

The Complete Information Literacy? Unforgetting Creation and Organisation of Information

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Abstract

Even though the concept of information literacy typically embraces an idea of a complete participation in an information community, its definitions have tended to underline the phases of seeking, searching and evaluation instead of creating information. Shortcomings of information creation can, however, explain many of the difficulties of finding information. This article develops the notion of information literacy with a specific focus on integrating creation and organisation of information as central aspects of being information literate and discusses the implications of developing information creation processes from the point of view of information professionals and users. Finally, suggestions are made for how information creation might be improved in practice.

Keywords: information literacy, information creation, knowledge organisation

1 Introduction

According to the internationally widely accepted American Library Association “Information Literacy Competency Standards for Higher Education”, information literacy is a set of abilities requiring individuals to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.” (ACR, 2000). The definition is illustrative of the the abilities based view of information literacy that was prevalent before and during the 1990s (Bawden, 2001). Bruce argued in 1997 (Bruce, 1997) for another viewpoint based on a more comprehensive user-centred view of information literacy that has become influential in the recent discussions on information literacy (Limberg & Sundin, 2006). Even though the term information literacy may be considered to refer to a idea of *using* information in a broad non-specific sense, the conceptions of information literacy discussed in the literature have tended to focus on the seeking, locating, receiving and evaluating information (e.g. Rader, 2002; Stern, 2002; Virkus, 2003; Johnson & Jent, 2005; Limberg & Sundin, 2006; Savolainen & Kari, 2009). There are exceptions (e.g. Catts & Lau, 2008; Sorimunen & Poikela, 2009), but the idea has not really been translated to practice. As Limberg and Sundin remark, the gap between policies, research results and practices seems to be a general tendency in the area (Limberg & Sundin, 2006). Marcum criticised the narrow view of information literacy concept and argued for widening the perspective towards learning and more comprehensive socio-technical competence (Marcum, 2002). The perspective has been elaborated further by Tuominen et al. (2005) who stressed the importance of seeing information literacies in the context of communities and their sociotechnical practices. Wilder (2005) suggested that the weakness of the notion of information literacy is that users do not conceptualise their information related problems as difficulties to *search* or *seek* relevant information. The problem is rather in *find-*

ing relevant high quality information. Another critical remark put forward by Wilder is that information literacy centric reasoning emphasises the complexity of retrieving and using information. An image of complexity is helpful in the context of use of information literacy described by O'Connor (2009), namely, in legitimising library profession in the present society. From the point of view of the users, a more sensible and productive approach would be to try to reduce the complexity instead of attempting to teach a large group of people to master complex, but only instrumental, skills.

Most of the information sought by the information literates and illiterates is created by fellow human beings. Therefore, besides focusing on facilitating the use, another plausible approach to help users would be to reduce the complexity of information and its expressions. The focus should be shifted from an extensive problematising of information seeking and use to explicating the creation, organisation and management of information. Finding information in the fast digitising world requires specific skills that are different from the skills of the print era and the first generations of web services (Tuominen, 2007). At the same time, however, the advances in information retrieval research and practice have made searching and accessing information easier than ever and compensated significantly for the need to acquire a new set of complex skills. Technology has also simplified creation and organisation of information, but in this area, the advances have been considerably less spectacular. Creating and editing information in such form that is certainly findable is not quite easy as web designers and information architects have discovered and emphasised, for a good reason (Morville, 2005; Morville & Rosenfeld, 2006). In an ideal world, every information creator (in the age of participatory web, everyone of us) would be an expert in producing information and information searching would be a problem only rarely.

This article develops the concept of information literacy with a specific focus on integrating creation and organisation of information as central aspects of being information literate. It highlights the implications of information creation processes for information professionals and users using examples from the literature. Finally, suggestions are made for education on how information creation might be improved in practice. The suggestions are based on observations made on a selection of social web services and on how their users have changed voluntarily the ways they create information.

