Is Quality of Content a Viable Indicator for the Evaluation of Scientific E-Commerce Portals?

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Abstract: Providers of scientific e-commerce portals frequently find standard usability criteria for evaluating e-commerce offerings insufficient, preferring instead to emphasize content quality as the principal determinant of portal usability. This paper proposes the thesis that it is demonstrably impossible to develop an objectively valid and/or universally accepted system of scientific indicators for the evaluation of e-commerce content quality.

1. Usability criteria and scientific e-commerce portals

Usability studies for evaluating e-commerce offerings have achieved a high level both of standardization and of sophistication. There is a substantial consensus among business studies experts as to their validity.

Some examples for such guidelines are:

- the Nielsen Norman Group Report Series: E-commerce User Experience. 207 Guidelines for E-commerce Sites
- the Research-based Web Design and Usability Guidelines maintained by the U.S. National Cancer Institute
- the Bonasource E-Commerce Usability Guide

These guidelines focus mainly on issues of general navigation, browsing and searching, homepage design, product pages, content, visual design, site-internal search engines and checkout / shopping cart.

Providers of scientific e-commerce portals, however, frequently find general usability criteria insufficient - or even misleading - preferring instead to emphasize content quality as the (or at least as a) principal determinant of portal usability (Harms 2002). This is hardly surprising, since research oversight and funding agencies continue to emphasize scientific quality of results in their benchmarking and quality assurance programmes (European Science Foundation 2003 et al.). Which is not to say that there are not also countervailing tendencies to enhance the emphasis placed on service-oriented issues such as turnaround time from submission to publication, availability, readership and the like. (Turk et al. 2002)

Defining scientific e-commerce portals is not easy, since the term covers a fairly wide and also somewhat disparate area.

One general portal type operates in the field of B2B scientific e-business. One such portal is CortecNet a content-rich life sciences marketplace for researchers which also has an internet-based customized procurement solution for enterprise clients (pharmaceuticals, biotech, chemical, industrial companies). CortecNet is built around proprietary content such as "categories" of chemical and biological products with value-added services including access to news, key publications, tools, technical forums, and expert "helplines". Additional services offered include email access, and tools such as mathematical and chemical mass calculators, currency convertors and the ability to personalize documentation and publications (Medline), news (Reuters), etc. The portal offers documentation including value-added life sciences information from Cortec's own proprietary sources.

A second portal type is orientated towards the professional educator. The product or service line typically revolves around ready-to-use courseware or around courseware design and implementation tools. One good example of this portal type is EOA (Earth Ocean Atmosphere) Scientific Systems. The portal offers science education software and resources that are self-described as being pedagogically correct with a mix of instructive and constructive components to speak to the needs of learners and assist teachers. Software titles have been approved by 14 states/provinces as main teaching tools in earth/space sciences. The company integrates a team of professionals to develop old and new media resources:

- Curriculum designers who are teachers and scientists
- Editors
- Graphic artists and animators
- Web designers
- Programmers specializing in Internet, multimedia and utility development
- Marketing experts who specialize in the education market, e-commerce and internet marketing strategies.

Instructive components are tutorials that combine text, pictures, activities, animations and video to instruct students and assist teachers. These components provide information and demonstrations of information and methods in science. Constructive components are more discovery-oriented. EOA's constructive components are interactive exercises of four varieties:

- Virtual experiments that allow learners to perform scientific experiments with the virtual equipment not easily available in schools.
- Demonstrations of experimental results that challenge learners to analyze and synthesize information gained from other sources.
- Mini-games and puzzles that are fun but teach students to think through problems and discover knowledge not previously provided.
- Projects for exploration using computers and also those not using computers.

A third portal type is the Current Research Information System, commonly known as "CRIS". A CRIS is any information tool dedicated to provide access to and disseminate research information. This includes information on people, projects, organizations, results (publications, patents and products), facilities, and equipment. Issues are: databases global, thematical and according to type of information (expertise, projects, institution, facilities and products - including publications); standards and guidelines; best practice; data access and exchange mechanisms; and to address other data standardization issues within the realm of research, training and development in a timely and efficient manner. Several international special interest groups act as focal points to bundle efforts in this area and to speak for the common interests of their members. In Europe, this special interest group is called euroCRIS. The group identifies and resolves issues and recommends management actions that support the accelerated implementation of data standards and best practices. It seeks to coordinate data requirements among global entities. In the realization of its mission euroCRIS capitalizes on international developments in science and science policy, particularly with reference to the European Research Area (ERA) and the evolving needs of user groups.

