Quality indicators for blogs and podcasts used in medical education: modified Delphi consensus recommendations by an international cohort of health professions educators

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ABSTRACT

Background Quality assurance concerns about social media platforms used for education have arisen within the medical education community. As more trainees and clinicians use resources such as blogs and podcasts for learning, we aimed to identify quality indicators for these resources. A previous study identified 151 potentially relevant quality indicators for these social media resources.

Objective To identify quality markers for blogs and podcasts using an international cohort of health professions educators.

Methods A self-selected group of 44 health professions educators at the 2014 International Conference on Residency Education participated in a Social Media Summit during which a modified Delphi consensus study was conducted to determine which of the 151 quality indicators met the a priori ≥90% inclusion threshold.

Results Thirteen quality indicators classified into the domains of credibility (n=8), content (n=4) and design (n=1) met the inclusion threshold.

Conclusions The quality indicators that were identified may serve as a foundation for further research on quality indicators of social media-based medical education resources and prompt discussion of their legitimacy as a form of educational scholarship.

INTRODUCTION

The last decade has seen an explosion of social media-based medical education resources including blogs, microblogs (eg, Twitter), networking websites (eg, Facebook) and podcasts.[1 2] They are increasingly being used for medical education[3–5] and integrated into formal curricula.[6–10] Despite this growth, the quality of social media-based resources has not been defined or standardised.[11–15] While the research on the quality of eLearning resources is informative,[16] social media resources differ in that they are openly available (ie, not behind a pay wall or login), unstructured (generally not part of a course or curriculum) and unregulated (most are not formally affiliated with institutions or formally appointed instructors). Early attempts at ensuring the quality of social media resources have included introducing prepublication expert peer review of individual blog posts,[17] curation of online content by expert panels[6] and identifying quality resources by quantifying impact.[18 19] However, these methods lack validation and are subject to some of the drawbacks of traditional peer review such as reviewer bias.[20–22]

While the ultimate goal of social media-based medical education resources is to benefit patient care through enhanced knowledge translation, four stakeholder groups would benefit from a standardised assessment of quality.[23–25] First, learners may not have the expertise to discern true from erroneous and important from less important content; quality standards would help learners to identify the highest quality resources. Second, educators who are unfamiliar with blogs and podcasts could benefit from quality standards that assess resources, allowing educators to appropriately recommend resources to their learners. Third, content producers could improve the design and delivery of their content by adhering to metrics of quality. Finally, academic leaders, particularly those participating in promotions committees attempting to quantify the impact of social media-based medical education resources, could use these quality standards to better adjudicate a faculty member's education scholarship.[19 23–26]

The purpose of this study was to identify the most important quality indicators for blogs and podcasts from the perspectives of health professions educators using a modified Delphi consensus process.

METHODS

Participants

A self-selected group of health professions educators attending the 2014 International Conference on Residency Education (ICRE) participated in a pre-conference Social Media Summit. A modified Delphi consensus study was conducted to assess quality markers for social media educational resources. Participants were randomly assigned to two groups (Group A or Group B).

Quality indicators

A previous study identified 151 potential quality indicators for blogs and podcasts through a multiphase methodology that included: a literature search for publications describing quality indicators for secondary resources; the extraction and qualitative analysis of those quality indicators; and four focus groups held to ensure that no important quality indicators were missed.[27] The qualitative analysis divided the quality indicators into three major domains—credibility (n=53), content (n=44) and design (n=54)—each of which had

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multiple subthemes. These quality indicators were subsequently pilot tested internally by the research team for clarity and content validity. This modified Delphi process was similar to a previous one conducted with expert bloggers and podcasters in the area of emergency medicine and critical care which elicited the priorities of producers of these resources.[28] The current study was conducted to determine whether medical educators would prioritise similar quality indicators as content producers.

Delphi survey

Using a modified Delphi methodology,[29–33] two real-time sequential web-based surveys were completed during a 2 h session as outlined in figure 1. The surveys were hosted on SurveyMonkey.com.

