Review of K-12 Online and Blended Education Research Literature

Conducted and Compiled by Kay Shattuck

December 31, 2015

Reviewing the research literature in preparation for setting Quality Matters Standards of online course design has been a key step since the development of the first QM Rubric in 2005. The summary presented here of the K-12 research literature extends the one completed in August 2013 and is offered to members of the QM 2016 K-12 Secondary Rubric Review Committee as they begin their work in continuous improvement of the QM K-12 Secondary Rubric. The outcome of that process will be the third edition of the QM K-12 Secondary Rubric.

The scholarly K-12 online and blended research literature published from mid-2013 through December 31, 2015, was searched for studies focused on the effectiveness and learner experiences in formal, course-based online learning. This latest review of the literature reveals some differences in the body of the K-12 research literature from the previous review. Whereas the 2008 to mid-2013 literature was marked by face-to-face vs. online comparison studies and by the potential of online learning for at-risk learners and learners with disabilities, as well as some beginning notice on the topic of interaction, the more recent research (September 2013 through 2015) focused on teacher training, professional development, and leadership for more effective online learning. Deeper focus on learner interaction, learner engagement, and budding attention to instructional design topics, although still somewhat focused on students with disabilities, was noted during the recent review.

A recent book edited by Ferdig and Kennedy (2014) presented research on K-12 online and blended learning from various perspectives (for example, at-risk learners, students with disabilities, and mobile learning). Uniformly, the case was made for more research in the field. The December 2015 issue of the scholarly journal *Online Learning* focused on K-12 online, blended, and distance education. It was noted in the introduction that the practice of K-12 online learning is "out-pacing the availability of useful research" (para. #1) and calls for "responsible innovation practices that are reflective and data-driven" (para. #3).

Purpose

Standards to be met in order to have a quality online course design are provided and annotated in the QM Rubrics. The Standards were developed initially for higher education online learning in 2005 and have since been regularly reviewed and improved through a rigorous process (See Shattuck, Zimmerman, and Adair [2014]). One of the beginning steps in the process is for a scholarly review of the published research especially of that which is associated with online course design topics. Research is documented, analyzed, and summarized. Care is taken to identify any new themes or directions being suggested in the published research that needs attention by those who set the QM Standards of quality in online/blended course design. This analytical summary of the research most related to online course design and online learning is one of the inputs provided to members of the Rubric Review Committee.

Methodology

A review of the August 2013-December 31, 2015, K-12 research literature was done to inform the K-12 secondary Quality Matters Rubric Committee of themes and emerging issues of the scholarly published research. The following database sources were searched, and results were culled to identify the topics and the types of sources. Research studies were then pulled out from "how to" and descriptive sources for further review and analysis.

- The Dissertation/Theses database was searched within the date range of 2013-2015, using the keywords "online learning," or "blended learning," and "K-12." Another search was conducted using "K-12," "online learning" or "online education" in abstracts. The addition of "course design" to the search resulted in only one record; therefore, 121 records were culled identifying themes and topics most related to online teaching and learning.
- Academic Search Complete was searched within the date range using K-12 + online learning (abstract) OR online education scholarly (peer-reviewed) journals; 442 were obtained and culled. A large number of articles focused on pre-service and teacher education, as well as a number of studies on administrative issues. Adding "design" to the search resulted in 70 records, which were culled for themes and topics.
- ERIC (USDE 2014-2015) was searched. A total of 86 records were found when searching for K-12 online learning; 60 of those records were from peer-reviewed publications. They were culled for themes and topics and refined using the terms "K-12 online learning," "peer-reviewed," "since 2014," and "research report," resulting in 29 records. Further refinement with the terms "elementary" and "secondary" resulted in 18 records—mostly on teacher preparation and professional, in-service development. Pre-service and descriptive write-ups without methodologies were noted but not included in this summary.
- The ProQuest Education Journals database was searched from September 2013 using the terms "K-12," "online learning," OR "blended learning" in abstracts of peer-reviewed journals. Thirty-three records were, thus, found and culled.
- Questia.com was searched using the terms "K-12" + "online" in peer-reviewed journals from 2014 to the present and resulted in 26 records.
- EdITLib was searched using "K-12" + "online learning" and resulted in 523 records found. The terms "design" and "in journals" were added to distill the list to 70 records; records that had already been gathered, "how-to" descriptive write-ups without methodologies, policy, and professional development articles were not included.
- Professional connections with social media and listservs led to a few additional resources, which were reviewed.

Results

The dominance of **pre-service (teacher education programs) and professional development** to prepare teachers for online teaching is obvious when reviewing 2013 through 2015 K-12 research literature. Even when searches included the keyword "interaction," the studies found often focused on providing awareness and training for interaction in online learning.

- Building on a review of the meager literature that suggested "the most important indicator of effective instruction was teacher preparation required to create engaging learning activities," Oberg (2015) surveyed cyber school teachers. The findings indicated alignment with existing literature on the importance of teachers learning how to create engaging learning activities.