2. Content quality in the context of science

Quality of content is substantively different in this context from content quality within the meaning of standard usability criteria. Scientific quality of content is determined by the considerations that determine the quality of scientific work in general: cutting-edge research results, long-term validity, uniqueness, universality, historical interest *et al.*

Traditional methods for determining the scientific quality of publications fall roughly into one of two categories: expert opinions (for instance peer review) and scientometry (for instance citation analysis). Whereas scientometric tools provide reasonably objective data, due to their dealing in measureable, quantifiable indicators, expert opinions are, by definition, inherently subjective. This does not disqualify the utility of expert opinions, but it does place a serious constraint on their objectivity value. Scientometric tools, on the other hand, can only be applied in a limited manner to web-based portals. This is due to the constitutional differences between online offerings and the scholarly journals that the scientometric methodology was developed to analyse.

One need also to bear in mind that there are factors which limit the validity - and also the acceptance - of scientometric techniques. Some scientists emphasize the social differentiation based on status and authority in science and scientific communication. They differ fundamentally in the evaluation and attribution of the causes of these social disparities. While authors who are associated with the library sciences and scientific scientometry (especially of a natural science provenance) often view these status differences unproblematized as an expression of the differences in the quality of scientific works - and not seldom equate resonance (frequency of citation) and quality of a work, authors working on issues of tension between epistemology and social sciences see social disparities or power structures in the sciences: recognition of authors is not necessarily an expression of the scientific quality of their publications. (Fröhlich 1994)

3. Natural limits on content quality indicators in science

I propose the thesis that it is inherently impossible to develop an objectively valid and/or universally accepted system of scientific indicators for the evaluation of e-commerce content quality. Oddly enough there are some interesting similarities between content quality criteria in the general sense and those which may be applicable to specifically scientific content. These very similarities, however, serve to highlight the differences.

The philosophical foundation for an objective, or at least universally accepted, quality standard in science is quite narrow. Thomas Kuhn's seminal work "The Structure of Scientific Revolutions" (Kuhn 1962) makes it clear that scientific work is not always informed by purely objective considerations. Kuhn also maintained that, contrary to popular conception, typical scientists are not objective and independent thinkers. Rather, they are conservative individuals who accept what they have been taught and apply their knowledge to solving the problems that their theories dictate. Most are, in essence, puzzle-solvers who aim to discover what they already know in advance - "The man who is striving to solve a problem defined by existing knowledge and technique is not just looking around. He knows what he wants to achieve, and he designs his instruments and directs his thoughts accordingly."

According to Kuhn (Kuhn 1962), the primary task of scientists during periods of normal science is to bring the accepted theory and fact into closer agreement. As a consequence, scientists tend to ignore research findings that might threaten the existing paradigm and trigger the development of a new and competing paradigm. For example, Ptolemy popularized the notion that the sun revolves around the earth, and this view was defended for centuries even in the face of conflicting evidence. In the pursuit of science, Kuhn observed, "novelty emerges only with difficulty, manifested by resistance, against a background provided by expectation."

4. Implications for the evaluation of scientific e-commerce portals

How much overlap is there between e-learning, learning objects, educational media etc. and e-commerce content quality? In order to make this determination, let us now look at two recent portal projects and see how their goals and methods impact on the issue of content quality.

The Collaborative Online Learning and Information Services (COLIS) project was funded by DETYA (the Australian Department of Education, Training and Youth Affairs) to achieve the following objectives:

- Establish a test bed for the development of collaborative online learning and information services
- Develop a scalable standards based model for institutional interoperability which enables the seamless sharing of online learning and scholarly information resources
- Contribute more fully to the work of the Instructional Management System (IMS) Global Learning Consortium
- Link with international software companies , corporate management systems providers, learning management systems, content producers, and national government agencies

COLIS' goals are:

- To share knowledge and expertise in developing the functional and technical architectures necessary for institutional systems interoperability.
- To engage in national and international research programs aimed at developing systems interoperability.
- To share systems development where appropriate.
- To share the purchase of commercial systems components, where appropriate.
- To develop strategic alliances with other universities and with industry partners to further the interests of the COLIS agenda.