Survey 1 assessed each of the previously identified 151 quality indicators during the first half of the session. For each indicator, individual participants anonymously rated its importance as a measure of quality for blogs and then for podcasts. A 7-point Likert scale was used with 1 labelled 'strongly disagree' and 7 labelled 'strongly agree'. Basic participant demographic data were also captured. To prevent rater fatigue, participants in Group A answered questions 1–73 and those in Group B answered questions 74–151.

The results of Survey 1 were immediately compiled and used to develop Survey 2, which was completed immediately after Survey 1 during the second half of the session. Survey 2 was composed of all quality indicators from Survey 1 that had a mean score of ≥5 (out of 7), with the mean scores listed next to each survey item. Instead of a Likert scale in Survey 2, participants were asked whether they endorsed the inclusion of each of the items in the final list of quality indicators by selecting 'include' or 'do not include'.

Data analysis

Descriptive statistics of the participant demographics and survey data were calculated. While consensus can be achieved through a variety of techniques,[34] it was determined a priori that ≥90% consensus from Survey 2 would provide a concise but meaningful list of quality indicators, based on the previously conducted modified Delphi consensus study of bloggers and podcasters.[28]

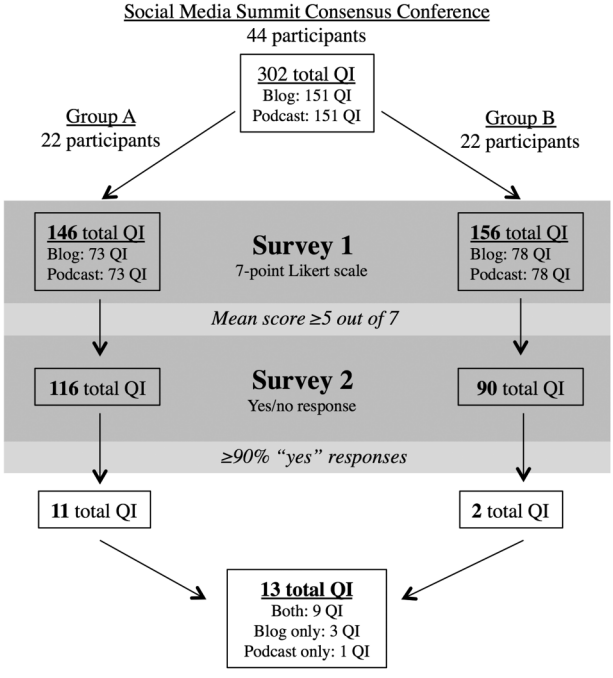

Figure 1 Flowchart demonstrating the modified Delphi consensus process to identify quality indicators (QI) for blogs and podcasts.

RESULTS

Participants

A total of 44 participants completed both surveys. Table 1 lists the demographic information of the participants. There was a

Table 1 Participant demographic information for health professions educators in Groups A and B (n=22 for each)

	Group A, n (%)	Group B, n (%)	Total, n (%)
Number of years post-residency training			
0–4	5 (23)	4 (18)	9 (20)
5–10	3 (14)	8 (36)	11 (25)
>10	9 (41)	2 (9)	11 (25)
Other*	5 (23)	8 (36)	13 (30)
Specialty			
Emergency medicine	7 (32)	12 (55)	19 (43)
Family medicine	0 (0)	1 (5)	1 (2)
Infectious disease	2 (9)	0 (0)	2 (5)
Informatics	1 (5)	0 (0)	1 (2)
Internal medicine	0 (0)	0 (0)	0 (0)
Medical education	1 (5)	0 (0)	1 (2)
Ophthalmology	1 (5)	0 (0)	1 (2)
Paediatrics	1 (5)	0 (0)	1 (2)
Physical medicine and rehabilitation	1 (5)	0 (0)	1 (2)
Psychiatry	1 (5)	0 (0)	1 (2)
Psychology	0 (0)	1 (5)	1 (2)
Public health	0 (0)	1 (5)	1 (2)
Radiology	2 (9)	0 (0)	2 (5)
Research	0 (0)	1 (5)	1 (2)
Surgery	1 (5)	0 (0)	1 (2)
N/A	1 (5)	5 (23)	6 (14)
No response	3 (14)	1 (5)	4 (9)
Advanced degrees†			
MD	13 (59)	15 (68)	28 (64)
Masters	12 (55)	13 (59)	25 (57)
MBA	0 (0)	1 (5)	1 (2)
PhD	2 (9)	4 (18)	6 (14)
Country			
Australia	0 (0)	2 (9)	2 (5)
Canada	17 (77)	17 (77)	34 (77)
Thailand	1 (5)	0 (0)	1 (2)
UK	2 (9)	0 (0)	2 (5)
USA	0 (0)	3 (14)	3 (7)
No response	2 (9)	0 (0)	2 (5)
Experience with medical education blog			
Have read one	20 (91)	22 (100)	42 (95)
Have contributed one	11 (50)	9 (41)	20 (45)
Own or have owned one	6 (27)	5 (23)	11 (25)
Experience with medical education podcast			
Have listened to one	19 (86)	18 (82)	37 (84)
Have contributed to one	9 (41)	9 (41)	18 (41)
Own or have owned one	4 (18)	2 (9)	6 (14)