- Szabo (2015) describes an action research study in which graduate students in teacher education program are exposed to and provide feedback on facilitation for asynchronous online discussions.

- Kellogg and Edelmann (2015) explored the learning and networking benefits, as experienced in MOOCs, to K-12 educators.

- Wayer (2013) explored how four K-12 teachers designed blended learning courses and students' responses to those courses. She found "The more experience that a teacher had with teaching in a blended format, the more likely they were to enact their course as designed, have higher levels of student activity, exhibit a greater degree of blendedness, and take an instructional approach of learning with technology rather than from it. Recommendations are made for future professional development in blended learning, for blended teaching practice, and specifically for the profiled school." (abstract)

- While not focused on online learning, Hechter and Vermette (2014) found use of the TPACK framework an important guide for helping teachers learn about promoting student engagement during a K-12 in-service. (See 2011 QM Research Grant study done by Ward at University of Akron - https://www.qualitymatters.org/research-grants-fy11-and-fy10pdf-1/download/QM%20Research%20Grants%20FY11%20and%20FY10.pdf - for the beneficial connection between TPACK and QM Standards in teacher education.)

- Kuo, Belland, Schroder, and Walker (2014) found that K-12 teachers were exposed to three types of interaction (student-content, student-teacher, and student-student) as a predictive model for student satisfaction.

- Cavanaugh, Maor, and McCarthy (2014) provided an overview of pedagogical theories tied to approaches to mobile learning (see p. 393) and summarize research literature regarding mobile learning in K-12. Their overview offers K-12 focused research in support of student engagement, motivation, project-based/inquiry-based practices, collaboration, and interaction. The authors point out the need for professional development to prepare teachers for mobile learning.

- The U.S. Department of Education's 2016 National Education Technology Plan (released in December 2015) points out the importance of preparing teachers "to teach effectively with technology and to select engaging and relevant digital learning content" (p. 6).

Closely associated to teacher education and professional development is the topic of **leadership** and policy. The policy studies were not reviewed in detail; however, some of the leadership studies are included here as they relate rather directly to online learner success.

- Using data from 10 states to evaluate the effect online teaching has on reading and math proficiencies, Harris-Packer and Ségol (2015) suggested that online K-12 students benefitted when taking online courses in those states that have developed and implemented over time "best practices of instructional delivery in the online setting." The authors call for more research in identifying the instructional methods for online learning.

- LeFrance and Beck (2014) found "very few Educational Leadership programs provide any administrator preparation for leading a K-12 virtual school or teachers of online courses. Important ramifications exist for Educational Leadership programs preparing educators to lead fully online and blended learning programs" (p. 160).

- Koong, Chan, and Griffin (2014) conducted a review of the literature focused on K-12 research and its policy implications. Recommendations included "relevant stakeholders across different countries/regions to consider policies on the goal-setting of curriculum addressing 21st-century skills development and bridging the gap between school and society; on the availability of digital technology for school education; on the privacy/legal issues of learning data in e-learning process; and on the teacher development for pre-service and in-service teachers" (p. 70).

- The importance of leadership was pointed out by Davis, Eickelman, and Zaka (2013) when they explored the failings of sustaining innovative strategies of co-evolution of education and digital technologies. Using a series of case studies, they highlighted the decoupling of the roles of a class teacher and the decoupling of the services provided by a single school into being provided by networked organizations, including a virtual school and web-based services (p. 438).

There is increased focus on **design-related issues** in the recent K-12 research literature. Those studies include:

- Chiu, C-H. (2013) dissertation: Verification of theory based design features for designing online instruction for students with learning disabilities and other struggling learners is a standalone contribution to the lit. Three panels of experts in 1) multimedia theory, 2) design/development of online instruction for all K-12, and 3) design/development of online instruction for students with learning disabilities rated the importance of each principle. (Abstract.) The principles came from a comprehensive review of the literature to identify theory-based design principles applicable to online instruction.

    - Factor 1: Learner variability ("needing to be accommodated in the design of online instruction" (p. 99),

    - Factor 2: Cognitive strategies (examples include avoiding cognitive overload, working memory, varying modes of instruction, chunking content to benefit short-term memory, long-term memory schemata, and reflection" p. 100),

  - Factor 3: Prerequisites for teaching/learning ("enhancing teaching and learning" including "mediated actions in activities, cognitive reasoning, building on prior knowledge, and effective approaches to navigation" (p. 100),
  - Factor 4: Context for learning, for example visual and verbal connections, minimizing working memory load, context for sustaining inquiry, connecting knowledge and everyday life, use of text and animation" (p. 100)
  - Factor 5: Media presentation included "mediated activity, engagement, media presentation, textual, pictorial and verbal representation" (p. 100-101).