2 Information literacy

The term of information literacy has a multitude of definitions. Bawden (2001) presents a comprehensive review of the discussion on the topic and concept and its relation to partly overlapping concepts such as digital literacy, library literacy and computer literacy. As Mutch suggests, much of the information literacy discussion has focused on the concept rather than its implications (Mutch, 1997). Possibly the most popular definition is the already mentioned definition from the ALA standard (ACR, 2000), although in academic discussions on the concept, the broader sociotechnical, sociocultural and socioconstructive views have gained more ground (e.g. Tuominen et al., 2005; Alexandersson & Limberg, 2005; Limberg & Sundin, 2006). An intuitive consensus seems to exist that the concept is related to an ability or capability to undertake information seeking and use, but the precise definitions vary to such an extent that the wish of Snavely and Cooper (1997) of a greater clarity is still as current as it was at the time of their writing in 1997.

Bruce defines the seven faces of information literacy as the 1) IT Experience, 2) Information Sources Experience, 3) Info Process Experience, 4) Info-Control Experience 5) Knowledge Construction Experience, 6) Knowledge Extension

Experience and 7) Wisdom Experience (Bruce, 1997). The Big Six Skills method of Eisenberg and Berkowitz (1990) and several other definitions are based on similar process models (Webber & Johnston, 2000). These process models and related information seeking process models (e.g. Kuhlthau, 1993) represent linear or iterative views of how information is carried from information sources to the mind of the user. The major problem of all process models is that digesting information is social and contextual (Hyldegård, 2006), and only rarely linear activity (Foster, 2006). Therefore, considering the sociotechnical dimension of information literacy has been emphasised as necessary for the advancement of information literacy initiatives (Tuominen et al., 2005).

Besides being a concept related to abilities or broader competence, information literacy has been discussed as a societal issue. Information literacy campaigns have been started all over the world. Motivations behind the projects have been parallel, but in practice, different. Most of the initiatives have dealt, directly or indirectly, with national information society projects, innovation and competitiveness (Rader, 2002). Alexandersson and Limberg have demonstrated a positive correlation between information literacy and learning outcomes (Alexandersson & Limberg, 2003, 2005). In general, however, the connection between the objectives and implementation of many initiatives has been vague (Limberg & Sundin, 2006). One of the problems has been that the relation between information literacy education and broader learning, curriculum design and teaching perspectives has remained vague (Bruce et al., 2006).

In addition to being a practical necessity, information literacy has been seen as a social question. According to this view, information literacy education is important for less privileged groups of people and in countries with lower living standards (Stern, 2002). Ek (2005) has demonstrated a correlation between 'information mastering' (a concept that is closely related to the earlier discussed

definition of information literacy) and the sense of coherence. Similarly to many societal programmes, the problem with a number of social initiatives of information literacy education has been their relatively modest outcomes even if the projects themselves should have been essentially beneficial. Information literacy education has not necessarily resulted higher levels of information literacy or improved information use (Limberg & Sundin, 2006). There are many apparent reasons. Education may have been too technical, too focused on information resources or the pedagogical assumptions have been flawed (Webber & Johnston, 2000; Wilder, 2005).

3 Information creation

Information creation has been studied relatively little in information sciences. The recent discussion on participatory media and digital media culture has touched the topic more frequently (Jenkins et al., 2006; Thomas et al., 2007), but mainly from the point of view of the new media forms and tools. The lack of interest in it in information science is striking, because information creation has been perceived, at least in principle, as a central theme of the field (Ashford, 1997; Wikgren, 2005; Huotari et al., 2005). As Trace (2007) notes, the research has been focused on information seeking, organisation and use (the last mentioned being a recent topic of more specific interest) and bypassed the issues related to information creation. Even though information literacy and similar information use and production related concepts could be equally useful in explicating theoretical and practical issues related to information creation than information seeking, the discussion has mostly focused on the concepts instead of the implications as Mutch (1997) observed already more than a decade ago.

Trace has studied information creation in the context of reports (documents) written by school children using an ethnomethodological approach. Doc-

uments represent cultural knowledge on social norms and realities shared in the classroom. They are social artefacts that are used to control and construct social relations. Documents are treated as physical objects and their physicality also affects the ways how information is created and structured. Both students and teachers control, organise and manage their environment by using documents. Documents were also evaluative instruments. Students rated their own work and teachers assessed students' work by using documents. Documents reflect expectations posed on students. They provide means to trace and measure work and its results using the number of submitted reports and the number of pages as a measure. In a broader perspective, the documents acted as an instrument of construction of the students' membership in the school community (Trace, 2007).

