If you go down to the woods today...

Facilitator:Can you remember what we learned about flowers when we did the Flower Power thing a couple of weeks ago?

L2:That wasn't in it.

Facilitator:Yeah, but what about flowers in general, what did you learn?

L2:[pause] about...how many leaves they have?

Facilitator:Yeah, and what are the, what's in a flower, what are the parts of a flower

L2:Seeds

Facilitator:Hmm

L2:Pollen

Facilitator:Yeah, what does the pollen do?

L2:Make honey for the bees, the bees make honey

Facilitator:Yeah...and what is the other function of pollen?

L2:Ah...don't know!

6.3 Conflict

There was some conflict among the learners. However, in some cases, this could be interpreted as a collaborative interaction, as the children finally reach agreement.

From MobiQuest 1, Discovering Mini-beasts

L3:What slug?... Oh

L2:What are you doing? [to someone who is trying to move the slug]

L3:No, no don't

L4:He's grand where he is [one child trying to move the slug]

L4:Just leave him

At other times, actions being carried out on the mobile phones were a source of conflict:

From MobiQuest 4, If you go down to the woods today...

L1:Wait [sending message on the XDA]

L4:No, do all the texting after

L1:I'm not doing any text! I'm just sending it.

L7:Well, I know what evergreen trees look like

L1:There, it's sent.

6.4 Participants' Views

Three participants, each of whom participated in two of the four MobiQuests, took part in a semi-structured interview. Where they had not participated directly, they had been in the classroom during the other MobiQuests.

All three found the outside activities to be good. They said it was “cool” or “fun” to be outside and they liked “exploring the woods” and “finding the insects”. One said she liked “going home and telling my Mom all the things that I learnt”.

When asked did they enjoy the activities and what did they like about them, their answers included the following:

“It’s educational as well as real cool. Coz we’re learning stuff as well as having fun.”

“we were able to go out and explore and see, see the em, see the animals and the mini-beasts and the trees and flowers. It was real fun.”

“I like just finding the insects and ...all that stuff”

They disliked when they were one of the learners in the classroom, while others were outside:

“I didn’t like being inside the classroom where you had to learn inside about – I didn’t like being, when you were inside and people were outside having loads of fun with cameras and phones and taking pictures and you were inside the classroom just...waiting for things to come in.”

Using the worksheets in the classroom was “boring” and “the most annoying thing”.

One participant felt that the use of mobile phones was good because they were learning how to use their features (which she compared to learning how to type when using a computer):

“... I thought that was a lot of help, you know when like you have a mobile phone, it’s ee..., you’re going to know how to do the texts and take pictures.”

Another advantage to using the mobile phones was that they didn’t have to write things down or take things back to the classroom (they were doing that using the mobile phones):

“and you didn’t have to, like, write it all down and stuff”

“And you don’t have to, well, take all the stuff in in your bag.”

“it’s quicker. It’s quicker and easier”

7 Discussion

This chapter provides further analysis of the findings.

7.1 Collaboration

As shown in the Findings, collaborative interactions took place, focussed on the mobile phones and on objects in the learning environment. Collaboration was sometimes spontaneous, such as when participants helped each other in using the phones. At other times, the facilitator provided scaffolding by eliciting previous knowledge and questioning. The contextual environment provided prompts for such questions, such as when the children observed pollen sticking to their fingers – this prompted probing as to if they thought it could stick to other things. By contextualising the learning, opportunities for collaboration arose – the contextualisation brings about collaboration.

MobiQuest 2, Flower Power

Facilitator: Why do flowers have a nice smell?

L5: To attract bees

...

Facilitator: And you see the pollen that you saw...how does the pollen get transferred from this flower to another flower

[showing L7 with the XDA]

L5: It blows away with the wind

Facilitator: It blows away with the wind. And do you know, the way it stuck to your finger...do you think it might stick to anything else?

L8: Yeah...a bee or an insect

Facilitator: Yeah, or even to your fingers and what if you go walking around now...you could be spreading the pollen around as well.

...

Facilitator: And why do you think the ovary, with the eggs, is hidden away inside the plant?

L9: [saying something but can't hear with Daniel also speaking]

L5: So noone can damage it

MobiQuest 1, Discovering Mini-beasts

L1:When he's curled up he looks like a snail

Facilitator:And why is he curling up? Don't hurt him!

L2:Because he's ...he feels threatened

L3:[takes another picture – trying to get a good one]

There's another worm there lads

Facilitator:Threatened, yeah. Guys...see the way he's curling up in your hand – why do you think he's doing that?

L3:To protect himself

L2:I think he's got feelers on the top of his head.

Facilitator:Can you feel them on your hand?

L2:Yeah...look...

The strategy of giving each group one mobile phone to work with meant that they took turns at using it and also worked together on using it – this in itself brought about collaborative interactions.

There are further opportunities for collaborative interactions between the participants outside and their peers inside. This would rely on instantaneous delivery of messages to the HQ; a participant in the classroom would need to monitor incoming messages and send out messages in response. For example, in MobiQuest 4, the list of things to find could be staggered so that the participants only receive the second item after they have found and sent in the first item. This was not possible during this implementation as there was no one available to do this while the researcher facilitated the activity outside.

7.2 Contextual Learning

Contextual learning occurred, with the learners observing and interacting with the objects they discovered. It would be better to bring this to the entire class, but it was not logistically possible to take the whole class outside. Given sufficient time, the message viewer can be used for the participants to share their contextual learning with their peers – they can report on their direct experiences.

For example, Figure 28 shows the Flower Power messages, which were on the overhead screen in the classroom during the MobiQuest, which the children inside used to complete their worksheets. Figure 29 shows the things found by one of the groups during MobiQuest 4, the treasure hunt in the wood. This was used in the classroom to allow the rest of the class judge the winning team.

