Creating user-generated content for location-based learning: an authoring framework

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Abstract
Two recent emerging trends are that of Web 2.0, where users actively create content and publish it on the Web, and also location awareness, where a digital device utilizes a person’s physical location as the context to provide specific services and/or information. This paper examines how these two phenomena can be brought together so that user-generated content on mobile devices is used to provide informal learning opportunities relevant to a person’s location. However, the generative process of such media does not always have much guidance on how or what to create, so the quality of such information can be highly variable. To overcome this, a framework has been designed to guide the authoring of user-generated content so that it can be used for informal learning about one’s immediate surroundings (particularly in an outdoor setting), combining pedagogical aspects with those from human–computer interaction and environmental aesthetics. The framework consists of six dimensions that include aspects such as curriculum area (e.g. science, art), type of communication, use of language/media related to the landscape, knowledge level of content, contextual aspects, and types of interaction. In order to test the framework before it could be used to scaffold new content, it was first used to analyse and evaluate over 200 items of existing user-generated content, to investigate the appropriateness of the proposed dimensions and the items contained therein or if any were missing. This paper presents the findings of this initial testing phase, together with a discussion of how the framework can be improved, in order to help scaffold the creation of new user-generated content in the future.

Keywords
authoring framework, location-based learning, mobile learning, social media, ubiquitous learning, user-generated content.

Introduction
The purpose of this paper is to investigate how we can take advantage of the phenomena of Web 2.0 and location awareness to enable informal educational opportunities ‘on-the-fly’. The integration of the mobile and social Web presents us with particular challenges, as well as new and innovative mechanisms for learning. In particular, when designing user-generated content specifically for teaching and learning, how can we ensure we are providing information in an appropriate way? We cannot expect authors of such content to be trained teachers (although they could be), so is there any way we can provide a framework or guideline to advise on what kind of content could – or should – be produced? Indeed, in the context of this research, we expect authors of user-generated content to be almost anyone, of any age or demographic background, either acting as an individual or part of a wider grouping. This research question is examined in the context of informal learning about the environment (with a specific focus on the
outdoor environment, such as a historical attraction such as a castle, or a biological/geographical site such as a nature reserve), thus exploiting the location-awareness functionality that is built-in to many current and new mobile devices. Existing research into designing content for use on mobile devices has focused primarily on technical aspects and user interface design/HCI (human–computer interaction) (Hayhoe 2001; Grasso & Roselli 2005; Savio & Braiterman 2007), but little has been done to examine what the content should be about or what aspects should be addressed when it is created.

The mobile Web and location awareness

As Web-enabled mobile devices, such as laptops and mobile phones, have become more portable and more powerful, going online has become much easier and more ubiquitous so that users can – and expect to be able to – access the Internet from almost anywhere at any time (Johnson et al. 2010). The growth in usage of Wi-Fi (wireless fidelity or wireless networking) hot spots is predicted to continue, so that by 2014, there will be over 11 billion global connects/sessions, up from two billion at the end of 2010. By 2012, at least half of these are expected to come from handheld devices (Vogelei 2010).

The mobile Web and location awareness of handheld devices, where such devices ‘know’ their geographical position through the use of positioning technology, such as global positioning system (GPS), Wi-Fi, or cell towers, are technologies that are expected to evolve significantly in the near future (Gartner 2010). The means by which we can receive or create data at any time and any place is easier and more widespread than ever before. This, in turn, provides a multitude of opportunities for informal learning ‘on the fly’, where users can exploit the ‘always-on’ phenomenon to find out information in their spare time, for example, travelling on a bus or waiting for a friend. If we can embody an effective pedagogy within user-generated content, we can (subject to device and network availability) provide learning any time and at any place. Hwang et al. discuss the strategies, criteria, and research issues in context-aware ubiquitous learning in greater detail, including an examination of the contexts that are most important for ubiquitous learning and also examples of learning activity design, together with important considerations to take into account when engaging in ubiquitous learning (Hwang et al. 2008). Work carried out by researchers on the CONtent Creation Excellence through Dialogue in Education project (http://www.concede.cc) has also attempted to problematize the issue of user-generated content for use within higher education and has constructed a generalized framework for how such content can be introduced effectively (Helmstedt & Ehlers 2011). However, this is very much a work-in-progress and has yet to be fully tested.