4 Beyond seeking and use

The common feature of information literacy models is that they cover a process that begins from information need or task definition and spans to the point where new information is integrated into the personal sphere of users' knowledge. Information literacy does not typically explain how this new knowledge is turned into information so that the process may start again from the beginning (e.g. Bruce, 1997; Tuominen et al., 2005; Sundin, 2008). Of course, it is possible to conceive the creation part of the information process as a topic related to communication sciences or pedagogy and thus to reside outside the scope of information sciences. However, from the information literacy, information management and knowledge organisation points of view, this phase of the process is central. Information systems design, indexing, classification, description and organisation may be conceptualised as structuring, production or communication, but the aim of these processes is to *create* information and metainformation for

information literate readership. Besides reading, the notion of *literacy* embraces the idea of writing. In contrast, the discussion on the concept of information literacy has mostly bypassed this connotation. In the spirit of dialogic literacy (Bereiter & Scardamalia, 2005; Korhonen, 2009) that refers to participation in knowledge creating dialogue, it would be timely to incorporate creation as a part of literacy also in the contexts of information literacy. It would also be desirable to place a special emphasis on discussing the specific implications of creation to information use, information creation, information sciences and to information professions.

A common presupposition in information science is that information is what it happens to be. The broad definitions of information quoted in textbooks suggest this as well as the more in-depth debates on its nature (e.g. Dervin, 1998; Ingwersen & Järvelin, 2005; Bates, 2006; Hjørland, 2009). Information is explicated as an abstract concept and something people act with, but not necessarily in any more concrete terms. The objectives of research is to understand how people cope with this information and how people can be helped to find information by developing, for instance, knowledge organisation and metainformation systems, and information retrieval methods. Universal classification of everything has found occasional favour with classifiers and more recently in the early Semantic Web movement (Berners-Lee et al., 2001). Both librarians and computer scientists have been forced to back-pedal and come to terms with partial solutions (Brooks, 2002). A too general model does not address the problems of information management. Detailed models, on the other hand, do not correspond with reality and are so complicated that only highly specialised information professionals and ontologists can work with them.

There is, however, a wealth of degrees of information and organisation between a total entropy and universal order. The problems of information use

may be addressed by developing information retrieval systems and organisation of knowledge. Besides at the point when information already exists, another natural moment to intervene the process would be when the information is being created. Another partial solution to complete the other partial solutions to the problems of information seeking and use could be to educate the people who create information (that is everyone) to create it in a way that it is as findable and usable as possible.

One of the lessons of the many metadata projects on the web is that it takes an information professional to annotate an ordinary web page using Dublin Core metadata scheme (Lawrence & Giles, 1999; Dekkers & Weibel, 2003). Increasing numbers of people do instead describe their photographs in Flickr, bookmarks in Delicious, video clips in YouTube and themselves in Facebook (Macgregor & McCulloch, 2006). Ordinary people are not incapable of producing useful metadata. There is no reason to believe that it would be impossible for them to learn with a relatively little effort the basics of structured documents and other simple methods that would increase the findability and usability of information. The question is how, how soon and what kind of information creation literacy and annotation competence is taught.

5 Dimensions of creating information

The present linear paradigm of creating information has been prevalent since the invention of writing. Technological developments, including papyrus scrolls and the corpus, have mainly provided new means for managing and structuring running text. Digitisation and the non-linearity of digital information open up new possibilities for hypermedial information creation and knowledge organisation based on arbitrary numbers of complementary and contradictory orders as Weinberger (2007) has suggested. Hypertextual documents allow parallel

presentation of alternative versions of same information and give readers an option to choose what to read. For instance, on a web site, reading can begin on any page of the site and cover only pages that are directly relevant to a particular reader. Yet, almost no one writes illinear hypertext.

Traditions and learned conventions provide a partial explanation as well as the novelty of digital writing that, for instance, Petrelli and Wright (2009) have studied. Another reason is that running text and physical order of things is useful far beyond the extent hypermedia advocates and, for instance, Weinberger is ready to admit. From the information management and findability point of view, however, running text has well-known problems (Voorhees, 1999). At least some of these issues could undoubtedly be solved to a degree by changing the form of traditional texts and adapting less linear forms of creating information, possibly without compromising all of the virtues of running text.