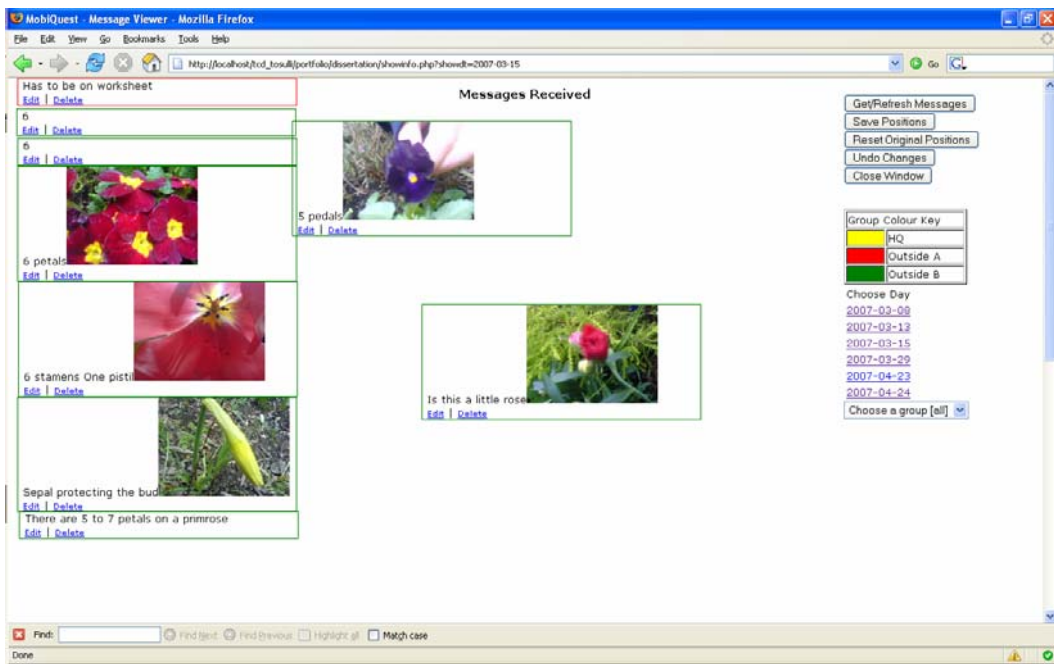


Figure 28 – the Message Viewer for MobiQuest 2

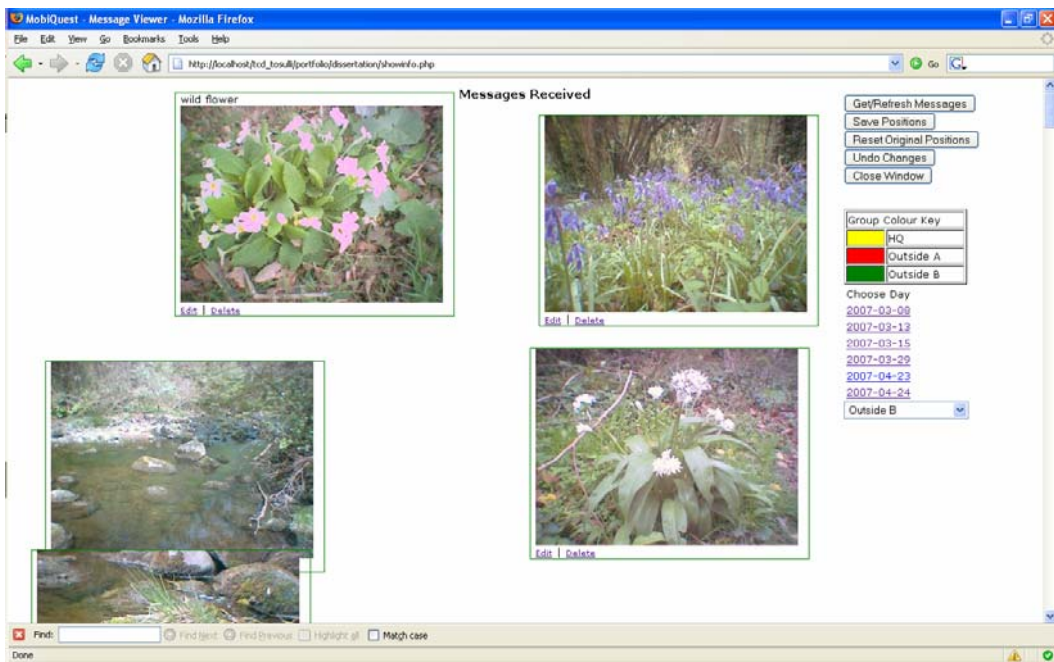


Figure 29 – the Message Viewer for MobiQuest 4

This quote from one of the interviewees is noted:

“I like going home and telling my Mom all the things that I learnt”.

This may be worth further investigation, as regards the interest shown in learning and how it can be taken out of the classroom.

All aspects of the learning context contributed to both collaborative and contextual learning occurring – the mobile phones were a context for interactions, objects in the environment prompted inquiry and interactions, the facilitator elicited knowledge and prompted interactions (Sharples, Corlett, & Westmancott, 2002).

7.3 Other Use of Mobiles

Besides being used for the actual learning activity, the MobiQuest communications framework allowed other interactions to take place between the participants and their teacher, such as the message “you can come in now”, sent during the Flower Power MobiQuest.

Information about the task could be delivered to the mobile phones so the participants could refer to them during the activity. This is one of four messages that were sent to each mobile phone for MobiQuest 4:

“1. Find 3 deciduous trees. Get pic of the each tree + close-up of its leaves. Add the name if you know it and any other details to help identify it.”

7.4 Limitations/Problems

MMS messages were not always received at the HQ, resulting in all picture messages sent during the first MobiQuest being lost and some from the second one. Closer monitoring of the mobile phones during the subsequent MobiQuests was applied to ensure all messages were sent. Additionally, MMS messages were not always delivered instantaneously. This delay was factored into the third and fourth implementations.

The teacher reported that the lack of picture messages arriving at the HQ at all or on time caused the children in the classroom to become disengaged from the activity. This is reflected in the feedback from the participants (Findings, section 6.4). This reduced possibilities for further interaction between them and the participants outside.

The teacher also reported that the Flower Power worksheet (see Appendix F: Worksheet – Flower Power MobiQuest) was repetitive in structure. A lack of time meant that the teacher was not consulted for input to this worksheet in advance.

During the first MobiQuest, the participants were asked to find specific mini-beasts, such as ants and a ladybird. It was difficult to find these on demand. The subsequent mini-beasts MobiQuest addressed this by allowing the participants to use whatever they happened to find. For the Flower Power MobiQuest, it was easier for the facilitator to know in advance what flowers would be found around the school.

8 Conclusion

8.1 Summary

The MobiQuest learning experience brought about opportunities for collaboration among the learners, due to a number of factors. The tasks the learners had to achieve required that they send messages incorporating images and text about objects they found. Objects in the contextual environment prompted interactions as they discussed them; the mobile phones were also a context for interactions. The facilitator's scaffolding also encouraged the occurrence of interactions.