- Kereluik (2013) found exposure to scaffolding interventions to promote self-regulated learning during two terms of high school mathematics online courses had no documented impact: "Exposure to interventions had no effect on self-efficacy, motivation, individual, or environmental control outcomes nor did initial preparedness for online learning. Further neither exposure to interventions or initial preparedness had an effect on final course grade or retention" (abstract). [Unable to get access to dissertation, but, "These results along with design considerations related to integrating SRL scaffolds in online K-12 courses are discussed and possible reasons for the lack of effectiveness are outlined as well as future design iterations that may lead to effective SRL scaffolds for online K-12 students."

- Darabi, Liang, Suryavanski, and Yurelki (2013) conducted a meta-analysis of empirical studies on the effectiveness of online learning discussions that had a control group and statistics for determining effect size. Only eight studies, which include some with high school learners, met their meta-analysis criteria. Findings "underline the importance of using structured and well-designed strategies in online discussion, findings document the effectiveness of pedagogically rich strategies that include the instructor's involvement and participation, monitoring and moderating, regular interaction and facilitating learners' interaction, collaboration, and teamwork" (p. 239).

- Beese (2014) found a very high attrition rate in a synchronous interactive video program at the high school level. The author pointed out, "The combination of insufficient time for planning and preparation, lack of support for students, and poor communication was detrimental to the program" (p. 292). Study results point out the need for deliberate, well-designed online courses, along with institutional support and instructor responsiveness.

- De la Varre, Irvin, Jordan, Hannum, and Farmer (2014) explored why high school students in rural settings drop out of online courses. Four of the five reasons might be seen as possibly being influenced with stronger course design and institutional support: (1) scheduling and time constraints, (2) lack of academic rigor and motivation, (3) technology problems, and (4) problems with online medium and lack of teacher immediacy. The first reason provided by students and facilitators was parental influences.

- Rozitis (2104) sought to identify competencies for online designers working in high school online learning for the purposes of providing a set of competencies for hiring and training of online high

school teachers. Categories included communication, content, assessment, technology, and professionalism.

- Burdette and Greer (2014) found that survey results from 119 parents of K-12 online students with disabilities noted their main concern was with instruction and activities, especially noting that social media, simulation, discussion, and games were not part of the course offerings.

- Repetto and Spitler (2014) reported on the concept of 5 Cs that is suggested from triangulating the special education, general education, and distance education literatures to impact practice and improve educational outcomes (p. 115). The 5 Cs of student engagement framework include: curriculum, caring community, control, climate, and connect. While approaching the topic from a macro- cyber school perspective, rather than a micro-course design level, the authors pointed out the importance of at-risk students being able "to see that there is a connection" between their current concerns and/or learning objectives (p. 116) and that there is "ample amount of time to master specific learning objectives (p. 120), in a safe and supportive climate with a sense of community (p. 118), with students receiving instruction on targeted academic, social, and behavioral interventions" (p. 118), as well as engaging learning activities. Related to course design, the authors suggest employing the principles of UDL (p. 123).

- Geer, Rice, and Dykman (2014) reviewed the published, peer-reviewed research on online learning and students with disabilities from 2004 to 2014. The chapter provides summary charts from a review of the research literature. Topics include policy and practice, online strategy instruction (for example, a simple course design and accessible technology), academic performance in a specific content area (for example, importance of teacher interaction and feedback), content based e-learning environments (importance of learner support), information technology and transition skills, social competence intervention (for example, learning support and scaffolding activities). Many of those studies, specifically those related to online course design, are documented in the QM Research Library.

- Using the Universal Design for Learning Scan tool. Smith and Harvey (2014) measured how closely lesson content aligned with "UDL principles, guidelines, and checkpoints" (p. 222) in more than four hundred seventy-five randomly selected math, science, and world history courses offered by the Khan Academy. The researchers highlighted the importance of attending to UDL and suggested when designing online courses providing multiple means of representation, multiple means of action and expression, and multiple means of engagement (p.12) must be considered, especially to have courses accessible and appropriate for K-12 students with disabilities.
- While not focused on UDL specifically, Sailors (2014) hoped to find significance in a quasi-experimental study with 106 middle school students with the treatment group having instructional units designed to include advance organizers (design prompts). Although too few completed the activity, significance was not found; however, students were positive about the organizers and the online units.

- Borup, Graham, and Drysdale (2014) explored online high school educators' perception of teaching presence as an aspect of the Community of Inquiry. "It was found that teachers worked to improve student outcomes by (1) designing and organizing learning activities, (2) facilitating discourse with students and parents, (3) providing students with one-on-one instruction, (4) nurturing a safe and caring learning environment, (5) motivating students to engage in learning activities and (6) closely monitoring student behavior and learning. These six elements describe the core of teacher engagement" (p. 793). (CoI teaching presence includes course designing [for interaction & engagement] as well as engagement during delivery of an online course.)

- Nordstrom (2015) studied the impact of only narration, only text, or both for 112 sixth grade students taking an online math lesson. No significant difference was found in achievement in any of the groups; however, the importance of prior knowledge was recognized. Nordstrom suggested students' prior knowledge level be considered when providing self-paced online math instruction.