The Multimedia Resources for Learning and Online Teaching (MERLOT) project provides a perspective on technical and sociological issues involved with the dynamic growth and use of learning object repositories used for teaching and learning. MERLOT is designed primarily by and for the faculty and students of higher education. Its system infrastructure provides links to online learning materials and environments for adding annotations to those materials such as peer reviews and assignments. MERLOT is an open community, and community members help MERLOT grow by contributing or evolving materials and adding assignments and comments.

These materials may be added by the people who created them or by any member of MERLOT. MERLOT begins to address part of the problem of collecting resources created by individual teachers or authors from local storage and rating their quality to make them both available to and usable by other teachers and to learners. How will the assets created by this process be made persistent, maintained over time, and distributed reliably? It should be noted that the issue of asset peristence over time is an important one when it comes to scientific content. Other saleable items can (and must) come and go as the short-term demand for them waxes and wanes; but this is not the case with scientific truth.

Let us look more closely at the MERLOT peer review system:

Peer reviews of material are contributed by qualified faculty members in the relevant discipline(s). Peer review editorial boards in 14 fields ranging from biology and business to mathematics, teacher education and world languages are responsible for developing evaluation standards and conducting peer reviews of materials for that discipline. Editorial board members also monitor and contribute to the MERLOT collection in their respective disciplines.

Peer reviewers are selected from among MERLOT's institutional partners. Peer reviews (which are different from member reviews) are crucial elements in the MERLOT project and are, therefore, conducted with similar rigor across the various disciplines that the MERLOT project encompasses.

The subject of history - taken as an example - was added to the MERLOT list of disciplines in 2000. The history team developed a system to classify the learning objects (web sites) in the history collection. The team developed criteria for determining which sites should be peer reviewed, which sites should not be reviewed because they lacked learning objects (but were maintained, nevertheless, because they are archival collections), and which sites should be removed from the site altogether. The team also developed a detailed peer review process that is based on assessment of content quality, potential effectiveness for teaching and learning, and ease of use.

Assessment for content quality focuses on whether or not the learning materials present valid concepts, models, and skills and if the learning materials present educationally significant concepts, models, and skills for the discipline. Potential effectiveness for teaching and learning is determined by the peer reviewers on the basis of their experiences as teachers and whether or not the materials are likely to improve teaching and learning that benefit both teacher and student. Ease of use is evaluated on the basis of how easy (or not) it is to use the site. (Paquette 2003)

Plainly, the peer review model just described is extremely labour intensive. During the time the portal project continues to receive public funding there should be no difficulty in practicing this type of peer review. Will this also be true when the public funding runs out?

Or will the portal providers find that the peer review process is not really cost effective? In other words, will real-world paying customers be willing to foot the bill for this kind of quality control when it is no longer subsidized with tax monies? The odds are steep against this happening.

Another approach is to circumscribe the question in order to delimit its total range. Pedagogical theorist C. McNaught applies polarity theory as a way of analysing this issue. This theory proposes that situations can be described in terms of dilemmas or problems to which there can be no solution, only a constant state of tension. She also advocates that these poles should be considered together, holistically. From this perspective, McNaught asserts that there are several dilemmas that should be considered, and discusses each in turn (Oliver 2003):

- Scholarship *versus* cost effectiveness;
- Integrated support *versus* piecemeal support;
- Maintaining a comfort zone *versus* pushing the boundaries;
- Rewarding teaching innovation *versus* efforts on research outputs;
- Collaboration *versus* individualism;
- Rewarding first attempts *versus* standards of best practice; and
- Iterative educational design *versus* traditional models.

While it is clearly useful to make a determination of what the decisive factors for findings about scientific content quality are, this still leaves unanswered the question, in any given case, whether or not a specific content possesses the high-quality attribute.