Contextualised learning took place during the MobiQuest, as learners discovered real objects that stimulated them to recall previous knowledge. They got real, sensory impressions from the objects that helped them to make links and develop new knowledge about the objects.

There are a number of principles to apply in designing a MobiQuest, in order to ensure collaborative and contextual learning do take place. Most of the MobiQuest should take place in a real physical environment that contains objects with which the participants can interact. The facilitator should be aware of what objects the participants may discover in the environment and structure the activity accordingly. The activity should be facilitated in a way that provides support for collaborative interactions between the learners, through elicitation and questioning. The speed of delivery of messages by the mobile network should be checked in advance so that activities can be devised accordingly.

8.2 Further Work

There are a number of avenues for further research in this area. Further study of interactions between participants in a contextual environment and their peers in the classroom is necessary. Variations of the MobiQuest could be implemented, varying the activity and working with learners at different levels in different situations. A possible variation is pairing the participants, with one learner visiting the contextual environment while his/her partner remains in the classroom; they exchange clues and details about what is found. Learners could easily use their own mobile phones in a MobiQuest; their familiarity with their own phones could affect interactions focussing on the tools. This

could yield interesting data about the ratio of participants to mobile phones and how that affects the learning.

In conclusion, the MobiQuest is a contextual m-learning application that can, by design, bring about collaborative learning. It makes use of mobile phones without letting the technology overcome the pedagogical foundations.

Appendix A: Consent Form

5th March 2007.

Dear Parents,

As part of her dissertation for MSc in Information Technology in Education run by Trinity College, Dublin, Terri O'Sullivan is carrying out research into the use of mobile phones as a learning tool.

The children will be sent in supervised groups out into the school yard to search for items relevant to the week's topic e.g. Insects. They will be given clues from the children in the classroom via mobile phone, which will be provided by Ms. O'Sullivan. The children outside will then take a photo of the object and send it to the class inside and so on.

There will be three forty minute sessions over a three week period and the topics will include the SESE curricular areas of:

- 1) Mini beasts and insects
- 2) Trees and buds
- 3) Flowers and plants.

I understand that the data compiled will be treated with confidentiality by everyone concerned with the project. If you are happy for your child to participate in this activity please sign the consent form below.

Sincerely,

I give my consent to _____ (child's name) to participate in the above research project using mobile phones during the period from March 7th to March 30th 2007.

Signed: _____

Parent/guardian

Appendix B: Technology Used

SMS Gateway

The SMS gateway software chosen was NowSMS⁵. This was chosen because of the researcher's previous experience with it and the availability of technical support through the company's web site.

A Siemens MC35i Terminal, a type of GPRS (General Packet Radio Service) modem, was connected to the gateway. This allowed for messages to be received and handled by the gateway⁶. A GPRS modem uses the mobile network for communications and can be connected directly to a laptop or PC. Once it has an active SIM card in it, it can access services such as SMS and MMS on the mobile network. Some mobile handsets can also be used in this way, as a modem attached to a computer, but they cannot be used to pass received MMS messages onto the gateway.

Mobile Phones

It was decided not to build an application specifically to run on the mobile phones (with, for example, a technology such as J2ME – Java 2 Mobile Environment) but instead to use existing functions of the phones, to keep the development time within the timeframe available.

Web-based Application

A web-based application was chosen as this does not require any additional software to be installed on computers to access the application, a standard web browser can be used⁷. With this configuration, the gateway could, if desired, be located centrally with the control panel being accessed from a number of physical locations via the internet. All MobiQuest management functions could then be carried out over the web, if necessary. For this research, the applications were not accessed via the internet. This made

⁵ <http://www.nowsms.com/>

⁶ Another possible option was mobile phone blogging (whereby messages are sent to a number or email address and then appear on a web site) but the chosen solution did not rely on internet connectivity being available at the research site.

⁷ browsers such as Mozilla Firefox or Microsoft Internet Explorer

implementation at a school easier as it was not necessary to ensure there was a working internet connection.

Database

The central database was implemented as a relational database using MySQL, an open source database management system. MySQL was chosen because it is free to use for educational purposes and because the researcher was familiar with it. The database schema is shown in Appendix C: Database Schema.

Web Languages

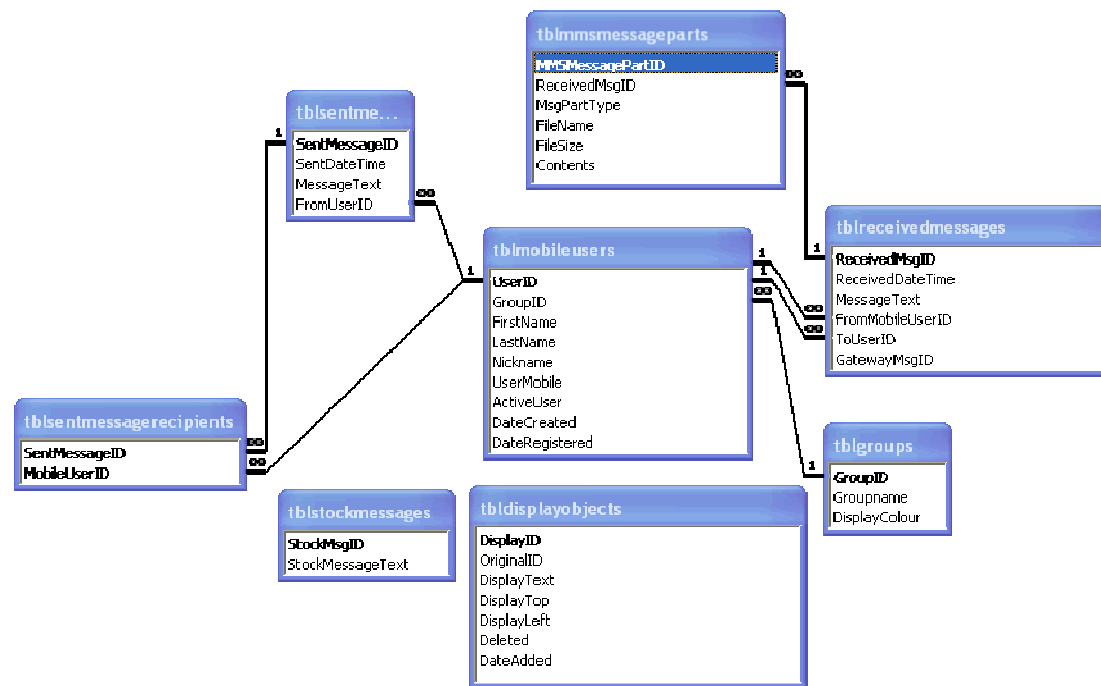
The web pages were built using XHTML (Extensible HyperText Mark-up Language), the current standard language for marking up the content of web pages. CSS (Cascading Style Sheets) was used to define the appearance of the content. CSS is used by web developers to separate the content (marked up by XHTML) and the presentation of that content (such as fonts and colours) so that the appearance can be consistent across web pages and easily updated. JavaScript was used as a browser scripting language to provide functions such as pop-up windows and the movement of elements on the message viewer.