*Non-clinician professions listed under 'Other': education technologist, PhD educator, occupational therapist, medicinal education training manager, medical education curricular support.
†Participants may have multiple degrees and thus totals exceed 100%. If an individual had multiple Masters degrees, only one was counted in this table.

preponderance of educators from Canada (77%) specialising in the field of emergency medicine (43%) and holding a Doctor of Medicine (64%) and/or a Masters degree (57%).

Top quality indicators

Of the 151 initially abstracted quality indicators, there was ≥90% agreement on the importance of 13 items (table 2). Figure 1 outlines how these 13 items were derived through the modified Delphi methodology. Nine quality indicators were applicable for both blogs and podcasts with an additional three indicators specific to blogs and one specific to podcasts. The only indicator that resulted in 100% consensus for both blogs and podcasts was transparency by the authorities who created the resource (eg, author, editor, publisher) regarding conflicts of interest. In total, there were eight quality indicators in the domain of credibility (transparency and trustworthiness of authorities), four in content (subject matter) and one in design (presentation, aesthetics and functionality).

The online supplementary appendix lists all of the 151 surveyed quality indicators and the consensus results from Surveys 1 and 2 for both blogs and podcasts.

Credibility

The majority of identified quality indicators were from the credibility domain (9 of 13 indicators). The only item to garner 100% agreement involved the transparency of the authorities (author, editor, publisher) in disclosing conflicts of interest. Other identified items included transparency around the material's creation and its intent (eg, advertisement vs content, or fact vs opinion). Furthermore, the importance of transparency and clear attribution of materials was endorsed. The author's, editor's and publisher's positive reputation was deemed far less important as a marker for quality. These results suggest that, for credibility on blogs and podcasts, it is most important to be transparent by having identifiable authors, disclosing conflicts of interest and using referenced citations.

Content

Educators consistently valued high-quality, professionally represented and accurate content that was relevant for its intended audience (4 of 13 indicators). In contrast, a conversational tone and entertaining approach both scored poorly. Despite the nature of social media platforms, which are designed for open conversations, participants did not value interaction between the authority (eg, author or publisher) and the readers/listeners. Notably, peer review was not determined to be a priority.

Design

Only one of the design quality indicators achieved ≥90% consensus among educators, suggesting that high-quality content is valuable largely independent of the aesthetics and presentation design framework. The only indicator that achieved consensus reinforced the importance of podcast resources using technology that is functional for all learners. Issues of mobile-responsive design, intuitive user interface, customisability and high-quality images and audio were not as valuable to educators.[28]

DISCUSSION

A diverse self-selected group of health professions educators from the 2014 ICRE Social Media Summit identified 13 quality indicators within the domains of credibility, content and design with ≥90% consensus for educational blogs and podcasts using a modified Delphi methodology. These quality indicators provide a foundation for future scholarship to identify quality and critically appraise social media educational resources.

This study builds upon the previous work in this field[27] to identify the quality indicators that were felt to be the most important to a group of expert health professions educators. A modified Delphi consensus process conducted with expert emergency medicine bloggers and podcasters endorsed substantially more quality indicators at the >90% level (14 for bloggers and 26 for podcasters).[28] This difference may reflect the content producers' greater fluency about the operational nuances and pitfalls in publishing educational material using social media.