- Although not focused on online learning, Allison (2015) also used the cognitive theory of multimedia learning to study K-12 teachers' application of the theory. The associated design principles of redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation were used less frequently than were personalization, signaling, and voice and politeness (which might be translated into teacher presence in an online learning environment).

It is not surprising that a focus on **interaction** is observed in the K-12 research literature. Indeed interaction is where people observe and experience the complexities of learning. Those interactions can be at the student-teacher, student-content, student-student, and student-computer/design interface.

- Borup (2013) applied survey methodology to analyze perceptions of content, peer, and instructor interactions in two online high school courses. "Students perceived learner-instructor and learner-content interactions to have significantly higher educational value than learner-learner interactions, and viewed learner-instructor interaction to be significantly more motivational than learner-content interaction. Furthermore, nine significant correlations were found between the time students spent on human interaction and course outcomes" (abstract). Borup also explored the parent-instructor interaction. An Adolescent Community of Engagement (ACE) framework was constructed for the K-12 online learning environment: student, teacher, and peer engagement (this can be related to community of inquiry framework). Parent engagement was suggested as the fourth construct in the framework.

- Smistad (2013) examined student-student feedback with ten-year old students in a four-week online course. When working collaboratively, students expressed that feedback from their peers was dependent on the "emotions" they felt when receiving the feedback, which was potentially isolating. Recommendations include designing for scaffolding activities and increased teacher presence.

- Barbour, Grzebyk, and Eye (2014) found that high school students found reliance on mobile technologies to be both limiting and a negative experience.

- Although not focused in online learning, Tseng, Liang, and Tsai (2014) found a positive relationship between self-regulation of high school learners and strategies for searching for information online.

- Harvey, Greer, Basham, and Hu (2014) did a study that examines the interaction within K-12 online learning. A convenience sampling technique was used with n=140; 80% self-identified as high school students, 16% as middle school students. "Even though opportunities for socialization are often cited as a drawback to online learning, social interaction didn't seem to be as strong a concern in our sample. Most participants expressed satisfaction with the amount of interaction with their teachers, whereas less than half seemed satisfied with their interaction with peers" (p. 23) Possible explanations were offered, including the explanation of students in the sample already being involved with their peers in community sports, volunteer work, and community gatherings.

The recent K-12 research literature can be seen as not only moving from the broad concept of interactions but toward a focus on learner **engagement**, the mental/activity substance of interaction.

- Kim, Cozart, & Hyewon (2015) begin their abstract with the statement: "Engagement and motivation are not one and the same, but motivation can be transformed into engagement with proper design of support" (p. 261). One hundred high school students enrolled in a self-paced asynchronous math course (82 had no prior experience taking an online math course) were surveyed three times during the semester to gather data on differences between high and low performers as related to changes in their motivation, regulation, and engagement throughout the study. Findings suggest support for, for example, designing scaffolding opportunities for facilitation by the online instructor would likely have a positive impact on the online students' effort of self-regulation. The researchers also noted that self-efficacy, especially for low performers' might be to provide vicarious experiences, autonomy, clear expectations, goal specificity, and balanced task difficulty" (p. 269).

- Jackson, Jackson, and Chambers (2013) measured students' perceptions of their online educational experience when courses redesigned emphasized the community of inquiry (CoI) framework that promoted collaboration and student connectedness. The author suggested such design to promote student-to-student interactions led to increased positive perceptions of their experience.

- Doering and Hendrickson (2015) found that by using an active, real-world problem solving, adventure learning environment 95 high school students worked collaboratively and at the same time used "the opportunity to define self-identified driving questions" (p. 387).

- Hensberry, Moore, and Perkins (2015) tested out the impact of interactive simulation with fourth-graders when learning fractions. Significant changes in attitude were found in pre- and post-tests. The authors concluded: "that interactive simulations, when paired with effective teaching, can be

highly effective tools for supporting both procedural and conceptual understanding" (p. 273).

- Louwrens and Hartnett (2015) begin, "While our understanding of student engagement in the compulsory schooling sector is well developed in face-to-face contexts, the same cannot be said for online and distance learning environments" (p.27) in introducing their study of middle schoolers who benefitted by designed and facilitated activities requiring behavioral, cognitive, and emotional engagement.

- More attention to missing course designs for engagement came from Wayer, Crippen, and Dawson (2015). This multiple case study primarily focused on results of an eight-week iNACOL professional development session on blended learning provided to four K-12 instructors. Content areas were algebra, biology, English, and heath-physical education. Coding variables for the online portion of the blended courses included (1) course organization, (2) structure and organizations of content, (3) types of instructional resources, (4) instructional purpose of resources, (5) instructional approach, and (6) LMS tools used. A cross-case analysis for purposes of addressing research question 3: How did the design and enactment of the online components differ across the content areas?" (p. 224) indicated differences in design, place of online activity, time of online activity, enactment of online activities, degree of blendedness and use of technology (p. 230). Findings identified that "across the cases, student-instructor and student-student interaction in the online environment were largely absent [and that] this was a missed opportunity for students to engage with each other and the content beyond the regular classroom discussion" (p. 236).