The web pages were integrated with PHP scripts to create dynamic web pages. PHP is a scripting language that can interact with other applications such as a database. PHP scripts can be run on a web server, to produce dynamic web pages using, for example, a mix of static content and data from a database, by outputting web page content marked up with XHTML.

Web Server

During the research, the MobiQuest web pages were hosted on a web server run locally on a laptop. The web server used was Microsoft IIS (Internet Information Services) version 5.1.

Appendix C: Database Schema



Appendix D: The Implemented MobiQuests

After the initial consultation with the teacher, two different MobiQuests were devised, on the topics of mini-beasts (insects) and flowers, as she had already or was planning to cover these in class, based on the primary curriculum. This was also to provide variety for the children participating in the research.

The mini-beasts MobiQuest was reused for the third implementation but with a different objective to the activity. The final implementation took place during a class field trip to a nearby wood.

Implementation No: 1

Date: March 8th 2007

Title: Discovering Mini-beasts

Description:

In the classroom, the MobiQuest HQ was set up, connected to an LCD projector. The MobiQuest web site was used as an aid in explaining to the class what the activity was to involve. Four children were given the role of 'Field Researcher'. They were given a mobile phone for the group and then went out around the school grounds to look for insects, with the researcher acting as facilitator and participant observer.

The rest of the class, working in the classroom with the teacher, had a worksheet (see Appendix E: Worksheet – Discovering Mini-beasts MobiQuest) on which they had pictures of insects. They were filling in information about the insects on the worksheet and coming up with clues to send to the group outside using the MobiQuest Control Panel. The clues were to describe the insects on the worksheet, which the group outside then had to find.

Two children inside the classroom were given the role of 'HQ Control', which meant they sent the messages out and refreshed the display to see incoming messages.

Implementation No: 2

Date: March 15th 2007

Title: Flower Power

Description:

In the classroom, the MobiQuest HQ was set up, connected to an LCD projector. The MobiQuest web site was used as an aid in explaining to the class what the activity was to involve. The entire class was given a worksheet (Appendix F: Worksheet – Flower Power MobiQuest) which gave them details about the parts of a flower. It included a diagram on which they could label the parts for themselves.

Two children were allocated the role of HQ Control in the classroom, as before.

Two groups of three children were allocated the role of Field Researcher. They went out around the school grounds to look at and examine flowers, with the researcher as facilitator. Each group had a mobile phone.

The rest of the class, working in the classroom with the teacher, had to complete a table of information about different flowers. In order to fill in the table, they had to send text messages to the groups outside, asking questions about particular flowers. These questions were prompted by cues on the worksheet. They received answers to the questions in the form of MMS and SMS messages.

Implementation No: 3

Date: March 29th 2007

Title: Mini-beasts

Description:

This was an updated version of the first implementation, designed to address the problems encountered the first time. A group of 6 children, divided into two teams of 3, went to a separate room with the researcher while the rest of the class continued with other class work. In the room, the MobiQuest HQ was set up, connected to an LCD projector. The MobiQuest web site was used to explain to this group what the activity involved.

Their task this time was to collect enough information about 4 different insects (not specified) to be able to present a short lesson to the rest of the class about what they found. They were shown a worksheet (see Appendix G: Worksheet – Mini-beasts) that the class would complete as part of their lesson.

They then went out around the school grounds, with a mobile phone per group, to find and get images of various insects. Their objective was to compile information on the message

viewer that they would then use to teach the rest of the class a short lesson. However, the activity ran over time and they did not get to do the lesson.

Implementation No: 4

Date: April 24th 2007

Title: If you go down to the woods today...

Description:

During a class visit to a nearby wood, 6 children worked separately with the researcher. Prior to leaving the classroom, the MobiQuest HQ was set up. The children were split into 2 groups of 3 with a mobile phone given to each group. It was explained to them that they were going on a treasure hunt in the woods, during which they had to find certain things. The Control Panel was used to send a number of text messages to the mobile phones, listing what they had to find. There would be a winning group, based on the number of required objects they found.

They then went to the wood with the researcher acting as facilitator. There, they found the objects on their list and sent them to the HQ as MMS messages. On return to the classroom, the MobiQuest HQ was moved to a separate room so the groups could organise the messages they sent in on the message viewer.

Both group findings were then shown to the entire class using the LCD projector and the class voted which team won based on their collection of messages, as both had managed to collect all the required objects.


Appendix E: Worksheet – Discovering Mini-beasts

MobiQuest


This 3-page worksheet was hand-made and photocopied by the teacher. A scanned copy of the worksheet is shown here.

A minibeast key

BUGS




NAME: _____ HABITAT: _____
DESCRIPTION: _____




NAME: _____ HABITAT: _____
DESCRIPTION: _____

BEETLES




NAME: _____ HABITAT: _____
DESCRIPTION: _____




NAME: _____ HABITAT: _____
DESCRIPTION: _____


minibeast




NAME: _____ HABITAT: _____
DESCRIPTION: _____



NAME: _____ HABITAT: _____
DESCRIPTION: _____



NAME: _____ HABITAT: _____
DESCRIPTION: _____



NAME: _____ HABITAT: _____
DESCRIPTION: _____

NAME: _____
HABITAT: _____
DESCRIPTION: _____

NAME: _____
HABITAT: _____
DESCRIPTION: _____

Mini beast Quiz

1. What is the difference between a Centipede and a millipede?
2. What is a habitat?
3. Name some good habitats for mini-beasts.
4. Why do you think some insects have camouflage?
5. Name some different types of protection that some mini beasts have.
6. Name a minibeast that is a herbivore.
7. Where do beetles keep their wings?
8. Why do creatures live in or near the compost heap?
9. What is your favourite insect? Why?