In our study, health professions educators identified four items that were deemed as quality indicators specific for blogs (n=3) or podcasts (n=1), but not both. Interestingly, the educators found it important for bloggers to be content experts on topics they wrote about, but this was not a requirement for podcasters. This may reflect how these two social media modalities are commonly used, with blogs often serving as reference tools and podcasts used to provoke discussion and transmit tacit knowledge. Furthermore, citations, references and coherence of content were important for blogs but were not criteria for

Table 2 Quality indicators for blogs and podcasts with ≥90% consensus among medical education experts within the three domains of credibility, content and design

Quality indicator	Domain/subtheme	Blogs (% consensus)	Podcasts (% consensus)
Do the authorities (eg, author, editor, publisher) that created the resource list their conflicts of interest?	Credibility/bias	100	100
Is the identity of the resource's author clear?	Credibility/transparency	95	95
Does the resource make a clear distinction between fact and opinion?	Credibility/bias	95	95
Is the information presented in the resource accurate?	Content/academic rigour	94	100
Does the resource employ technologies that are universally available to allow learners with standard equipment and software access?	Design/functionality		94
Does the resource cite its references?	Credibility/use of other resources	93	
Are the resource's statements consistent with its references?	Credibility/use of other resources	93	
Does the resource clearly differentiate between advertisement and content?	Credibility/bias	91	90
Is the resource transparent about who was involved in its creation?	Credibility/transparency	91	90
Is the content of this educational resource of good quality?	Content	91	90
Is the content of the resource professional?	Content/professionalism	91	90
Is the resource useful and relevant for its intended audience?	Content/orientation	91	90
Is the author well qualified to provide information on the topic?	Credibility/transparency	91	

podcasts. This may represent a difference in expectations around the media as it may be unwieldy to accurately list or mention full citations in audio format (even though most podcasts have a companion website or blog where references can be more easily listed). Specifically for podcasts, educators valued compatibility across all platforms. Because learners often listen to podcasts on their mobile devices, which may run on different operating systems (eg, iOS, Android), compatibility across these different devices is perceived as important to educators. In contrast, compatibility is less critical for blogs, presumably because blogs typically exist on universally accessible and often mobile responsive website platforms.

Traditional prepublication peer review has been the gold standard for quality in scholarship and print journal publications. The absence of peer review is often cited as one of the major weaknesses for digital self-publishing platforms such as blogs and podcasts.[13–15] However, the peer review process has been faulted as an imperfect and unproven approach to quality assurance, with major limitations including reviewer bias, inconsistent quality in reviews and the inability of peer review to accurately identify academic fraud.[20–22 35 36] We speculate that these drawbacks, in addition to the time and resources required to implement peer review, may account for the failure of our consensus findings to endorse peer review for blogs and podcasts as a quality marker. Only 69% (blogs) and 53% (podcasts) of the participants endorsed an editorial or peer review process, which was similarly found in a survey of Canadian emergency medicine residents and programme directors.[36] Also, only 47% (blogs) and 40% (podcasts) of participants endorsed the inclusion of peer-reviewed citations as references.

These consensus recommendations have several limitations. First, a number of participants have contributed to or owned blogs (11/44) or podcasts (6/44) and all self-selected to attend the Social Media Summit. While this may impart a level of fluency and expertise in our panellists, it introduces bias and may limit the generalisability of our findings to the broader population of health professions educators. Second, the participants consisted of a majority of Canadians and a significant number of emergency physicians. This uneven distribution of countries and specialties probably reflects the location of the meeting (Toronto, Canada) and the popularity of social media-based education in the field of emergency medicine.[1 3 4 37] The high consensus rate threshold of ≥90% agreement may attenuate these biases, as substantial agreement across study participants was needed to endorse a quality marker.

Main messages

- Thirteen common quality indicators consistently received high consensus agreement (≥90%) among health professions educators.
- Health professions educators value credibility as the most important domain in assessing quality for blogs and podcasts in the form of transparency and trustworthiness.
- Similar to health professions education resources of all forms, education experts value accurate, professional and audience-specific content for blogs and podcasts.
- The incorporation of a traditional peer review process did not reach consensus as a quality indicator for health professions educators.