A recent opinion survey (SRI Consulting Business Intelligence 2003) conducted among e-Learning practitioners revealed some interesting points with regard to educational quality indicators. Respondents were allowed to select more than one option; and four-fifths (81%) saw “learning effectiveness” as an appropriate indicator of quality. “Learner experience” (62%) and “cost efficiency” (60%) are quite close as quality indicators. Among responses for “other,” accessibility of e-learning appeared most frequently.

Respondents were then asked to rate the quality of various e-learning components used in their programs. Content emerged with the highest quality marks - 86 percent rated their content as medium- or high-quality. This finding may come as a surprise, given the very vocal over content quality found in many online forums and industry conferences. The question doesn’t distinguish between internally developed and off-the-shelf content, which is one possible explanation for the discrepancy. LMS (i.e. Learning Management) systems received the next highest quality rating, though only 22 percent rated their LMS as “high quality” and a nearly equal percentage (23%) gave them a “poor quality” rating.

E-learning content—variously described as courses, modules, or learning objects—has been the subject of much discussion in the debate over quality. Respondents were asked to rate the quality of various types of e-learning content. Not surprisingly, internally developed content received the highest marks, with 71 percent of respondents rating such content medium- or high-quality. However, a far more unexpected finding is the higher quality ratings that off-the-shelf content garnered over custom-developed content (defined in the survey as content developed by outside consultants). While 59 percent viewed their off-the-shelf content and medium-quality or higher, less than half (48%) had similar regard for their custom-developed content."

"Measures of learning - and of quality - are elusive and often controversial in higher education" (Oblinger et al. 2001) Developers of faculty and student programs recognize that learning is social, private and experiential, and that higher order learning requires reflection and knowledge construction, which are key elements for quality assurance in online learning. The success of an online course is affected by its pedagogical richness, which is the degree to which a course addresses learning styles, use of media, and interactivity with content, testing and feedback, and collaboration. Other success factors include content quality, delivery support functions for instructors, administrators, and students, including those with vision and hearing impairments; pedagogically driven instructional design with well-defined objectives, web site usability factors, and technological factors. Good content forms a basis for a successful course and is a matter of authorship.

To sum up: the community of opinion amongst educators and courseware developers as to what factors can serve as indicators of content quality has identified a number of pertinent issues. Though some may stress certain indicators more than others, there appears to be little controversy of the kind that denigrates the views of other participants in this discourse. The next logical step should be to develop the means to test and measure these indicators with regard to any given scientific or educational content. There is no evidence, however, that such instruments have deen developed or are being developed - beyond the usual opinion poll (of which peer review is actually a logical sub-set.)

5. Non-scientific content quality

One point that quickly shows up in most discussions about Web content quality, is that guidelines tend to assume that the quality issue has already been successfully addressed. For instance one frequently encounters advice such as to provide useful and usable content or to place important information at the top of the page or at the top of the Website's hierarchical structure. Certainly the content provider has his or her own views about the importance, relevancy and pertinence of the information offered, but whether others share these views is very much an open question. Even assuming that the content provider is "right" in her assessment - in the sense that there is a broad consensus on the part of stakeholders that it is correct - there is still the question of independent validation or certification of the fact.

There are numerous position statements on the content quality issue which come from marketing specialists. Selected here for special consideration due to the high-visibility and media presence of its principal protagonist (B. Schmonsees) is a methodology alternatively called Message Management or sometimes Total Quality Content (TQC).

This methodology lays claim to providing a more systematic way to define and measure quality and effectiveness. Its focus is on how well the content influences the opinion and behavior of the reader through:

> The value of the message: How unique are the thoughts and ideas that make up the subject matter? How relevant is that information to the reader?
>
> The quality of the writing: Is it clear and concise? Does it simplify things for the reader and promote comprehension and retention? Does it have a structure that simplifies updating and continuous improvement?

The impact of the delivery experience: Is the information easy to find? Does the interaction engage the reader? Do they feel like they are being dealt with in a more personalized and human like fashion? Can the content be easily customized and repurposed by the user?

Schmonsees also advocates a planning, process, and technology strategy that helps customers maximize quality and effectiveness. This is what a business practice he calls Message Management claims to accomplish. Message Management's root premise is that marketing and sales content are too important to be managed in a haphazard manner. It is a so-called proactive business strategy supported by an allegedly more rigorous planning, process, and technology.