Appendix F: Worksheet – Flower Power MobiQuest

This worksheet was produced by the researcher, with the flower diagram provided by the class teacher. It was photo-copied and used in the classroom during the implementation.

Flower Power

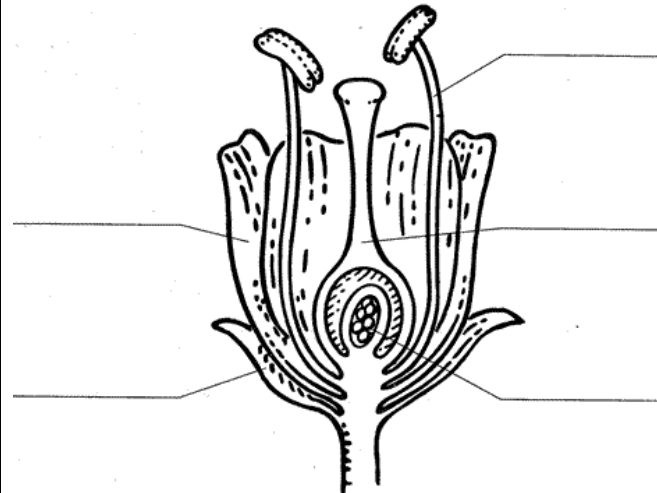
Flowers are beautiful to look at and pleasant to smell, but they also have a very important job in the world of plants. Most plants make seeds inside the flower.

The different parts of a flower are listed in the table below.

| Flower Part | Description |
|-------------|---|
| pistil | A large centre stalk, often shaped like a water bottle. |
| stamen | A tall, thin stalk with a knobbed tip. It holds <u>grains of pollen</u> . |
| petal | Brightly coloured and sweet-smelling leaves |
| sepal | Small leaf-like part at the base of a flower |
| ovary | Ball-shaped part at the base of the pistil, containing ovules. This is where the seeds for the plant develop. |

Label the different parts on this diagram of a flower.

Colour in the parts in colours of your own choosing.



Using the photos your class mates send in on the mobile phone, fill in the information about different flowers in this table.

You will need to ask them questions by sending them text messages. For example, if you want to find out how many petals a daffodil has or what the pistil feels like, you could text this question to them. You can also look at the photos they have taken of the different flowers. Remember, you will have to describe the parts to them.

| Flower name | pistil | stamen | petal | sepal | ovary |
|-------------|--|--------------|--|--|--------------|
| Daffodil | Number: Description: What does it feel like? | Description: | Colour: Number: Other information: | Colour: Number: Other information: | Description: |
| Tulip | Number: Description: What does it feel like? | Description: | Colour: Number: Other information: | Colour: Number: Other information: | Description: |

| Flower name | pistil | stamen | petal | sepal | ovary |
|---|--|--------------|--|--|--------------|
| Primrose | Number: Description: What does it feel like? | Description: | Colour: Number: Other information: | Colour: Number: Other information: | Description: |
| Pansy | Number: Description: What does it feel like? | Description: | Colour: Number: Other information: | Colour: Number: Other information: | Description: |
| Other – write in the name here: _____ | Number: Description: What does it feel like? | Description: | Colour: Number: Other information: | Colour: Number: Other information: | Description: |

How seeds are produced

The pistil has two parts.

The top part is sticky. This is called the stigma. It catches pollen grains. The stigma is on a long neck called the style.

The stamen has two parts. The top part is the anther. The anther produces pollen. The anther is on top of a long stem.

The first step to producing seeds is called pollination. This is the transfer of pollen from the anthers of one flower to the stigma of another.

After a pollen grain has landed on a stigma, it germinates and produces a pollen tube that grows downward through the style and through the ovary until it reaches on ovule in the ovary. The pollen and the ovule together create a seed.

The seeds are left when the flower dies, so new flowers can grow from the seeds.

Flower Power Quiz

How do you think pollen grains get transferred from the anthers of one flower to the stigma of another?

Why do you think the anther is at the end of a long stem? _____


Why is the stigma sticky? _____

Why do you think the ovary is at the centre of the flower? _____

Why do you think petals are brightly coloured?

Appendix G: Worksheet – Mini-beasts MobiQuest

This worksheet was produced by the researcher. It was photo-copied and used in the classroom during the implementation.

| | | |
|---|------------|---|
|  | Minibeasts |  |
|---|------------|---|

| | |
|--|--|
| <p>About this minibeast</p> <p>Name: _____</p> <p>Distinguishing characteristics:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Habitat: _____</p> | <p>Draw a picture of a minibeast here.</p> <p>You can also label the main parts of the minibeast. Here are some suggestions for the parts to label:</p> <p>Wings Scales Feelers/Antennae</p> <p>Body Pincers Legs Shell</p> |
| <p>About this minibeast</p> <p>Name: _____</p> <p>Distinguishing characteristics:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Habitat: _____</p> | <p>Draw a picture of a minibeast here.</p> <p>You can also label the main parts of the minibeast. Here are some suggestions for the parts to label:</p> <p>Wings Scales Feelers/Antennae</p> <p>Body Pincers Legs Shell</p> |

| | |
|--|--|
| <p>About this minibeast</p> <p>Name: _____</p> <p>Distinguishing characteristics:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Habitat: _____</p> | <p>Draw a picture of a minibeast here.</p> <p>You can also label the main parts of the minibeast. Here are some suggestions for the parts to label:</p> <p>Wings Scales Feelers/Antennae</p> <p>Body Pincers Legs Shell</p> |
| <p>About this minibeast</p> <p>Name: _____</p> <p>Distinguishing characteristics:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Habitat: _____</p> | <p>Draw a picture of a minibeast here.</p> <p>You can also label the main parts of the minibeast. Here are some suggestions for the parts to label:</p> <p>Wings Scales Feelers/Antennae</p> <p>Body Pincers Legs Shell</p> |

Appendix H: Initial text messages – “If you go down to the woods today...” MobiQuest

These text messages were sent from the MobiQuest HQ to the two mobile phones used by the participants for this MobiQuest, before they left the classroom.

1. Find 3 deciduous trees. Get pic of the each tree + close-up of its leaves. Add the name if you know it and any other details to help identify it. -
2. Find 1 evergreen (coniferous) tree. These are trees that do not lose their leaves in winter. Cones grow on them. Include info 2 help identify it if ur not sure
3. Find 2 different wild flowers + get good photos that show them as clearly as possible. Can you identify them?
4. Pond life - can you find and get a photo of one kind of living thing in the pond.