Current research questions

- Quality indicators for blogs and podcasts have been identified by this international group of health professions educators. What do other stakeholders (eg, learners, content producers, academic leaders) value as high quality and how should differences be resolved?
- Can stakeholders convert the identified quality indicators into a format that consistently facilitates accurate and timely assessment of quality?
- Can these quality indicators be used to help academic leaders assess the value of digital scholarship?

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The next steps should include assessing the views of the other stakeholders, such as different learner groups, a broad range of content producers and a diverse network of academic leaders. Ultimately, the data resulting from these consultations should contribute to the development of practical tools to help stakeholders assess the quality of such resources.

In conclusion, by identifying the quality indicators most important to health professions educators, this modified Delphi study provides 13 quality indicators that may help develop standards, guide development and improve identification of high-quality medical education blogs and podcasts.

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Contributors All authors contributed by interpreting the collected data, drafting and revising the manuscript for important intellectual content, approving the final published version and agree to be accountable for all aspects of the work. Additionally, ML, BT and TC provided a significant contribution in the conception and design of the work. ML, TC and NST contributed by acquiring the data.

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Appendix

List of all 151 quality indicators regarding both blogs and podcasts on a 7-point scale for Group A (questions 1-73, n=22) and Group B (questions 74-151, n=22). Survey 1 mean scores are reported for blogs and podcasts. For Survey 2, only mean quality indicator scores ≥ 5 met the a priori threshold for voting. Scoring scale: 1=not important, 4=neutral, 7=very important

		BLOGS		PODCASTS	
Item	**Quality Indicator**	**Survey 1: Mean Score**	**Survey 2: % Consensus to Include**	**Survey 1: Mean Score**	**Survey 2: % Consensus to Include**
DOMAIN: CREDIBILITY					
1	Is the resource credible?	6.33	86%	6.24	86%
2	Is the resource transparent about who was involved in its creation?	6.29	91%	6.24	90%
3	Is it clear who created the resource?	6.43	82%	6.48	80%
4	Is the identity of the resource's author clear?	6.50	95%	6.48	95%
5	Is the author well respected?	5.33	18%	5.10	20%
6	Is the author well qualified to provide information on the topic?	6.24	91%	6.10	86%
7	Are the author's affiliations stated?	5.81	59%	5.62	50%
8	Is it clear who published the resource?	6.00	62%	5.81	57%
9	Is the publisher well respected?	4.90		4.81	
10	Is the identity of the resource's editor clear?	4.86		4.76	
11	Is the editor well respected?	4.76		4.67	
12	Is the editor well qualified to edit information on the topic?	5.30	36%	5.29	33%
13	Are the editor's affiliations stated?	4.90		4.81	
14	Is the contact information of the resource's authority (e.g. author, editor, publisher) listed?	5.29	64%	5.29	71%
15	Is the phone number of the resource's authority (e.g. author, editor, publisher) listed?	3.00		2.95	
16	Is the address of the resource's authority (e.g. author, editor, publisher) listed?	3.71		3.67	
17	Is the email address of the resource's authority (e.g. author, editor, publisher) listed?	5.43	55%	5.38	57%
18	Are all entities that contributed to the creation of the resource listed?	5.48	50%	5.29	43%
19	Can other learners/contributors/participants be identified?	4.76		4.67	
20	Are the processes (e.g. editorial, peer review, evaluation, etc.) that were used to create the resource outlined?	5.65	69%	5.55	53%
21	Is there an editorial process?	5.35	47%	5.30	40%
22	Is the editorial process independent from sponsors, conflict of interest, and other sources of bias?	5.85	56%	5.80	53%
23	Is there a peer review process?	5.40	33%	5.10	38%
24	Is there an internal (reviewed by someone affiliated with the resource) peer review process?	5.05	27%	4.85	
25	Is there an external (reviewed by someone not affiliated with the resource) peer review process?	5.15	33%	4.90	