In this research, informal learning is mediated through location-based technologies to support learning at specific physical locations, for example, nature reserves or heritage sites, to learn about our surroundings from a number of different disciplinary perspectives. The envisaged scenario is that of browsing/creation of geolocated user-generated content by visitors to such a site using mobile devices. Previous visitors or local residents who have an interest and knowledge of the area would publish information about the site on the Web that they think others would find interesting and informative. This information would be created in location at the time of the visit (if resources allowed), or asynchronously either before or after the visit. The content could be accessed at any time by anyone – so there is no waiting around for an organized guided walk to start at a particular time. It also means that visitors can explore wherever they want to go, rather than being taken on a prescribed route. It would enable families, groups, or individuals to interact with the content either on their own or with others, and provide personalization to the user as they can choose to receive the content that they are interested in, facilitated by tags, user-derived classifications, or some other filtering mechanism. The variation in user-generated content also means that it is possible to gain different perspectives that might not otherwise be available – for example, a visitor from a different country or culture who creates some content might be able to create fascinating parallels or give a contrasting view of an aspect of the environment, compared with a local visitor or resident.

Mobile and contextual learning in informal situations

This work is underpinned by the notion that visitors mentioned in the scenarios earlier are engaging with a
form of mobile learning. A common assumption of mobile learning is the idea that learners are continuously on the move. However, this is not just their physical mobility, but also how they are active in different contexts and how frequently these might change. Context is created by interactions among people, their surrounding environment, and the tools or resources available to them (Sharples et al. 2009). The primary context in this study is the physical location of the user and their position relative to specific landmarks or items/areas of interest (e.g. a historic building, a sculpture, a formal garden). However, other contextual aspects are present and are largely dictated by the users themselves, that is, the visitors to these locations. Their goals, the resources they choose to use, and the nature of the interaction itself (with a device and/or other people) are all governed by the user. The learning taking place in these situations is largely informal, where visitors engage with geolocated user-generated content in a self-directed and self-managed manner. Livingstone defines informal learning as ‘any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria’ (Livingstone 2001). As well as dictating their own goals or tasks, visitors also decide what content to interact with and the length of time they spend with it, the source of the content, the application of their learned knowledge, and the evaluation of learning outcomes (Livingstone 2001). According the description of Beckett and Hager (2002), informal learning is holistic, activity/experience-based, dependent upon other activities, activated by individual learners, and is often collaborative (Beckett & Hager 2002, cited in Colley et al. 2003). The ways in which visitors might interact with social media and user-generated content while, for example on a day trip, coincides neatly with these attributes.

In these situations, the behaviour of visitors (learners) in the peer production of user-generated content can be described as ‘wildfire activities’, a term proposed by Engeström to describe modes of activity or social interactions that may be transient in nature, appear or disappear unexpectedly, or flare up and expand, and may be temporarily extinguished but later reappear (Engeström 2009). Communities of visitors in the described scenarios fit closely with how Engeström describes groups of participants in these sorts of interactions: they are heterogeneous and ad hoc, with an amorphous membership that is constantly changing (Engeström 2009). The value of these wildfire activities is that they clearly demonstrate not only a physical mobility of visitors (learners) but also a virtual movement of ideas and information so that user-generated content resulting from such activities is seen not simply as a ‘by-product’ of the Internet, but instead encompasses a much broader and inclusive mechanism by which informal learning can occur. The phenomenon of stigmergy – where a trace left in the environment by a particular action invokes a similar action resulting in indirect and spontaneous coordination – can also be applied here. It is suggested that, upon encountering geolocated user-generated content while visiting a place of interest, a visitor would feel inspired to create their own content, possibly as a response or maybe as a new item for someone else to stumble upon in the future.

For users who wish to generate new content, aspects of the framework can be used as part of an authoring interface, so authors are asked to specify which domain their content relates most closely to (via, e.g., a drop-down box or keyword/tag); they would be prompted to describe shape, colour, etc. or think about the type of communication to use (e.g. task, reminiscence), and also give their content a ‘knowledge’ rating to specify whether it is suitable for complete beginners or those with more advanced knowledge of the subject. This issue of process, rather than mere product, is discussed in more detail in the final section of this paper.

**Using mobile devices to learn about our surroundings**

The authenticity of learning opportunities carried out in location resonates with several previous projects by other researchers. Many people like to explore their environment through tourism, leisure pursuits, and through visiting friends and relatives. Examples of some of these projects, including instances of informal and mobile learning, are detailed here.