Appendix I: Semi-Structured Interview Protocol

Semi-structured Interview

MobiQuest Research for Dissertation

Reminders to self: turn on recorder + ensure **mic is on** (plug in the camcorder for external mic to work), record names of interviewees at start.

Date: _____ Location: _____

Interviewees

| No. | Name | Age | No. | Name | Age |
|-----|------|-----|-----|------|-----|
| 1 | | | 7 | | |
| 2 | | | 8 | | |
| 3 | | | 9 | | |
| 4 | | | 10 | | |
| 5 | | | 11 | | |
| 6 | | | 12 | | |

Questions (use to elicit; write key phrases in here)

Did you enjoy the activity?

What did you like about it?

What did you dislike about it?

How does it compare to an activity that takes place entirely inside the classroom?

Did you think it was useful to use mobile phones as part of the activity? Why?

What did you learn today?

What would you advise me to change about this activity, if I was to do it again?

Appendix J: Data – Messages Sent/Received

Key

Xda dna1: mobile phone used outside

Sony Ericsson: mobile phone used outside

System: MobiQuest HQ

Date/Time format is year-month-date time


MobiQuest 1 – Discovering Mini-beasts

Note: these are text messages that were sent from the HQ to the outside participants, as clues to what they needed to find. A technical problem resulted in messages from the outside phones being lost.





| Date/Time | Message Text |
|---------------------|---|
| 2007-03-08 13:35:54 | hello |
| 2007-03-08 14:01:54 | it has pinchers |
| 2007-03-08 14:06:24 | a group of them are called a colony |
| 2007-03-08 14:16:16 | it black it shiny and it has a hard shell |
| 2007-03-08 14:31:23 | this insect eats flies |
| 2007-03-08 14:34:37 | this will become a butterfly |

MobiQuest 2 – Flower Power

Messages sent from System are those the class inside sent to the participants outside.



| Date/Time | From | To | Message |
|------------------------|---------------|---------------|---|
| 2007-03-15 09:59:50 | Terri | System | test 123 |
| 2007-03-15 13:13:41 | System | xda dna1 | Test message from MobiQuest HQ |
| 2007-03-15 13:13:55 | System | Sony Ericsson | Test message from MobiQuest HQ |
| 2007-03-15 13:20:39 | Sony Ericsson | System | The class  |




| Date/Time | From | To | Message |
|------------------------|---------------|---------------|---|
| 2007-03-15 13:31:31 | Sony Ericsson | System | Ltm |
| 2007-03-15 13:31:43 | xda dna1 | System | this is a flower |
| 2007-03-15 13:32:44 | System | xda dna1 | hi team this is the HQ |
| 2007-03-15 13:37:16 | xda dna1 | System | this is the classroom |
| 2007-03-15 13:43:55 | System | xda dna1 | can u find roses |
| 2007-03-15 13:48:58 | xda dna3 | System | |
| 2007-03-15 13:49:49 | System | xda dna1 | how many pistils does a daffodil have and what does it feel like |
| 2007-03-15 13:50:04 | xda dna1 | System | Has to be on worksheet |
| 2007-03-15 13:56:19 | System | Sony Ericsson | how many pistils does a tulip have |
| 2007-03-15 13:59:55 | Sony Ericsson | System | Sepals feel like crepe paper  |
| 2007-03-15 14:02:01 | System | xda dna1 | describe its ovary |
| 2007-03-15 14:10:11 | System | Sony Ericsson | how many petals does a tulip have |
| 2007-03-15 14:11:02 | Sony Ericsson | System | 6 |
| 2007-03-15 14:12:20 | Sony Ericsson | System | 6 |
| 2007-03-15 14:13:08 | Sony Ericsson | System | 6 petals  |
| 2007-03-15 14:13:14 | Sony Ericsson | System | 6 stamens One pistil  |

| Date/Time | From | To | Message |
|------------------------|---------------|---------------|--|
| 2007-03-15 14:14:11 | System | xda dna1 | how many petals does a primrose have, what does stamen feel like |
| 2007-03-15 14:15:28 | System | Sony Ericsson | how many petals does a pansy have |
| 2007-03-15 14:16:26 | Sony Ericsson | System | Sepal protecting the bud  |
| 2007-03-15 14:18:26 | Sony Ericsson | System | There are 5 to 7 petals on a primrose |
| 2007-03-15 14:20:34 | xda dna1 | System | Pansies have 5 petals and 3 stamens |
| 2007-03-15 14:22:53 | Sony Ericsson | System | 5 petals  |
| 2007-03-15 14:23:35 | System | Sony Ericsson | how many sepals has primrose |
| 2007-03-15 14:25:54 | Sony Ericsson | System | Is this a little rose  |
| 2007-03-15 14:26:06 | Sony Ericsson | System | 5 petals  |
| 2007-03-15 14:30:32 | Sony Ericsson | System | A primrose has 6 sepals |
| 2007-03-15 14:32:46 | System | Sony Ericsson | you can come in now |

MobiQuest 3 – Mini-beasts

| Date/Time | From | To | Message |
|-----------|------|----|---------|
|-----------|------|----|---------|

| Date/Time | From | To | Message |
|---------------------|---------------|--------|---|
| 2007-03-29 10:13:44 | System | Terri | Test message from MobiQuest HQ |
| 2007-03-29 13:17:04 | Sony Ericsson | System | Laptop |
| 2007-03-29 13:18:04 | Sony Ericsson | System | Laptop |
| 2007-03-29 13:20:05 | Sony Ericsson | System | Laptop |
| 2007-03-29 13:55:17 | xda dna1 | System | hello |
| 2007-03-29 14:09:19 | Sony Ericsson | System | Highhi |
| 2007-03-29 14:38:37 | xda dna1 | System | Spider with eight legs has a wastn  |
| 2007-03-29 14:38:48 | xda dna1 | System | Sprider  |
| 2007-03-29 14:39:00 | xda dna1 | System | no legs and no wings |

| Date/Time | From | To | Message |
|------------------------|------------------|--------|--|
| | | |  |
| 2007-03-29 14:39:18 | xda dna1 | System | snail shell  |
| 2007-03-29 14:39:24 | Sony Ericsson | System | Worm  |

MobiQuest 4 – If you go down to the woods today...