26	Are there comments from other learners/contributors that endorse or refute the information presented in the resource?	5.50	67%	5.15	67%
27	Does the resource undergo a formal or informal evaluation process?	5.20	47%	4.95	
28	Are web metrics listed for the resource that illustrate if others have used the resource?	5.10	60%	4.75	
29	Is there a way to provide feedback on the resource?	6.05	87%	5.85	79%
30	Is there a formal process (e.g. standardized steps for all resources that are completed prior to publication) for generating the resource's content?	4.80		4.55	
31	Is there a process outlined to update the resource? How frequently?	5.30	40%	4.90	
32	Are updates/revisions denoted within the resource?	5.95	53%	5.60	60%
33	Does the resource cite its references?	6.35	93%	6.40	87%
34	Are the resource's statements consistent with its references?	6.15	93%	6.10	80%
35	Are the resource's references peer-reviewed?	5.75	47%	5.65	40%
36	Does the resource refer learners to additional resources?	5.45	33%	5.35	33%
37	Are recommended resources of good quality?	5.85	33%	5.90	40%
38	Are recommended resources related to the topic?	6.00	73%	5.95	67%
39	Does the resource respect copyright and licensing laws?	6.15	73%	6.15	80%
40	Does the resource respect and protect the privacy of its learners?	5.70	56%	5.75	50%
41	Is the resource reputable?	6.05	44%	6.05	38%
42	Has the resource been endorsed by reputable individuals and/or organizations?	5.25	22%	5.25	25%
43	Has the resource been awarded any quality credentials/badges from independent organizations (e.g. HONcode)?	5.00	33%	5.00	38%
44	Is the resource accountable?	5.90	56%	5.85	50%
45	Are appropriate disclaimers regarding the use of the resource stated?	5.60	78%	5.60	75%
46	Are the resource's biases stated clearly?	5.95	67%	5.95	63%
47	Do the authorities (e.g. author, editor, publisher) that created the resource list their conflicts of interest?	6.25	100%	6.10	100%
48	Are the authorities (e.g. author, editor, publisher) that created the resource free of financial conflicts of interest?	5.80	75%	5.75	86%
49	Are the authorities (e.g. author, editor, publisher) that created the resource free of non-financial conflicts of interest?	5.65	63%	5.70	71%
50	Does the resource have an appropriate advertising policy?	5.05	25%	5.00	14%
51	Does the resource clearly differentiate between advertisement and content?	6.30	91%	6.30	90%
52	Is the resource free of advertising?	4.35		4.35	

53	Does the resource make a clear distinction between fact and opinion?	6.55	95%	6.55	95%
DOMAIN: CONTENT					
54	Is the content of this educational resource of good quality?	6.65	91%	6.70	90%
55	Is the content of the resource professional?	6.35	91%	6.35	90%
56	Does the resource avoid stereotypes? Is the resource sensitive to the cultural differences of learners?	6.10	64%	6.05	62%
57	Does the resource inform learners of any potentially improper, upsetting, or controversial materials that it includes?	5.10	23%	5.15	24%
58	Is the conduct of the resource authority (e.g. author, publisher, etc.) and the learners professional?	6.10	77%	6.10	80%
59	Are the expectations for the conduct of learners made explicit?	5.30	41%	5.25	38%
60	Are interactions between learners moderated effectively to ensure professional conduct?	5.58	41%	5.55	33%
61	Does the resource motivate and interest its intended audience?	6.00	82%	6.10	81%
62	Does the resource provide an experience that supports learner goals?	6.15	71%	6.20	71%
63	Is the resource entertaining?	4.70		4.70	
64	Is the resource emotionally engaging?	4.60		4.90	
65	Does the resource encourage higher-order thinking (e.g. application, problem solving, analysis)?	6.00	77%	5.75	76%
66	Is the resource useful and relevant for its intended audience?	6.30	91%	6.40	90%
67	Does the resource use examples, scenarios, and cases that help learners to understand the content?	6.10	73%	6.10	71%
68	Does the tone of the resource engage and excite the learner to read/listen?	5.70	36%	5.90	38%
69	Does the resource have a conversational tone?	4.90		5.00	18%
70	Does the authority (e.g. author, publisher) engage in a dialogue with the learners using the resource in an open and timely fashion?	5.21	32%	5.35	36%
71	Does the authority (e.g. author, publisher) engage with learners on social media in an open and timely fashion?	4.80		4.85	
72	Does the authority (e.g. author, publisher) address comments made by learners about the resource in an open and timely fashion?	5.50	36%	5.40	38%
73	Does the resource contain an appropriate amount of information for its length?	5.70	45%	5.65	52%
74	Is the information presented in the resource of a consistent quality?	6.05	78%	6.05	83%
75	How current is the resource? Was it created or updated recently?	5.64	83%	5.68	78%
76	Is the information presented in the resource accurate?	6.45	94%	6.45	100%
77	Is the content of the resource presented in a	6.23	83%	5.95	67%