Collaborative Mindtools have been developed by Hwang et al. to enable context-aware ubiquitous learning about butterflies using mobile devices in location (Hwang et al. 2010, 2011). Their studies showed that students who used the location-based Mindtool applications (through either concept maps or repertory grid techniques) performed better in post-tests than students in the control groups who did not use them.
‘CAERUS’ was a context-aware handheld guide, delivered on a personal digital assistant, for visitors of the University of Birmingham Botanic Gardens (Naismith et al. 2005). It delivered location-specific information, tailored to the user’s interests, through the presentation of themed multimedia. While user feedback was somewhat mixed, the evaluation shows that the use of the guide promoted a deeper engagement of the visitors with the surroundings than had been observed previously.

The ‘History Unwired’ project\(^1\) created a walking tour for visitors using video and audio on GPS-enabled mobile devices through lesser known areas of Venice. What was unusual about this project was the inclusion of local inhabitants to narrate the tour, and give their perspectives and stories about the areas. It explored not only aspects of local folklore, art, and culture but also investigated how tourists might interact with private, as well as public, space (Epstein & Vergani 2006).

‘MyArtSpace’ was a project that encouraged children visiting an art gallery or museum to record their experiences using mobile devices through the collection of artefacts (coded with two-letter tags), and also enabled their own creation and uploading of images, sounds, and text. These multimedia were accessed after the trip and facilitated later reflection in a classroom setting, thus bridging informal and formal learning (Vavoula et al. 2009). MyArtSpace has now evolved into OOKL,\(^2\) and is used by museums and other venues across the UK to digitize, represent, and promote the artefacts contained within each venue so that visitors might find a new way of interacting with them, both at the time of the visit and afterwards.

Clough has worked with the Geocaching community to explore informal learning within community membership and participation. Geocaching is a type of GPS-enabled treasure hunt where participants hide Geocaches at particular physical locations that are accessible to the general public, and provide clues on where to find it via a Geocaching website. Learning opportunities were found to be both intentional and accidental, as participants would sometimes find out information about a local area as a by-product of seeking out the cache (Clough 2010). Clough’s paper describes the work in more detail and also discusses the findings in relation to Jonassen’s research on constructivist learning with technology (Jonassen et al. 2002).

These projects all show an enthusiasm for learning in location, particularly in outdoor environments. There also seems to be a growing trend away from using wholly ‘authoritative’ or institutionally derived sources of information towards more of a blend of these sources in combination with those from the general public. However, one key challenge is how to sift out the large amount of poor quality content or ‘spam’ that is widespread on the Web. Peer review or recommendation by community members is one way of ensuring high-quality content, as the ‘good’ content is filtered off from the not-so-good (Agichtein et al. 2008). However, another mechanism whereby high-quality content might be promoted is at its point of creation, using guidelines or a framework to provide advice to authors, particularly where the purpose of such content is to explicitly provide an educational experience or foster informal learning opportunities.

### The design of user-generated content for location-based learning

In constructing a framework to guide the authoring of user-generated content for teaching others about the environment, we borrow from several distinct domains, including environmental aesthetics, HCI, and pedagogy. This intersection of disciplines provides support for describing the environment and the items contained within it, while also allowing for aspects of learning, and technical or learner–device interactions to be expressed and explained in a clear manner. It presents a starting point to inform authors on the sorts of things they should consider when informing others about some snippet of information or knowledge item they wish to convey, while also suggesting a useful way to implement crossover areas between these disciplines.

Carlson has proposed a curriculum for learning about the landscape – this can be translated into domains, under which such information is categorized or classified (Carlson 2001). The eight curriculum areas are form, common knowledge, science, history, contemporary use, myth, symbol, and art. Form includes shapes/lines and colours; common knowledge is the classification of content such as tree, mountain, river, etc; science relates to the natural sciences, particularly knowledge of biology, geology, and ecology; history pertains to the historical land use, while contemporary use refers to the current perspective on the landscape.

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Myth and symbol can be closely integrated or completely separate: myth refers to the mythology of the landscape and particularly any stories that relate to the area, for example, ghost stories or travellers’ tales. A symbol can be a part of the landscape, for example, a particular hill or landmark that has cultural, historical, or mythical significance. Lastly, art refers to works of art that refer to the landscape or are integrated within it; it may also have close links with the myth and symbol aspects. While these categories are specifically related to landscape rather than the wider environment, they provide a basis for integrating existing knowledge domains (disciplines) with an environmental perspective and so are included here.