Note: the picture parts of MMS messages for MobiQuest 4 are not included here as they are numerous. They can be seen in the artefact on the accompanying CD.

| Date/Time | From | To | Message |
|------------------------|--------|------------------|--|
| 2007-04-24 12:08:39 | System | xda dna1 | 1. Find 3 deciduous trees. Get pic of the each tree + close-up of its leaves. Add the name if you know it and any other details to help identify it. |
| 2007-04-24 12:08:39 | System | Sony Ericsson | 1. Find 3 deciduous trees. Get pic of the each tree + close-up of its leaves. Add the name if you |

| Date/Time | From | To | Message |
|------------------------|---------------|---------------|---|
| | | | know it and any other details to help identify it. |
| 2007-04-24 12:08:54 | System | xda dna1 | 2. Find 1 evergreen (coniferous) tree. These are trees that do not lose their leaves in winter. Cones grow on them. Include info 2 help identify it if ur not sure. |
| 2007-04-24 12:08:54 | System | Sony Ericsson | 2. Find 1 evergreen (coniferous) tree. These are trees that do not lose their leaves in winter. Cones grow on them. Include info 2 help identify it if ur not sure. |
| 2007-04-24 12:09:27 | System | xda dna1 | 3. Find 2 different wild flowers + get good photos that show them as clearly as possible. Can you identify them? |
| 2007-04-24 12:09:27 | System | Sony Ericsson | 3. Find 2 different wild flowers + get good photos that show them as clearly as possible. Can you identify them? |
| 2007-04-24 12:09:37 | System | xda dna1 | 4. Pond life - can you find and get a photo of one kind of living thing in the pond. |
| 2007-04-24 12:09:37 | System | Sony Ericsson | 4. Pond life - can you find and get a photo of one kind of living thing in the pond. |
| 2007-04-24 14:24:30 | xda dna2 | System | |
| 2007-04-24 14:24:38 | xda dna2 | System | |
| 2007-04-24 14:24:54 | xda dna2 | System | |
| 2007-04-24 14:25:05 | xda dna1 | System | girls talking |
| 2007-04-24 14:25:12 | Sony Ericsson | System | |
| 2007-04-24 14:27:33 | xda dna2 | System | |
| 2007-04-24 14:28:00 | xda dna1 | System | bud |
| 2007-04-24 14:28:11 | xda dna1 | System | wild flowers 2 |
| 2007-04-24 14:28:34 | xda dna2 | System | ber |
| 2007-04-24 14:28:45 | xda dna1 | System | |
| 2007-04-24 14:29:06 | xda dna1 | System | |
| 2007-04-24 14:29:28 | xda dna1 | System | |
| 2007-04-24 14:29:40 | xda dna2 | System | |
| 2007-04-24 | xda dna2 | System | |

| Date/Time | From | To | Message |
|------------------------|----------|--------|---------|
| 14:30:00 | | | |
| 2007-04-24 14:30:06 | xda dna2 | System | |
| 2007-04-24 14:30:40 | xda dna1 | System | ferns |
| 2007-04-24 14:31:00 | xda dna2 | System | |
| 2007-04-24 14:31:06 | xda dna1 | System | gghh |
| 2007-04-24 14:31:22 | xda dna1 | System | beach |
| 2007-04-24 14:31:39 | xda dna1 | System | cgf |
| 2007-04-24 14:31:50 | xda dna1 | System | |
| 2007-04-24 14:32:01 | xda dna2 | System | |
| 2007-04-24 14:32:18 | xda dna2 | System | |
| 2007-04-24 14:32:29 | xda dna1 | System | |
| 2007-04-24 14:32:46 | xda dna1 | System | |
| 2007-04-24 14:33:02 | xda dna1 | System | |
| 2007-04-24 14:33:13 | xda dna1 | System | |
| 2007-04-24 14:33:25 | xda dna1 | System | |
| 2007-04-24 14:33:41 | xda dna1 | System | |
| 2007-04-24 14:33:52 | xda dna2 | System | |
| 2007-04-24 14:34:09 | xda dna2 | System | |
| 2007-04-24 14:34:20 | xda dna2 | System | |
| 2007-04-24 14:34:37 | xda dna2 | System | |
| 2007-04-24 14:34:48 | xda dna1 | System | |
| 2007-04-24 14:35:00 | xda dna2 | System | |
| 2007-04-24 14:35:21 | xda dna2 | System | |
| 2007-04-24 | xda dna2 | System | |

| Date/Time | From | To | Message |
|------------------------|------------------|-----------|----------------|
| 14:35:38 | | | |
| 2007-04-24 14:35:49 | xda dna1 | System | |
| 2007-04-24 14:36:00 | xda dna1 | System | |
| 2007-04-24 14:36:17 | xda dna1 | System | |
| 2007-04-24 14:36:28 | xda dna2 | System | |
| 2007-04-24 14:36:52 | xda dna2 | System | |
| 2007-04-24 14:37:08 | xda dna2 | System | |
| 2007-04-24 14:37:19 | xda dna2 | System | |
| 2007-04-24 14:37:26 | xda dna2 | System | |
| 2007-04-24 14:37:37 | xda dna2 | System | |
| 2007-04-24 14:37:48 | xda dna1 | System | |
| 2007-04-24 14:38:00 | xda dna2 | System | |
| 2007-04-24 14:38:11 | xda dna2 | System | |
| 2007-04-24 14:38:27 | xda dna2 | System | |
| 2007-04-24 14:38:39 | xda dna1 | System | |
| 2007-04-24 14:39:01 | xda dna1 | System | |
| 2007-04-24 14:39:18 | xda dna2 | System | |
| 2007-04-24 14:39:29 | xda dna1 | System | |
| 2007-04-24 14:39:41 | xda dna2 | System | |
| 2007-04-24 14:39:52 | xda dna1 | System | |
| 2007-04-24 14:40:00 | Sony Ericsson | System | |
| 2007-04-24 14:40:06 | Sony Ericsson | System | |
| 2007-04-24 14:40:12 | Sony Ericsson | System | |
| 2007-04-24 | xda dna1 | System | oak tree |

| Date/Time | From | To | Message |
|------------------------|------------------|-----------|----------------|
| 14:40:29 | | | |
| 2007-04-24 14:40:40 | xda dna1 | System | oak tree |
| 2007-04-24 14:41:00 | Sony Ericsson | System | |
| 2007-04-24 14:41:01 | xda dna1 | System | wild flowers |

Appendix K: Data – Interview Transcripts

Note: the transcript of the informal group interview with the class is on the accompanying CD. Recordings of both are also on the CD.