	logical, clear and coherent way?				
78	Is the topic of the resource well defined and labeled appropriately?	5.45	50%	4.95	
79	Is the topic of the resource comprehensively addressed?	4.59		4.23	
80	Does the resource provide enough background information to situate the learner in the context of prior knowledge?	5.14	39%	4.73	
81	Does the resource deliver a balanced account of information by presenting all sides of the topic?	4.77		4.73	
82	Does the resource identify the areas at the limits of what is known within a field and acknowledge limitations?	5.14	39%	5.05	39%
83	Does the resource use efficient, accurate language that is appropriate for its target audience?	5.68	78%	5.95	78%
84	Does the resource use precise language (i.e. non-ambiguous) that is exact, to the point, and free of jargon, slang, and confusing terminology?	5.27	39%	5.32	44%
85	Does the resource use correct grammar and spelling?	5.41	72%	4.64	
86	Is the resource composed in a way that makes it easy to understand (i.e. not overly convoluted)?	6.23	72%	6.09	78%
87	Does the resource add to the field?	4.95		4.95	
88	Does the resource contain original information? Does the resource synthesize, integrate, and analyze existing information?	5.55	78%	5.68	72%
89	Does the resource provide an overview and orientation to potential learners so they can decide how and whether they should use it?	5.23	44%	5.18	44%
90	Does the resource state its objectives?	5.09	33%	5.14	33%
91	Does the resource address standards that have previously been defined for a particular type of learner (e.g. milestones, competencies, or objectives)?	3.73		3.91	
92	Does the resource have a clear purpose?	5.27	61%	5.32	67%
93	Does the resource define its target audience?	4.77		4.91	
94	Is the resource at the appropriate level for its target audience?	5.27	56%	5.41	56%
95	Are the prerequisites that learners should meet prior to using the resource outlined?	3.50		3.55	
96	Are the materials, time, and any other requirements needed to use the resource outlined?	3.86		4.41	
97	Does the resource provide guidance regarding how it can be used (e.g. copyright and licensing information)?	4.41		4.36	
DOMAIN: DESIGN					
98	Does the resource's learner interface use multimedia design principles to optimize learning in a convenient and efficient manner?	5.82	72%	4.91	

99	Is the resource's content attractively designed with a strong visual component that holds the learner's attention?	5.50	50%	4.00	
100	Is the resource's text and multimedia elements formatted to optimize readability and aesthetic appeal?	5.59	78%	4.32	
101	Is the resource's font consistent? Are its font styles used judiciously for emphasis?	4.73		3.86	
102	Is the resource's text formatted to make the content easy to read?	5.59	67%	4.23	
103	Does the resource's use of colors add to the visual appeal of the content	5.09	22%	3.73	
104	Are the images high-quality? Do they increase the visual appeal of the content?	5.18	50%	4.09	
105	Are the resource's images labeled with captions, titles, and/or text alternatives?	4.73		4.09	
106	Are the resource's videos and animations high-quality? Do they increase the visual appeal of the content?	5.50	56%	4.41	
107	Is the resource's audio high-quality? Does it increase the affective appeal of the content?	4.59		6.14	89%
108	Is the pace and speed of speech of the audio appropriate?	4.45		6.41	78%
109	Is the resource's information structure (layout) organized logically, consistently, and concisely?	6.09	83%	5.09	
110	Does the resource's layout avoid unnecessary text and multimedia elements that may divert attention away from the core content or message?	5.95	67%	4.73	
111	Are the aesthetic components of the resource consistent throughout the resource (e.g. formatting, font, layout, textual cues, headers, labeling)?	5.27	28%	4.64	
112	Does the resource use a consistent and accepted citation format for references and citations?	4.64		4.59	
113	Does the resource create an interactive learning experience through the use of technology?	5.18	39%	4.77	
114	Can the learner interact with the resource's multimedia elements in a way that enables, supplements, and/or optimizes learning?	5.36	56%	4.86	
115	Can the learner interact with audio clips in a way that enables, supplements, and/or optimizes learning?	4.55		5.48	39%
116	Can the learner interact with video or animations in a way that enables, supplements, and/or optimizes learning?	5.18	44%	4.76	
117	Does the resource utilize cases and questions that encourage active learning and self-assessment of knowledge by learners (e.g. quizzes)?	5.23	61%	5.27	56%
118	Does the resource allow its learners to interact with other people using embedded communication technologies?	5.00		4.45	