It is also vital to explore how user-generated content might foster social interactions with other members of the community. Wood suggests how spontaneous encounters between children and members of their family or peers can result in ‘informal teaching’ (Wood 1998). Communication is carried out via ‘suggestions, hints and warnings, conversation, practical tasks shared, family reminiscences’ (Wood 1998), and these social interactions help orchestrate and extend a child’s learning and understanding. Findings by Naismith et al. from the CAERUS project also revealed that descriptions and exhortations (e.g. ‘look carefully at the bark of that tree’) play a crucial role in encouraging visitors to engage with their environment (Naismith et al. 2005). A related finding suggests a particular value in telling the story of the background of the object, or of indicating to the visitor something that is not obvious. Smith also suggests using reminiscing as a means of ‘extracting meaning from experience’ (Smith 1983).

Information can also be used to convey something unusual or unexpected in order to pique a visitor’s curiosity – for example, in the Ambient Wood project, children were more interested in the feathers from a dead bird that they had discovered serendipitously than finding out information about and interacting with nearby blackberry bushes (Rogers & Price 2008).

In terms of how to write effectively for others to understand us, it is useful to examine the guidelines of such systems that already utilize user-generated content. For example, Wikipedia has ‘five pillars’ than underpin its fundamental principles and philosophy. These are the following:

- Wikipedia is an encyclopaedia.
- It has a neutral point of view.
- It has free content.
- Users should interact in a respectful and civil manner.
- Wikipedia does not have firm rules (other than these guidelines).

Wikipedia also has a manual of style that lays out guidelines for contributors to follow; however, this is mostly related to styles, internal hierarchies, and formatting rules rather than specifically dealing with content. There is a short section on ‘clarity’ that states that ‘...writing should be clear and concise. Plain English works best: avoid jargon, and vague or unnecessarily complex wording’. Simple Wikipedia has a more extensive article on the use of simple English to describe its content. It has a ‘How to write Simple English’ page, together with a ‘do not’ list (e.g. do not use poor grammar or incorrect spelling, do not use complex sentences, do not use words you are not sure about without using a dictionary, do not write articles so short that they offer no useful information).

A related aspect, when writing content for someone else to engage with, is to consider the difficulty level of the content – this needs to take into account the visitor’s prior knowledge of particular subject areas or required prerequisite knowledge (Brusilovsky 2001), but it can also be related to their age, experience, and or cultural norms.

The framework/guidelines that have arisen from this research are presented in Table 1. In the following section, these aspects are used to evaluate existing user-generated content from three different systems, all of which are used for location-based learning with a variety of different users.

Analysis of existing content

Overview

In this section, the proposed framework from Table 1 has been used to analyse existing over 200 items of user-generated content from three different platforms: OOKL (referred to earlier in this paper), People’s Collection Wales, and WildMaps. An initial survey of geocoded Wikipedia articles, a popular information source of user-created content, indicated only basic information (mostly textual), and was thus unsuitable for use in this study. There are some similarities among OOKL,
Table 1. Guidelines/framework for authors of geolocated contextual information.

<table>
<thead>
<tr>
<th>Landscape domain</th>
<th>Type of communication</th>
<th>Use of language/media related to the landscape</th>
<th>Knowledge level of content</th>
<th>Contextual aspects</th>
<th>Interaction – try to include:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Common knowledge</td>
<td>10. Hint or warning</td>
<td>17. Use emotions or personal response</td>
<td>• Beginner</td>
<td></td>
<td>34. Relevance to everyday life</td>
</tr>
<tr>
<td>4. History</td>
<td>12. Practical task</td>
<td></td>
<td>• Advanced</td>
<td></td>
<td>36. Anything unusual or</td>
</tr>
<tr>
<td>5. Contemporary use</td>
<td>13. Reminiscence</td>
<td></td>
<td>• specialist</td>
<td></td>
<td>unexpected</td>
</tr>
<tr>
<td>7. Symbol</td>
<td>15. Exhortation (e.g. 'look carefully')</td>
<td></td>
<td></td>
<td></td>
<td>38. Respect for others and for the environment</td>
</tr>
<tr>
<td>8. Art</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>39. The story behind the visible (e.g. photosynthesis in a leaf)</td>
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</table>
People’s Collection Wales, and WildMaps, and also some important differences among them. All are used to present both ‘authoritative’ or institutionally derived information and also user-generated content; however, the initial focus and background to each system is unique even if there now seems to be some parallel evolution among them. These systems are described in more detail shortly.