Learning information literacy requires, however, not just understanding of information creation as a technical process, but also its meaning for information creators. Different contexts of information creators and users make it difficult, but if the motivation for creating information were maximum intelligibility and accessibility, problems would hardly exist to such a degree as now. Information has other functions and meanings than explicit communication of 'pure facts'.

Trace (2007) found a wealth of functions for documents that are unrelated to their factual content, but are, in many respects, relevant issues for the creators of information. Similarly to documents, information literacy is engaged in these other contexts that are relevant for the information creator, but peripheral to the explicit factual content. In order to be intelligible, findable and useful, information creation needs to fulfil these other parallel criteria.

Although the context of the documents studied by Trace (2007) is specific and information creation process is primarily influenced by a set of variables

confined to the school context and to the shared lifeworld of students, the documents have references to many things outside the classroom. Information embodies the shared cultural knowledge of social norms and realities (Huvila, 2006). Information objects are social artefacts that are used to control and construct social relations and to be members in communities (Kogut & Zander, 1996; Duguid, 2005). Documents participate in the process of defining the role and status of students as being diligent, clever or lazy, both at school and outside. Information objects are treated either as physical or non-physical artefacts, and their materiality or immateriality affects the ways how they and their in-built information is constructed and structured. Creating a qualified document requires fulfilling a set of explicit and implicit formal and informal expectations. The form of the documents affords and constrains how information can be presented and profoundly what it is. Immaterial knowledge of a submitted document is a sign of accomplishment. Both creators and users control, organise and manage their surroundings by using information objects. Similarly, all information objects are evaluative instruments. Creators of the objects measure their own work and users evaluate creators' work using information objects as a reference. All information-objects embody expectations placed upon them. Teachers and managers can use them to follow and measure the effectiveness of the work of information creators. In a broader sense, the information objects construct their creators' membership in their communities.

In the field of cultural heritage information, the field reports written by archaeologists (Huvila, 2006) are an illustrative example of documents that are tightly connected to a membership in a community. They remind us of the documents described by Trace. Archaeological report represents the shared cultural knowledge of its creators to a degree that they are hard to interpret by archaeologists who are not experts in the specific period or type of site. The form

and physicality of the report affect considerably how information is presented. Measurement data, photographs and reporting accommodate to the restrictions posed by medium (paper) and reporting guidelines. In principle, digital data is preserved in original formats whenever it is possible. The usability and accessibility of these data and their compatibility with future systems cannot be guaranteed. Therefore, the paper report is still the version meant to last and to contain all the relevant information. Besides an 'information-container', a report is an instrument of control and evaluation of the archaeological significance of a site and of the quality of the work of archaeologist (Huvila, 2006). Reports are used to organise and manage knowledge on the meaning and significance of the site. They reflect the expectations of the archaeologist profession and of the organisation, which gave permission to excavate. Therefore the reports tend to contain only relatively certain interpretations. Non-typical and novel suggestions are usually left out. Membership of the community of archaeologists is a requirement to understand the condensed and slightly complicated rendering of a report.

In the case of Dublin Core metadata, information professionals can share cultural knowledge and norms, create social relations and evaluate their own and their colleagues' work within their own community by writing metadata. The form of metadata and the media that is being described affect how information is structured. Dublin Core allows also constructing membership in the community of information professionals, or more specifically, in the community of metadata enthusiasts. The relative invisibility of metadata, the small number of immediately evident benefits, the fact that the standards are not well known among ordinary web users, lack of integration in many popular software packages and other reasons explain why only a few people think that annotating is worth the trouble. In contrast, the tagging of images in Flickr or books in

LibraryThing, contributes immediately to the membership of the individual in a considerably larger and, apparently, more interesting community and helps to find interesting images and books from their own collections and the collections of other users. It is obvious that tags and formal metadata are not directly comparable descriptions of information. Their premises are fundamentally very different. Studies have shown that tagging systems and controlled vocabularies have similarities, but the descriptions are complementary rather than compensatory (Morrison, 2008; Yi & Chan, 2009). Tags and metadata are, however, comparable in that respect that they both are, at least supposedly, making information more findable.

6 Education in information creation

It is clear that teaching and learning information creation is not a purely technical matter, in a similar manner that writing texts is not only a question of being able to hold a pen. The questions and cultural issues are similar to the problems encountered in the acceptance Open Access scholarly publishing (Kling, 2004). Similarly, it is a question of acceptance and assessment of benefits like in the present information literacy education (Oakleaf, 2009a,b). The question is about the form of creating and sharing information and accepting the new forms as a part the everyday life of the information creating community.