- Golden (2014) explored high school students' views of student-student problem solving communications in F2f, synchronous audio conferencing, and asynchronous discussion forums. The researcher suggested that "With a greater awareness of the characteristics of the different communication approaches, educators, parents, and others interested in online education will better comprehend how students interact in this environment" (p. iv) and concludes, "Educators need to understand the circumstances under which online approaches can be effective, rather than using them indiscriminately" (p. 174).

- Yang and Chang (2013) studied the impact of seventh-grade students as they designed digital games or flash animations. Pre-, post-, and delayed post-tests indicated "significant improvements in critical thinking skills, and academic achievement, with increased retention of both course content and critical thinking skills observed for the delayed posttest" (p. 334).

- Pannell (2013) found no significant difference for 143 online students at a community college in the comfort in perceptions of self-management and the comfort in online learning between those who reported prior K-12 online learning experience and those without.

- Rector-Aranda and Raider-Roth (2015) explored how middle school students developed and established agency and voice in a simulated role-play activity in an online course. The authors

summarize, "The ideas expressed denote a strong desire for students to actively engage their voices and to exercise greater control over the conditions of their learning (Implications and action section).

- While not focused on online learning, Eseryel, Law, Ifenthaler, Ge, and Miller (2014) found students' (mean age of 14.6 years) "motivation determines their engagement during gameplay, which in turn determines their development of complex problem-solving competencies" suggesting, "that learner's motivation, engagement, and problem-solving performance are greatly impacted by the nature and the design of game tasks" (p. 42).

- While not focused on online learning, a study by Wright, Fugett, and Caputa (2013) found that three second grade students "without an identified disability" had no difference in reading comprehension when using print or digital text. (Students were using reading resources that were linked into readings.)

- Kuo and Hwang (2104) explored the relationship of 170 elementary school students' problem-solving abilities and their web-based problem-solving skills after participating in a learning activity focused on developing web-based problem-solving skills. Although not focused on online learning, the researchers suggested the importance of providing that structured type of learning activity to promote both web-based and general problem solving skills.

Discussion

A review of the K-12 online learning research literature from mid-2013 through 2015 revealed the dominance of pre-service teacher education, professional in-service development, and leadership to improve K-12 online learning, and of explorations of interaction within an online course. Those same issues had been evident in the previous review of the literature but are expanded upon and have a clearer focus in the reviewed recent literature. Additionally, the body of interaction literature includes raising the emphasis on theoretical approaches and relating to K-12-age students rather than adult learners. These studies include Allison's (2015) and Nordstrom's (2015) use of cognitive theory of multimedia learning and Chiu's (2013) identification and review of seven theories, including Cultural Historical Activity Theory, Human Computer Interaction Theory, Cognitive Theory of Multimedia Learning, Cognitive Load Theory, Universal Design for Learning, Kosslyn's psychological principles, and Wicken's principles of Display Design. Kereluik's (2013) use of self-regulated learning theories, as well as Smistad's (2013) use of the Person-Centered Instruction model, and Borup, Graham, and Drysdale's (2014) use of the Community of Inquiry framework focused on the K-12 online learning environment. There is also an increasing focus on Universal Design for Learning and other designing topics.

It is evident from the body of the most recent reviewed literature that the Standards included in the K-12 Secondary QM Rubric embody the emphasis of interaction and provide instructional design details for the many aspects of interaction. An example of this emphasis is that of assuring that students are made aware of the expected instructor feedback, of the types of interactions necessary for students'

fullest engagement with the content and activities designed in the course, and of the alignment of learning objectives, through learning activities, to the assessments.

A grounding note about scholarly research from the medical arena: Just as it is possible to read studies that provide evidence of the benefits of including eggs into one's diet, it is possible to read studies of the medical issues that can result from eating too many eggs (eggs can be replaced in this example with coffee, butter, etc.) Decisions should be based on the body of evidence being provided in the research instead of on a single study. Educational studies cannot use the same experimental controls or sophisticated methodologies of medical studies, so the evidence is sometimes more challenging to interpret. It is important to resist the urge to generalize from a single study. Each study has its own limitations (for example a study with a small, very specific subject base and often-neglected variables that influence or impact learning). Therefore, this literature review provides information to the Rubric Review Committee from the body of the most recent research literature.