For each system, it was important to examine original and author-created content, and it was also decided to focus upon the contributions of individuals rather than those who were representing an organization (e.g. National Trust) or existing formalized groupings (a local historical society or ramblers’ club). This is because it would be easier to ensure individual authorship and creativity of resources, rather than content submitted by a group representative that might be more ‘official’ or have to adhere to an unspecified set of rules or guidelines set out by that grouping. It was also decided to exclude any ‘secondary’ sources of media, for example, a photograph that was taken by someone else other than the author such as a relative or grandparent (insofar as this could be identified) as this research is primarily concerned with the first-hand experiences of the user themselves, rather than them reporting on the experiences of others.

For each item of user-generated content that was analysed, it was recorded what types of media were used (image, text, audio, video, Web link/URL) and also what aspects of the framework related to that bit of content. The systems used to harvest the user-generated content are detailed later.

OOKL

OOKL, as described earlier in this paper, is a means of facilitating visitor engagement with their surroundings via the use of handheld devices to record their experiences. Initially, with an emphasis on museums, art galleries, and botanic gardens, there is also the potential to use OOKL in open spaces and zoos. In the past, the user base has largely consisted of schools and their pupils; however, OOKL can also be used now by the general public.

The data examined from OOKL consisted of ten different ‘stories’ that were created mostly by children on school visits, which were then published and made available to the OOKL community via the OOKL website. The ten stories comprised of 117 media items (an average of 11.7 media items per story). A story is created by a user as a reflection of their visit to a particular location or venue; the user records and uploads media items when visiting the location (images, audio, or text – mobile creation of video is not currently supported), and later organizes these into a record of their visit, which can be viewed online or downloaded as a PowerPoint file. The stories were selected at random but attempted to include a number of different venues in order to test the framework as extensively as possible. Venues included Kew Gardens, the D-Day museum, a National Trust park, an environmental education centre in London, and various urban locations.

Peoples’ Collection Wales

Peoples’ Collection Wales (Casgliad y Bobl) is a bilingual online resource and mobile phone app (Trails Cymru) aimed at collecting, interpreting, distributing, and discussing the cultural heritage of Wales. It is a repository for existing digitized content from authoritative sources as well as allowing users to upload their own multimedia relating to Welsh life, and the history of Wales and its people. It allows for different sorts of categories to be created, such as themes, collections, stories, or groups. Geographical trails can also be produced that relate to location-specific artefacts; these trails can be created or viewed via a GPS-enabled mobile phone (Android OS or iPhone) to enable learning to take place in location. It is not geared towards a particular age group but is inclusive to a large user base, while serving those primarily living in or visiting Wales.

Peoples’ Collection Wales was launched in Summer 2010 and has not yet had a large number of independent contributors creating content – and those that have contributed content have often uploaded just photos or media created by someone else, possibly from a different decade. While this is an important part of the work of this project, it made finding suitably ‘primary’ user-generated content fairly difficult. Only 32 media items were analysed that represented media from several different aspects of Wales, its people, and its culture. Much of the uploaded content had been contributed by groups, or people representing groups, and this was excluded from the analysis for reasons given earlier in this paper.
WildMaps

WildMaps is one of the tools provided by WildKnowledge, a company that specializes in delivering and uploading mobile content via the Web for educational purposes. Like OOKL, it has a background in providing services and platforms for schools, although it too has expanded to include new audiences, such as tourists and also those working in the healthcare sector.

WildKnowledge has a suite of four tools: WildForm, WildKey, WildImage, and WildMap. WildForm is a way of recording data electronically, replacing traditional pen-and-paper forms. It can automate some of the data gathering, such as date/time/GPS location, etc. WildKey is an interactive decision tree (or branching database) tool that provides mobile decision support and was originally created to support biological field work. WildImage allows users to annotate images with metadata (named ‘Designated/Personal Interest Points’) that can itself contain images, text, Web links, audio, video, forms, and quizzes. WildMap, which was used here, allows users to create trails or tours that contain specific interest points (i.e. media items).

Community-created WildMaps can be published on the WildKnowledge website and downloaded to any Web-enabled mobile device. Three community-generated maps were available from the WildKnowledge website; however, two of these were either empty or had been used as tests and only contained ‘trial’ content. The remaining map contained 68 interest points (media items), which were then analysed using this framework. The map was a tour around a churchyard and focused mostly upon the gravestones/stonework and the natural surroundings of the area.

Results

Table 2 shows the numbers and percentages of items of user-generated content that contained different media types.

Nearly all media items contained text; this ranged from one sentence to around 200–300 words. Most contained around 100–200 words. Photographs were also very popular, with over three quarters of the media items containing at least one photograph. Some of the media items contained only a photograph and a few words of text (e.g. a title or very brief description) – this was especially true of content from the Peoples’ Collection Wales website. Audio and video were scarce, being present in only 5.5% and 0.9% of the items, respectively. Web links were also not well used, appearing in only 6% of the content.