An analysis of the instances of voluntary changes in the practices of information creation may be used to highlight aspects that could be used in information creation education. Flickr, Delicious, Wikipedia, and LibraryThing are examples of popular web services based on different models of formal voluntary and participatory information creation.

Flickr (www.flickr.com) is a popular photo-sharing site. People can upload their own photographs into the service, organise them by using sets and collec-

tions, and annotate them using tags and several other descriptors. Photographs are tagged and organised mostly by authors themselves for their private use (Rafferty & Hidderley, 2007). Cox (2008) lists reasons for the success of Flickr. The user experience is focussed on the subscribers' own work and figures on the activity related to them. There are many ways to browse the content, the system is open for anyone to browse and the free accounts make it easy to start using the service. The possibility of using Flickr content easily in other services is yet another factor that contributes to the popularity of the service.

As a whole, there are, however, a number of problems with the indexing approach (Rafferty & Hidderley, 2007). Flickr is not very well organised and not all of the individual photographs are very findable. Indeed, the user experience of Flickr is more oriented towards the ease of publishing one's own photos, random browsing and aesthetic experience rather than efficient searching of specific items posted by others (Cox, 2008). The huge scale of the service compensates, however, for its inaccuracy. If a user is interested in a picture of Eiffel tower, it might be difficult to find a specific photograph. However, the overall number of photographs uploaded to the service ensures that you are very likely to find one or several photos on almost all topics. Flickr demonstrates that the quality and consistency of information creation does not need to be advanced to yield in many ways limited, but still some obvious benefits.

Another example, Delicious (www.delicious.com), is a social bookmarking service for saving and sharing links to web resources. Delicious and its functioning is probably the most straightforward of the discussed services. Even if the service has useful community features and it forms a certain social space (Lee, 2006), its popularity is largely based on the fact that it offers together with similar webbased bookmarking services, the most convenient way to manage collections of visited websites (Wash & Rader, 2007). Delicious and its tagging

facilities are probably as easy or easier to use than most of the bookmarking functionalities built in web browsers, and because it is web based, the same library of links is available from home, work and from the various mobile devices used by an individual user.

In contrast to Flickr or Delicious, Wikipedia (www.wikipedia.org), “the free encyclopaedia”, builds on participants’ efforts to produce a collaborative reference work. Participation in Wikipedia can be motivated by diverse factors. In comparison to Flickr, Wikipedia is empathetically a collective rather than herd-like project. Wikipedia is used because of its effortlessness (Rainie & Tancer, 2007), but contributions are essentially motivated by participatory behaviour rather than ease of use. Community membership and possibility to be one of the contributors is important for many participants instead of the amount of immediate personal benefits. Many contributors have found Wikipedia useful and want to make it even more useful (Bryant et al., 2005; Schroer & Hertel, 2007; Rafaeli & Ariel, 2005; Johnson, 2007). A technical incentive to participate in Wikipedia is the low initial threshold to start and the variety of possible ways to get involved in the project (Bryant et al., 2005). Contributors can focus on details, write fully fledged articles, focus on administration or on specific topics or issues.

LibraryThing (www.librarything.com) describes itself as a service that catalogues “your” books online easily, quickly and free. Further, LibraryThing claims to be a community of book lovers. Part of its success can be attributed to that it copies something which has existed before. Collectors have for a long time compiled lists of their books and other collectors items and LibraryThing makes the explicit point that it is a community of book lovers on its front page. Like Flickr, it is easy to use for the purpose it has been designed for. In the service, it is also possible to reuse available cataloguing data from other users, librar-

ies and web-based bookshops such as Amazon. Both librarians (Hvass, 2008) and considering the number of users, non-librarians, have found it quick and efficient.

Irrespective of benefits or the motivations to participate, the popularity of Flickr and the organising tools it offers, suggest that if the context of information creation can be felt personally meaningful, possibly appeals to self-conceit, and the procedures of creating information are effortless enough, information will be created. The same observation applies largely to Delicious. In contrast, two of the lessons of Wikipedia are that community and the power of example matters in information creation. Similarly to the case of metadata standards or archaeology, it makes sense to people to be a member of the Wikipedia community. Because of the size and acknowledged significance of the community, it can dictate norms of a preferred behaviour.