The work of New Zealander John Hattie (2008; 2011) is offered to the 2016 Rubric Committee as a piece of supportive information. Hattie's seminal work is increasingly recognized (Wiggins, 2105); it is a synthesis of more than 800 meta-analyses of 500,000 studies relating to K-12 learner achievement. While there is some controversy in using meta-analyses methodologies, Hattie's work is increasingly cited. His use of *effect size* is insightful in that it acknowledges that many variables from different sources (teachers, students, peers, home, school) impact learner achievement. The higher the effect size of a variable, the more focus should be placed on that variable in order to promote learner achievement. Essentially, Hattie found that instructor feedback provided the highest effect size (impact) on student achievement. Although his study focuses on the impact of the teachers in traditional classroom-based learning, it serves as a source of support for the importance of various online course design targets, which are currently focused in the QM Standards, such as feedback, students' prior cognitive ability (statement of prerequisite knowledge), direct instruction, and class environment. (See the full list of variables with effect size and source of influence Hattie, 2003, p. 5.)

Recommendations to the 2016 K-12 Secondary Rubric Review Committee

An exhaustive review of the K-12 research literature was done covering mid-2103 through the end of 2015. The focus of the review was to gather and analyze research evidence on K-12 online learning, specifically those topics that impact or are impacted by the design of a course. Two broad themes were evident in the review: (1) the importance of preparing teachers to teach online, and (2) the importance of (and a sharper focus on) interaction and learner engagement.

As result of this review, members of the 2016 QM Secondary Rubric Review Committee are reminded of the significance of their work. As noted in the introduction, the increase of online learning courses and programs is outpacing the evidence-based research specifically focused on K-12 online learning. While there is a well-established and extensive body of evidence-based research focused on adult learners, the assumption that this knowledge transfers smoothly into K-12 online learning needs to be tested and modified when required. Therefore, each member of the committee is encouraged to apply her or his considerable expertise in K-12 online learning to assure that the QM Standards and

annotations continue to be useful "in the field," whether used during the formal course review process, during the course design process, or during a teacher training program. Reading the summary finding statements in this report might trigger some additions or clarifications that would sharpen the wording of the K-12 Rubric Standards and Annotations.

Second, members of the Committee should continue emphasizing the interrelated dimensions of interaction that can encourage and support learner engagement in an online course. The words interaction and engagement can be tossed around in education and can slip into buzz word platitudes; however, the QM Standards can align the dimensions of interaction and engagement, such as introducing and orienting learners to an online course, assuring a logical and explained connection among the learning objectives, learning materials, activities, learning necessary technologies, and assessments, to optimal effect.

References

Allison, C. (2015). *The use of instructional videos in K-12 classrooms: A mixed-method study.* Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3688706)

Barbour, M., K., Grzebyk, T. W., & Eye, J. (2014). Any time, any place, any pace-really? Examining mobile learning in a virtual school environment. *Turkish Online Journal of Distance Education, 15*(1). Retrieved from http://files.eric.ed.gov/fulltext/EJ1042983.pdf

Beese, J. (2014). Expanding learning opportunities for high school students with distance learning. *The American Journal of Distance Education, 28*(4), 292-304. doi:10.1080/108923647.2014.959343

Borup, J. (2013). *Types, subjects, and purposes of K-12 online learning interactions.* Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3595016)

Borup, J., Graham, C. R., & Drysdale, J. S. (2014). The nature of teacher engagement at an online high school. *British Journal of Educational Technology, 45*(5), 793-806. doi:10.1111/bjet.12089

Burdette, P. J., & Greer, D. L., (2014). Online learning and students with disabilities: parent perspectives. *Journal of Interactive Online Learning, 13*(2), 67-88. Retrieved from http://www.ncolr.org/jiol/issues/pdf/13.2.4.pdf

Chappell, S., Arnold, P., Nunnery, J., & Grant. M. (2015). An examination of an online tutoring program's impact on low-achieving middle school students' mathematics achievement. *Online Learning, 19*(5). Retrieved from http://onlinelearningconsortium.org/read/online-learning-journal/

Cavanaugh, C., Maor, D., & McCarthy, A. (2014). K-12 mobile learning. In R. E. Ferdig & K. Kennedy (Eds.), *Handbook of research on K-12 online and blended learning* (pp. 391-414). Retrieved from http://press.etc.cmu.edu/content/handbook-research-k-12-online-and-blended-learning-0

Chiu, C-H. (2013). *Verification of theory based design features for designing online instruction for students with learning disabilities and other struggling learners.* (Doctoral dissertation). Retrieved from https://kuscholarworks.ku.edu/bitstream/handle/1808/15127/CHIU_ku_0099D_12758_DATA_1.pdf?sequence=1&isAllowed=y

Darabi, A., Liang, X., Suryavanski, R., & Yurekli, H. (2013). Effectiveness of online discussion strategies: A meta-analysis. *The American Journal of Distance Education, 27,* 228-241. doi:10.1080/08923647.2013.837651

Davis, N., Eickelmann, B., & Zaka, P. (2013). Restructuring of educational systems in the digital age from a co-evolutionary perspective. *Journal of Computer Assisted Learning, 29*(5), 438-450. doi:10.1111/jcal.12032