In terms of analysing the content with respect to the framework in Table 1, it quickly became apparent that three additional aspects were required: ‘introduction/introductory text’ (under ‘Type of communication’), ‘models/physical representations’, and ‘actual item/artefact’ (under ‘Contextual aspects – other resources’). These were introduced into the framework analysis early on as they were essential for cataloguing a number of items from the OOKL stories.

Table 3 shows the percentages of media items relating to different aspects of the framework. The most commonly found aspects of the framework are shown at the top of the table; the least common are at the bottom.

Some items from the framework were not found in the media items that were analysed. These aspects were the following:

27 is the information related to time of day?;
30 available resources/experts;
31 available resources/leaflets; and
35 element of fun

Analysis of results

Most of the items analysed contained text and one photo (as shown in Table 2); only a small number contained audio and video. This could be due to the limitations in recording/editing audio and video on mobile devices (if created by users on-the-go), the large upload times that could be involved, or the fact that users might find it quicker and easier to write text and attach a photo.
Table 3. User-generated content analysed against the framework in Table 2.

<table>
<thead>
<tr>
<th>User-generated content that includes . . . (framework number / description)</th>
<th>Number of items (total = 217):</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. short textual description</td>
<td>191</td>
<td>88.0</td>
</tr>
<tr>
<td>16. describe shape, colour, size</td>
<td>147</td>
<td>67.7</td>
</tr>
<tr>
<td>3. science</td>
<td>80</td>
<td>36.9</td>
</tr>
<tr>
<td>18. use simple English (short, commonly used words) where possible</td>
<td>67</td>
<td>30.9</td>
</tr>
<tr>
<td>8. art</td>
<td>64</td>
<td>29.5</td>
</tr>
<tr>
<td>5. contemporary use</td>
<td>62</td>
<td>28.6</td>
</tr>
<tr>
<td>4. history</td>
<td>56</td>
<td>25.8</td>
</tr>
<tr>
<td>39. the story behind the visible (e.g. photosynthesis in a leaf)</td>
<td>54</td>
<td>24.9</td>
</tr>
<tr>
<td>21. be clear and concise</td>
<td>46</td>
<td>21.2</td>
</tr>
<tr>
<td>2. common knowledge</td>
<td>39</td>
<td>18.0</td>
</tr>
<tr>
<td>19. avoid jargon but do use appropriate language</td>
<td>34</td>
<td>15.7</td>
</tr>
<tr>
<td>32c. available resources/actual item/artefact [additional item to original framework]</td>
<td>30</td>
<td>13.8</td>
</tr>
<tr>
<td>36. anything unusual or unexpected</td>
<td>29</td>
<td>13.4</td>
</tr>
<tr>
<td>34. relevance to everyday life</td>
<td>28</td>
<td>12.9</td>
</tr>
<tr>
<td>7. symbol</td>
<td>26</td>
<td>12.0</td>
</tr>
<tr>
<td>33. authenticity</td>
<td>26</td>
<td>12.0</td>
</tr>
<tr>
<td>37. opportunity for reflection by the user</td>
<td>24</td>
<td>11.1</td>
</tr>
<tr>
<td>17. use emotions or personal response where appropriate</td>
<td>21</td>
<td>9.7</td>
</tr>
<tr>
<td>13. reminiscence</td>
<td>20</td>
<td>9.2</td>
</tr>
<tr>
<td>26. is the info related to the time of year or the seasons?</td>
<td>15</td>
<td>6.9</td>
</tr>
<tr>
<td>9. suggestion</td>
<td>14</td>
<td>6.5</td>
</tr>
<tr>
<td>15. exhortation (e.g. ‘look carefully’)</td>
<td>14</td>
<td>6.5</td>
</tr>
<tr>
<td>22. orient the visitor appropriately</td>
<td>13</td>
<td>6.0</td>
</tr>
<tr>
<td>38. respect for others and for the environment</td>
<td>13</td>
<td>6.0</td>
</tr>
<tr>
<td>25. needs prior knowledge?</td>
<td>11</td>
<td>5.1</td>
</tr>
<tr>
<td>12. practical task</td>
<td>10</td>
<td>4.6</td>
</tr>
<tr>
<td>15b. introduction/introductory text [additional item to original framework]</td>
<td>8</td>
<td>3.7</td>
</tr>
<tr>
<td>10. hint or warning</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>24. age-related? (children might not have the same knowledge or level of understanding as an adult)</td>
<td>5</td>
<td>2.3</td>
</tr>
<tr>
<td>23. domain-specific (beginners/intermediate/advanced/specialist)</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>29. available resources/other people</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>32b. available resources/models and physical representations [additional item to original framework]</td>
<td>3</td>
<td>1.4</td>
</tr>
<tr>
<td>1. form of landscape</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>20. be culturally sensitive</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>28. visibility of the landscape and its features/landmarks</td>
<td>2</td>
<td>0.9</td>
</tr>
<tr>
<td>6. myth</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>11. conversation</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>32. available resources/notices and signs</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