Semi-structured Interview with some of the participants

24th April 2007, at the school

Interviewees: Learner 1, Learner 3, Learner 7

- Learner 1 took part in the first and final MobiQuests (mini-beasts and woods)
- Learner 7 took part in the second and final ones (flowers)
- Learner 3 took part in the third and final ones (mini-beasts and woods)

I = Interviewer (the researcher, me)

[I informs the interviews that they are being videoed so she doesn't have to write down everything they say]

I: I just want to ask you some questions, ok?

Learner 7: OK.

I: Em...so we have A, J and R.

I: So...no no no, I'm just trying to get an idea of what you thought of this today and the other ones we did – remember, we did the Flower Power, with flowers, we looked at mini-beasts, remember?

I: So, first of all, about today and all of them in general.

I: Did you enjoy the activities?

All: yes

I: yeah?

Learner 1: yes, it was real cool.

Learner 7: I think it's, I think it's...

Learner 1: It's educational as well as real cool. Coz we're learning stuff as well as having fun.

J: I think that ...

I: yes, J

Learner 7: if our teacher was trying to do that with us, we would sit down in a stuffy classroom and we'd do it on a sheet.

I: OK

Learner 7: ...then you come and we were able to go out and do it

Learner 1: And we were able to go out and explore and see, see the em, see the animals and the mini-beasts and the trees and flowers. It was real fun.

Learner 7: It was just better.

I: Yeah. You don't have to say what you think I want to hear now; I want you to say what you really think, OK?

Learner 3: yep.

I: so that's good. So -

Learner 1: the sheet thing - I thought - was a bit...

I: the which thing?

Learner 7: sheet, inside

I: oh, OK...

Learner 1:.. boring. When everyone else was in the classroom and they had to do the sheet. That was a bit boring.

Learner 3: that was the most annoying thing

I: for the people in the classroom or the people outside

Learner 1: no, for the people in the classroom because em, we, oh, you had to wait and...just wait for the pictures to come in.

I: ok, the waiting was boring.

Learner 1: yeah and it was hard

I: so, it leads me onto another question then – **what did you like about all of these activities?**

Learner 7: I liked... I liked...I liked going outside with everyone and -

Learner 1: I like exploring in the woods

Learner 7: ...I like the pictures and everything.

Learner 3: I like just finding the insects and ...all that stuff

Learner 7: I like going home and telling my Mom all the things that I learnt.

I: OK.

Learner 1: I like, em....

I: OK, tell me what you didn't like about it.

[...intervention with other group working off camera]

I: what did you not like about it?

Learner 1: I didn't like being inside the classroom where you had to learn inside about – I didn't like being, when you were inside and people were outside having loads of fun with cameras and phones and taking pictures and you were inside the classroom just...

I: OK

Learner 1:...waiting for things to come in.

I: well then, tell me, do you think it was useful to use the mobile phones?

All: yeah

I: why?

Learner 3: coz it was a lot funner 'n' all

Learner 1: and you're learning, like, em, when you, when em, like you're on the computer doing essays and stuff, you're learning how to type and...

I: but what about using the mobile phones as part of your learning?

Learner 1: yeah, I thought that was a lot of help, you know when like you have a mobile phone, it's ee..., you're going to know how to do the texts and take pictures.

Learner 3: and you didn't have to, like, write it all down and stuff

I: well, OK, so the fact that you have the mobile phone means you don't have to write down.

Learner 3: yeah

Learner 7: And you don't have to, well, take all the stuff in in your bag.

Learner 1: it's quicker. It's quicker and easier and.

I: OK. And...so then, **how does it compare to activities you do that take place entirely inside the classroom?**

Learner 1: [sigh]

Learner 7: Oh God [sigh]...activities in there, we have to get like, a worksheet or something and we have to write down all, we, it asks us questions and everything and then we go outside and...

I: yeah

Learner 7: ...it's just much better.

I: well, how does this one, **how does going outside with the mobile phones compare to just going outside like you normally would on a cla... – like today, we went up to the woods. If you did that without the mobile phones, does it make a difference?**

Learner 7: when we go outside...when we go outside with our friends

Learner 1: oh, yeah...

Learner 7: we don't even think about...[inaudible]

[aside by I to the other group, working off-camera]

I: ok, so what you're saying to me is, going outside is, fun.

Learner 1: Fun

Learner 7: it's better. It's better.

I: Is it like, having the mobile... what I'm trying to get at is – do you think it's good having the mobile phones as part of your learning activities?

Learner 1: yeah. Yeah.

I: Why?

Learner 1: I think it's funner. When you go outside and you're looking um at them, like you wouldn't be able to get the pictures, you wouldn't be able to like, take the pictures and then go inside and show the class, like, what they look like.

I: ok. So you can show, you can see for yourself what they look like, is it?

Learner 1: yeah.

I: OK.

[end of interview]

Appendix L: Codes & Themes

This is a listing of the codes that were used in coding the qualitative data, grouped into the themes that emerged as the coding process took place. Some of the themes reflect the research questions while others reflect aspects of the design.

Coding reports for each of the MobiQuest transcripts are available on the accompanying CD. The reports show the coded segments.

Theme: Use of mobile phones

- actual sending of messages
- incoming messages
- message composition - text and image
- other - just doing something on the phone
- showing picture on screen to others in group
- taking photo with mobile

Theme: Grounding

- describing the task using website as visual aid
- establishing new knowledge req'd for the task
- establishing previous knowledge
- link task to worksheet

Theme: Facilitation

- reminders
- adjusting conditions to improve collaboration
- eliciting knowledge and scaffolding interactions
- guidance on use of tools
- more knowledgeable one (facilitator) helping other use a phone

Theme: Discovering from the natural environment (contextual learning)

- finding things in the environment
- getting to feel or hold something
- identification of observed creatures or objects
- making connections or links from what is observed
- observation of characteristics
- seeing things close up
- sensory impressions

Theme: Collaborating

- combining or sharing knowledge
- encouraging each other
- evaluating quality of picture taken - sharing an opinion
- helping each other - at same level
- identifying where to find what they're looking for

instructing each other
more knowledgeable one (facilitator) helping other use a phone
more knowledgeable one helping other use a phone
reaching agreement
setting questions for the class inside
showing picture on screen to others in group
working together to achieve the task

Other codes not grouped into themes

application of previous knowledge
claiming ownership
concern that all members get to partake
conflict
desire to complete the task
enquiry or asking questions about what they are seeing
established social groups or group dynamics
instructing each other
playing to the video camera
searching for creatures or objects

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