The lessons to be learned from LibraryThing is that formal information creation works if it is easy, if the model and form of information creation is clear to every participant and if the model of information creation can rely on existing behavioural patterns of individuals or communities. In LibraryThing, another apparent incentive is the amount of added value in the form of freely available information on books that can be automatically harvested from library catalogues and from various book sites on the net.

The examples like the earlier work of Trace (2007) and Huvila (2006), and the observations made on social web services show that the forms and formality of information creation are largely a question of communities and *socialising* instead of technical details. The same observation has been made also in the sociocultural stance of information literacy research (e.g. Limberg & Sundin, 2006). Community membership can make change as desirable as it makes adhering to traditions. Communities are also needed to yield the economies of scale

that functions in Flickr and to foster the collective behaviour common to book enthusiasts. Besides community creation, Flickr, Delicious and LibraryThing have focussed on the *simplicity* of information creation. Wikipedia is focussed on its complexity, but even it relies on the simplicity of joining up and starting to contribute. The third aspect that is visible in the web services is the evidence and immediacy of *benefits*. As has been noted in user-centred design, in many instances, designers or information creators do not have a very precise idea of users, their needs or the need to address user needs in specific detail, besides their own immediate needs (Fischer, 2001). An explanation and demonstration of the practical implications of annotating new information, writing in a findable way and structuring documents might be a way to achieve some success. Wikipedia relies heavily on policies that explain what is allowable, but also takes considerable interest in suggesting why something is not desirable. The encyclopaedia is full of examples of the benefits of complying with the guidelines. The fourth aspect of effective information creation that is visible in the web services, is the *reuse*, linking and citation of earlier information and metadata. When the effort is focussed on contributing non-existing information only, the effort is more manageable and less prone to errors.

These four observations can be translated to four examples of the possible emphases of education in information creation and organisation. The list is not meant to be exhaustive, but rather to illustrate the practical issues that might be taken into consideration.

1. Make information creators think about the readers (or listeners or spectators). Emphasise information creation for a community of users and as a part of that community.
2. Focus on simple tools in order to achieve as much as is feasible, no more.
3. Emphasise the ways information creators themselves can benefit from

better-created information.

4. Emphasise citing, reusing and linking to existing information as virtuous habits, and the creation of new information as desirable only when a particular kind of information does not seem to exist.

The emphases are very similar to the guidelines for information architecture (Morville, 2005; Morville & Rosenfeld, 2006). The difference between information architecture and common information creation education is that the latter needs to be developed and adjusted for people without a deep interest in design, findability or knowledge organisation.

The major advantage of digital information is that in many contexts users can be invited to contribute live in real information systems without compromising the existing content as wikis and the tagging and commenting functionalities added to content management systems demonstrate. The threshold of contributions can be kept low and there is less need to scare people from creating inaccurate information because of its related direct costs. When it comes to the actual task of information creation, the major factor that impedes a change of focus to more digital approaches, is the strong tradition in the forms of publishing and creating information. A similar tradition is that the organisation or annotation of real documents is not a task of the information creator but that of a librarian or information manager. The anxiety for the future of cataloguing was unravelled with the advent of automation and professional outsourcing (Steinhagen & Moynahan, 1998). Now a similar situation may be sensed when user created metadata and organisation is debated. As Elmborg (2006) suggests, a critical view of the present information professions and their roles is needed. In practice, findability would still be a never-ending task for information professionals even if the information creators participated in the project more extensively than within the confines of certain contexts such as

individual web services. Scholarly publishing and its reliance on the editorship, abstracts and keywords provided by the authors demonstrates that people can be persuaded to create formal descriptions and that there is still plenty to do even if the authors did something by themselves.

7 Conclusions

The starting point to discussing information creation as a part of information literacy was an observation that some of the problems of searching and using information could be solved by changing the ways information is created. Finding relevant information is significantly easier if it has been created to be found. Similarly, using information is easier, if information has been made usable from the beginning. Even small changes that take the specific features of the digital information environment into account, can make a significant difference.

Besides the usability and findability of information, information literacy education should take into account the breadth of qualities and expectations related to information objects. If information creation is socially and culturally a meaningful process, fairly radical changes could be possible in the ways that information is created.

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