The media items that were analysed show an emphasis in subject domain (column 1, Table 1) towards science (including natural science), found in 36.9% of items. The other domains, by percentage of items, were art (29.5%), contemporary use (28.6%), history (25.8%), symbol (23%), common knowledge (18%), form of landscape (0.9%), and myth (0.5%).

The types of communication (column 2) varied. Most common were a short textual description (88%) followed by reminiscence (9.2%), suggestion or exhortation (6.5%), practical task (4.6%), introduction (3.7%), hint or warning (2.3%), and conversation (0.5%).

When looking at the user of language (column 3), it is encouraging that around 30% of the analysed media were written in simple English that was clear and concise (21.2%) and without the use of unnecessary or unexplained jargon (15.7%). However, it seems that this is one area that could be improved, so that users...
can more easily read and understand what the author is trying to say. More detailed descriptions (of shape/form/colour – either through text or other media types such as images) were used in 67.7% of all items, while emotions or personal responses were apparent in 9.7% of the items. Visitor orientation was mentioned in 6% of items; this could be potentially very important when referring to a particular aspect of the local environment and so could be expected to be higher. Culturally sensitive content was contained in only 0.9% of the items.

In terms of knowledge domain (column 4), age-related or domain-specific content was only present in a small number of items (2.3% and 1.4%, respectively), although the need for prior knowledge was in 5.1% of items. However, these are still quite low numbers, and suggest that the majority of the content analysed could be understood by a large sector of Internet users.

For contextual aspects (column 5), temporal issues relating to the year or seasons were mentioned in 6.9% of media items (although those related to short-term time frames, e.g. daily changes, were not mentioned at all – this is discussed later). The most commonly mentioned available resource in the area was that of an actual item or artefact (found in 13.8% of the items). Examples of this included a gravestone, carving/sculpture, or a specific tree/shrub. Other available resources were not well used: ‘other people’ and ‘models/physical representations’ were only mentioned in three items out of 217 (1.4%), while ‘notices and signs’ were only mentioned in one item (0.5%), and experts and leaflets not at all. The visibility of the landscape and its features/landmarks was only mentioned in 0.9% of items, although this could be due to the characteristics of the locations visited and does not necessarily indicate that they are less useful or less important.

Under the final column from Table 1, of ‘interaction’ (column 6), the most prevalent aspect was that of ‘the story behind the visible’, where a more detailed description of the location was provided, related to something not immediately obvious or unseen (found in 25% of items). The idea of introducing something unusual or unexpected was apparent in 13.4% of the items. These data suggest that users like to inform others about something not obvious, or that is out of the ordinary – something that might intrigue or engage visitors to the area.

The remaining aspects of interaction were relevance to everyday life (12.9%), authenticity (12%), opportunity for reflection by the user (11.1%), and respect for others and for the environment (6%).

The framework was successfully used to classify items of user-generated location-based content. However, some aspects of the content could not be described fully, as some key elements were missing. These included religion, architecture/built environment, language, and geography as type of domains, together with material composition, function, and cultural relevance of the objects being described (column 1). One particular type of communication (column 2) was also missing: that of sound/music/ambient noise so, for example, a recording of birdsong could not be fully classified. Under column 5 (‘contextual aspects’), an additional resource that was missing from the initial framework was Web link/URL, which was found in 6% of all items. Lastly, under column 6 (‘interaction’), it is suggested to include ‘tonality/use of voice to maintain a lively commentary’ as a means by which to effectively engage with a user when recording audio content. More generally, an important limitation of this work is that the primary referent for the framework is the landscape, rather than the objects themselves, hence the reason why some of these items of content could not be fully classified.