Message Management is based upon six "strategic" principles (Schmonsees 2002):

- Embrace customer centric messaging
- Adopt a 360-degree view
- Less is more
- Transfer knowledge… don't just disseminate information.
- Increase channel value
- Continuously improve the content

This is quite interesting, because "content" as described above, could essentially be anything at all. Content is not so much content as it is an empty container, a black box, waiting to be filled by whatever is on offer.

We are seeing here a very strong emphasis being put on customer reception and response. This is unsurprising since e-commerce is, after all, mainly about selling things to people. Scientific research may well generate saleable products and services, though usually as a collateral benefit or spin-off of the primary research results, but it is generally accepted that commercial success is not the chief goal of science. Rather it is part of society's intellectual infrastructure, and it is mostly paid for not on a *pro rata*, fee-for-service basis, but by the expenditure of tax monies. Society as a whole sees science as a worthwhile pursuit, despite the fact that there is little paying demand for it on the part of individuals, and society is willing to foot the bill for this. (Interestingly, much the same general principle also applies to the building of prisons.)

Nonetheless, it is worth noting that there are some striking similarities between the respective marketing-orientated and scientific/educational approaches to assessing content quality. Common to both is the exhortation to improve content quality - while remaining somewhat vague about how this may specifically be achieved. Peer review and stakeholder opinion surveys are not inherently dissimilar to studying specific customer reception and response: they are just more vicarious, since some few act *pars pro toto* as spokespersons for all customers, rather than sampling the customers directly.

But why is there no - or only very little - paying demand for science? Much of what science does has little practical utility - at least in the short term. The long-term value of science is generally seen to be considerable, but this value judgement can only be applied to science in the aggregate. The discrete future value of any given bit of knowledge is not predictable. Not coincidentally, something very similar applies to archives as well: Of all the documents permanently archived, a substantial proportion will never be called for. Since it is not possible to determine which will and which won't actually be used, the archives have no choice but to archive anything that meets an aprioristic archival relevancy standard.

The net result of this is that society in general is willing to finance science in general, but that there are paying customers only for those facets of scientific endeavour that actually produce some form of short-term return on investment.

6. Is the lack of universally valid content quality criteria for scientific e-commerce portals necessarily a bad thing?

Yes and no. Let's begin with the "no"

There is some reason to believe that most of the chief barriers to the use of scientific e-commerce portals (leaving aside for the moment the lack of paying demand) are already successfully addressed by the standardized usability criteria applicable to all e-commerce portals. Thus, if these were to be applied to scientific portals, a high level of usability, and therefore of quality, would be achieved. The remaining "quality gap" would be no larger than that of any other e-commerce portal.

And there are two "yeses".

It is known that there is little paying demand for scientific or educational content. (The for-free demand, however, is considerable.) Perhaps this would change if there were less haziness on the issue of scientific content quality, since quality is, after all, a major factor in determining the utility of scientific information.

Also, the scientific community - like all other denizens of cyberspace - suffers from a glut of information, the phenomenon known as information overload, or sometime simply as "data smog". Information overload makes it extremely difficult to find pertinent information resources, although they are actually available and findable, because they tend to get lost in the static of a critically degraded signal-to-noise ratio. Despite the impressive advances made in the last few years in retrieval enhancement technology (such as intelligent agents, ranking algorithms, cluster analysis, web- or data mining, personalization algorithms and collaborative filtering), retrieval precision has suffered greatly due to the sheer amount of data recall returned by any given search argument. (Carlson 2003)

7. Conclusion

It seems evident that it would serve the cause of product differentiation (i.e. branding) to be able to offer certifiable or validated content quality as an attribute of scientific e-commerce portals. Absent a generally accepted standard to make such a determination possible, only those tools already known to and practiced by the scientific community can be deployed. These, however, are difficult to apply to such portals - and they are not really cost-effective. Therefore it is not possible to judge scientific e-commerce portals reliably by any other standards than are used to determine the usability of any other kind of e-commerce portal. Any such claim should thus be seen as part of a portal's marketing strategy rather than as an actual issue of scientific quality.

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