De la Varre, C., Irvin, M. J., Jordan, A. W., Hannum, W. H., & Farmer, T. W. (2014). Reasons for student dropout in an online course in a rural K–12 setting. *Distance Education, 35*(3). Retrieved from http://www.tandfonline.com/doi/abs/10.1080/01587919.2015.955259

Doering, A., & Henrickson, J. (2015). Fostering creativity through inquiry and adventure in informal learning environment design. *Journal of Technology and Teacher Education, 23(*3), 387-410. Chesapeake, VA: Society for Information Technology & Teacher Education. Retrieved from http://www.editlib.org/p/151571/

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning, *Educational Technology & Society, 17*(1), 42-53. Retrieved from http://www.ifets.info/journals/17_1/5.pdf

Geer, D., Rice, M., & Dykman, B. (2014). Reviewing a decade (2004-2014) of published, peer-reviewed research on online learning and students with disabilities. In R. E. Ferdig & K. Kennedy (Eds.), *Handbook of research on K-12 online and blended learning* (pp. 135-162). Retrieved from http://press.etc.cmu.edu/content/handbook-research-k-12-online-and-blended-learning-0

Hattie, J. A. (2008). Visible learning: A synthesis of over 800 Meta-Analyses relating to achievement. ISBN 0-415-47618-6.

Hattie, J. A. (2011). Visible learning for teachers: Maximizing impact on learning. Routledge ISBN 0-415-69015-3.

Hattie, J. (2003, October). *Teachers make a difference: What is the research evidence?* Paper presented at the Australian Council for Educational Research Annual Conference, University of Auckland. Retrieved from https://cdn.auckland.ac.nz/assets/education/hattie/docs/teachers-make-a-difference-ACER-(2003).pdf

Harris-Packer, J. D., & Ségol, G. (2015). An empirical evaluation of distance learning's effectiveness in the K–12 setting. *American Journal of Distance Education, 29*(1), 4-17. doi:10.1080/08923647.2015.990768

Harvey, D., Greer, D., Basham, J., & Hu, B. (2014). From the student perspective: Experiences of middle and high school students in online learning. *The American Journal of Distance Education, 28*, 14-26. doi:10.1080/08923647.2014.868739

Hechter, R., & Vermette, L. A. (2014). Tech-savvy science education? Understanding teacher pedagogical practices for integrating technology in K-12 classrooms. *Journal of Computers in Mathematics and Science Teaching, 33*(1), 27-47. Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Hensberry, K., Moore, E. & Perkins, K. (2015). Effective Student Learning of Fractions with an Interactive Simulation. *Journal of Computers in Mathematics and Science Teaching, 34*(3), 273-298. Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Golden, S. (2014). Impact of communication modes on discussion in K--12 online education. (Doctoral dissertation, Kent State University). Retrieved from https://etd.ohiolink.edu/!etd.send_file?accession=kent1405679223&disposition=inline

Jackson, L.C., Jackson, A. C., & Chambers, D. (2013). Establishing an online community of inquiry at the Distance Education Centre, Victoria. *Distance Education, 34*(3), 353-367. doi:410.1080/01587919.2013.835774

Kellogg, S., & Edelmann, A. (2015). Massively Open Online Course for Educators (MOOC- Ed) network dataset. *British Journal of Educational Technology, 46*(5), 977-983. doi:10.1111/bjet.12312

Kereluik, K. M. (2013). Scaffolding self-regulated learning online: A study in high school mathematics classrooms. ProQuest Dissertations and Theses database. (UMI No. 3604541)

Kim, C-M, P., Cozart, S. W., & Hyewon, J. L. (2015). From motivation to engagement: The role of effort regulation of virtual high school students in mathematics courses. *Educational Technology & Society, 18*(4), 261-272. Retrieved from http://www.ifets.info/journals/18_4/20.pdf

Kong, S.C., Chan, T.-W., Griffin, P., et al. (2014). E-learning in school education in the coming 10 years for developing 21st century skills: critical research issues and policy implications. *Educational Technology & Society, 17(*1), 70-78.

Kuo, F.-R., & Hwang, G.-J. (2014). A Five-Phase Learning Cycle Approach to Improving the Web-based Problem-Solving Performance of Students. *Educational Technology & Society, 17(*1), 169-184. Retrieved from http://www.ifets.info/journals/17_1/15.pdf

Kuo, Y-C., Belland, B. R., Schroder, K. E. E., & Walker, A. E. (2014). K-12 teachers' perceptions of and their satisfaction with interaction type in blended learning environments. *Distance Education, 35*(3). Retrieved from http://dx.doi.org/10.1080/01587919.2015.955265

LaFrance, J. A., & Beck, D. (2014). Mapping the terrain: educational leadership field experiences in K-12 virtual schools. *Educational Administration Quarterly, 50*(1), 160-189. doi:10.1177/0013161X13484037

Louwrens, N. & Hartnett, M. (2015). Student and teacher perceptions of online student engagement in an online middle school. *Journal of Open, Flexible, and Distance Learning, 19*(1), 27-44. Distance Education Association of New Zealand.