119	Does the resource enable learner-to-learner interaction through the use of communication technologies?	4.82		4.36	
120	Does the resource enable learner-to-educator interaction through the use of communication technologies?	5.09		4.77	
121	Does the resource have a strategy for disseminating content (e.g. email list, social media posts, RSS feed, search engine optimization)?	5.23	50%	5.18	50%
122	Are new resources/content released on a consistent schedule?	5.00		5.14	44%
123	Does the resource have high technical quality and functionality?	5.45	78%	5.68	72%
124	Is the resource stable (i.e. does not crash)?	5.95	83%	5.95	83%
125	Is the resource optimized to respond and load quickly?	5.77	67%	5.77	61%
126	Is the resource always available or does it have significant down-time?	5.86	50%	5.91	56%
127	When the resource requires downloads, is it possible to select between downloading individual files and entire file sets?	5.36	39%	5.50	44%
128	Is the resource accessible in multiple ways?	5.59	56%	5.55	56%
129	Is the resource portable (i.e. accessible on mobile and non-mobile devices)?	5.86	72%	6.05	78%
130	Is the resource designed to meet the requirements for users with disabilities (e.g. color-blind or visually impaired)?	4.00		4.05	
131	Is the resource compatible with multiple browsers (e.g. Chrome, Firefox, Safari) and operating systems (e.g. Windows, Mac)?	5.91	72%	5.77	67%
132	Is the resource maintained such that its text and multimedia elements remain functional?	6.00	78%	5.64	72%
133	Are the hyperlinks contained within the resource functional?	6.18	83%	5.77	67%
134	Does the resource employ technologies that are universally available to allow learners with standard equipment and software access?	6.00	89%	5.77	94%
135	Does the resource's interface have a learner-friendly design?	6.09	78%	5.77	78%
136	Is the functionality of the resource self-evident without training?	6.05	89%	5.77	89%
137	Are the icons and buttons used in the resource logically and intuitively designed?	5.82	56%	5.45	50%
138	Is navigating the resource intuitive? Does it allow learners to access information quickly?	6.05	83%	5.64	72%
139	Are the resource's navigation layout and hierarchical content structure logically organized and learner friendly?	5.86	72%	5.32	56%
140	Are the resource's hyperlinks clearly marked and used carefully?	5.59	44%	5.05	28%
141	Are the hyperlinks within the resource appropriately and logically labeled to indicate their content and the type of destination site (e.g. text, audio, video site)?	5.50	28%	4.95	

142	Are hyperlinks within the resource that have been followed distinguished from those that have not been followed?	4.32		4.14	
143	Within the resource, is the size of downloadable files clearly indicated next to the download link?	4.50		4.50	
144	Is the content of the resource customizable to different audience levels and learning environments?	4.36		4.14	
145	Are learners able to adjust the pace of the resource, as needed?	5.14	11%	5.23	22%
146	Can the resource be re-purposed into different learning formats to adapt to learner needs?	4.32		4.36	
147	Is the resource designed with consideration for time and place restrictions of learners (e.g. short modules that can each be completed in entirety in brief period of time)?	5.59	44%	5.50	56%
148	Is the content of the resource available in multiple modalities (e.g. video, audio, online text, downloadable file, mobile app, etc.)?	4.91		4.82	
149	Does the resource contain support options to guide learning, troubleshoot common resource functionality problems, and answer general questions?	4.91		4.86	
150	Does the resource provide support through an instruction or FAQ page?	4.64		4.64	
151	Do resource managers provide timely support to end-users?	4.68		5.00	