The aspects of the framework that were included in Table 1 but were not found in any of the media items analysed included ‘available resources/experts’ and ‘available resources/leaflets’, temporal information relating to time of day, and an element of fun. While it is possible that analysis of items was somewhat subjective, and hence difficult to say if the ‘fun’ element was present or not (since the definition of what is ‘fun’ might vary between different people), it is fairly certain that the other three items were not present, which suggests that location-based social media might be created because there is a lack of these other resources (experts, leaflets) available at the time/place relating to that media. It also seems possible that while people are aware that locations change according to the seasons or on a yearly basis, they either do not consider short-term, daily changes in how the content might be affected, or this is not an issue (the content might have the same relevance no matter what time of day/night) – hence users do not consider this when authoring content.
Value and wider impact of this research

It is clear that the framework has provided some detailed information – mostly content analysis – of existing user-generated content. But can it be used to guide the creation of such content in the first place? It is proposed that some of the aspects of the framework (such as domain or contextual aspects) would be used to tag items of social media to enable personalization or filtering for those browsing or reading the items. In this way, it would help with the curation of user-generated content/social media (Bhargava 2009) and provide a way of matching up a user’s interests and existing knowledge with the media items available, thus reducing a potential flood of content to a manageable trickle.

The framework can also be used as guidance provided to end users/visitors, for example, at a particular venue, or issued from an organization/institution. For example, if a local community history group wants to engage with visitors to the area, they could ask their members to create content relating to myths or disputed historical perspectives of the area. Issuing clear guidance about the type of communication that could be used (column 2 in Table 1), together with instructions of the kind of language and possible interactions (columns 3 and 6), would be very valuable in scaffolding the process of content creation (Scott et al. 2003), particularly if potential ‘contributors’ are more familiar with passively browsing content on the Internet rather than uploading or creating it. Another example scenario is the use of user-created content by school children or university students as part of a formalized biology or geography field trip, whereby they are asked to record their experiences while outdoor in location, a good example of a particular goal-oriented activity. Again, advice about the creation of the content would help focus their learning and would encourage metacognition about the authoring process. Social interactions between users, in the form of browsing content produced by others, or producing content for others to view (either new content, or in response to existing media) are an important part of learning and knowledge construction (Vygotsky 1978). By creating content, the user is engaging in experiential thinking (a learning process relating to personal experiences), while the activity of browsing content created by others would result in reflective thinking and metacognition (Norman 1993), particularly if the user then decided to author their own response for the original content creator. An essential part of this study is the social interaction between users (synchronous or asynchronous, in terms of both time and place) that enables reflective thinking and shared knowledge construction to occur (Hwang et al. 2010).

The framework can be tested further to see if some of the lesser-classified items would be valuable and engaging for prosumers of user-generated content and social media. For example, ‘myth’ and ‘form of landscape’ were not found in many media items in this study. However, it is expected that these would be more prevalent if the media items corresponded to locations with different qualities, for example, a national park such as the Lake District (where the landscape is more variable and the main reason to visit is to explore the countryside), or a place where there might be a higher prevalence of local mythology (or if this was presented as a focal part of the trip, e.g. a Ghost Walk).

It is hoped that a number of positive consequences will result from the utilization of this framework. The first is that users would be steered towards creating high-quality media right from the outset, thus the content in these systems might be perceived to have higher value and less prone to abuse or ‘spam’. Secondly, by tagging media relating to domain and other contextual aspects, personalization and filtering is enabled (through an implied ontology), thus making content presentation to the user much more manageable. Lastly, the framework can be used to guide or create learning aims and outcomes, to structure more institutionally organized learning and goal-oriented behaviour.

A limitation of this work is that the content analysed in this study was not given to actual users to investigate how learning about the environment might be enabled. As yet, it is not known from this work how effective user-generated content is for learning. The passive consumption of such content or other social media may (or may not) be as effective as more traditional, didactic methods of teaching and learning. However, it is likely that the active creation – or co-creation – of content will engender a deep engagement with the learning process through participatory and socioconstructivist learning principles. It is also important that the framework is not used in a manner that is too prescriptive; if too much creative control is taken away from the users, this could cause a demotivational effect and make them less inclined to either browse or create content for others to interact with. This issue might manifest itself in the
potential design of an authoring or feedback system for user-generated content and will be considered in the future development of this work.

The amount of user-generated media on the Web is only going to increase even more over time. What is critical for education, whether formal or informal, is how we can engage with it effectively and efficiently, so that high-quality content – and its curation – becomes valuable resources and experiences throughout our life-long learning journeys.

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Notes

1 http://web.mit.edu/frontiers/.
7 http://www.peoplescollectionwales.co.uk/.
8 http://www.wildknowledge.co.uk/.

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