Nordstrom, L. (2015). *The impact of written text and narration on learning in an online middle school math lesson.* Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3714750)

Oberg, A. M. (2015). *Active learning manifested within a synchronous online classroom* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3725687)

Pannell, L. M. (2013). First steps to college and career success: Predictors of recent high school graduate readiness for online learning. (Doctoral dissertation). Retrieved from http://aquila.usm.edu/cgi/viewcontent.cgi?article=1031&context=dissertations

Rector-Aranda, A., & Raider-Roth, M. (2015). 'I finally felt like I had power': student agency and voice in an online and classroom-based role-play simulation. *Research in Learning Technology,* 23. doi:http://dx.doi.org/10.3402/rlt.v23.25569 Retrieved from http://www.researchinlearningtechnology.net/index.php/rlt/article/view/25569

Repetto, J. B., & Spitler, C. J. (2014). Research on at-risk learners in K-12 online learning. In R. E. Ferdig & K. Kennedy (Eds.), *Handbook of research on K-12 online and blended learning* (pp. 107-134). Retrieved from http://press.etc.cmu.edu/content/handbook-research-k-12-online-and-blended-learning-0

Rozitis, C. P. (2014). *Instructional design competencies for online high school designers-by-assignment: A Delphi study.* Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3645854)

Shattuck, K., Zimmerman, W. A., & Adair, D. (2014). Continuous improvement of the QM Rubric and review processes: Scholarship of integration and application. *Internet Learning, 3*(1). Retrieved from http://www.ipsonet.org/publications/open-access/internet-learning/volume-3-number-1-spring-2014)

Sailors, K. M. (2014). *Advance organizers in an online social studies unit to promote self-regulation in middle school students.* ProQuest, UMI Dissertations. Retrieved from http://search.proquest.com/docview/1618233273

Smistad, K. E. (2013). *Student feedback in elementary online learning: A phenomenological study using person-centered instruction.* ProQuest Dissertations and Theses database. (UMI No. 3559881)

Smith, S. J., & Harvey, E. E. (2014). K-12 online lesson alignment to the principles of Universal Design for Learning: the Khan Academy. *Open Learning, 29*(3), 222-242. http://dx.doi.org/10.1080/02680513.2014.992402

Szabo, Z. (2105). Better together: teams and discourse in asynchronous online discussion forums. *Journal of Psychological and Educational Research, 23*(1), 73-88.

Tseng, S.-C., Liang, J.-C., & Tsai, C.-C. (2014). Students' self-regulated learning, online information evaluative standards and online academic searching strategies. *Australasian Journal of Educational Technology, 30*(1), 106-121. Retrieved from doi: http://dx.doi.org/10.14742/ajet.v30i1.242

Wayer, N. M. (2013). *From design to enactment: A case study of blended learning across the content areas in a K-12 school.* ProQuest Dissertations and Theses database. Retrieved from http://search.proquest.com/docview/1547360014

Wayer, N., Crippen, K. & Dawson, K. (2015). Design and enactment of online components during four blended learning courses. *Journal of Online Learning Research, 1*(2), 219-239. Association for the Advancement of Computing in Education (AACE). Retrieved from http://www.editlib.org/p/148717/

Wiggins, G. (2015, February). What works in education—Hattie's list of the greatest effects and why it matters [Web blog post]. Retrieved from https://grantwiggins.wordpress.com/2012/01/07/what-works-in-education-hatties-list-of-the-greatest-effects-and-why-it-matters/

Wright, S., Fugett, A., & Caputa, F. (2013). Using E-readers and Internet Resources to Support Comprehension. *Educational Technology & Society, 16*(1), 367-379.

Yang, Y-T. C., & Chang, C-H. (2013). Empowering students through digital game authorship: Enhancing concentration, critical thinking, and academic achievement. *Computers & Education,* 68, 334-344.

Additional Resources

Basham, J. D., Stahl, W., Ortiz, K. R., Rice, M. F., & Smith S. J. (2015). *Equity matters: Digital and online learning for students with disabilities.* Lawrence, KS: The Center on Online Learning and Students with Disabilities. Retrieved from http://ht.ly/Vpmus

Ferdig, R. E., & Kennedy, K. (Eds.) (2014). *Handbook of research on K-12 online and blended learning.* Retrieved from http://press.etc.cmu.edu/content/handbook-research-k-12-online-and-blended-learning-0

Staker, H., & Horn. M. B. (2012, May). *Classifying K-12 blended learning.* Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2012/05/Classifying-K-12-blended-learning2.pdf

U. S. Department of Education, Office of Educational Technology (2016). *2016 National Education Technology Plan: Future Ready Learning-Reimaging the role of technology in education.* Retrieved from http://tech.ed.gov/