National Standards for Quality Online Courses (K-12)

and QM K-12 Secondary and K-12 Publisher Rubric Revision

Literature Review

Conducted and compiled by

Kathryn Kennedy, PhD

Director of the Michigan Virtual Learning Research Institute at Michigan Virtual

Krista Tomaselli

Assistant Director of Instructional Product Development at Michigan Virtual

and

Rebecca Stimson

Senior Writer and Publications Manager

Michigan Virtual Learning Research Institute at Michigan Virtual

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Introduction

This literature review has been conducted to inform the work of the Standards for Quality Online Courses revisions, a project led by a partnership between Quality Matters and the Virtual Learning Leadership Alliance. This literature review will also inform the revisions of the Quality Matters K-12 Secondary and Publisher Rubrics. It includes a short summary of the relevant research literature followed by an alphabetical listing of the resources correlated to the iNACOL National Standards for Quality Online Courses to which they apply. This review also includes an appendix that lists additional standards sets, which can be consulted as resources, as well as abstracts for most of the references listed.

Methodology

The review of the research literature was conducted August through October 2018 by Kathryn Kennedy, Director of the Michigan Virtual Learning Research Institute at Michigan Virtual; Krista Tomaselli, Assistant Director of Instructional Product Development at Michigan Virtual; and Rebecca Stimson, Senior Writer and Publications Manager, Michigan Virtual Learning Research Institute at Michigan Virtual. Searches within the date range of 2014-2018 were completed using the keywords K-12, online learning, online teaching, and online programs. The following databases were searched in order to achieve saturation:

- Michigan Virtual Learning Research Institute's Research Clearinghouse
- QM Research Library
- Academic databases – Academic Search Complete, ProQuest Dissertations & Theses, Google Scholar, Google
- Virtual academic repositories – ResearchGate and Academia.edu

The findings were recorded on an Excel spreadsheet, with each entry including the reference, the abstract from the original publication, and, often, reviewer notes. An analysis of each reference's relationship to each of the iNACOL Standards was made and documented on a Google spreadsheet by the QM Research Team. The final step was an analysis of the research gathered in general relationship to the iNACOL standards and the QM K-12 Rubric, which resulted in an overview of the findings.

Brief Overview of Findings

The following bulleted list features key findings from the studies reviewed for this literature exploration.
- In Arslan-Ari's research (2017), animations with narration were used to understand how visual cueing could help connect prior knowledge and learning acquisition. The purpose of this study was to investigate the effects of cueing and prior knowledge on learning and mental effort of students studying an animation with narration. Visual cues were helpful for students with low prior knowledge of the topic, whereas students with high prior knowledge of the topic who were not provided visual cues were able to outperform

students with low prior knowledge. Cueing in animations used for instructional purposes is dependent on learners' prior knowledge. Low prior knowledge learners find visual cueing more useful than high prior knowledge learners.

- Adelstein and Barbour's study (2016) examined the validity of the iNACOL Standards for Quality Online Courses. One of the key pieces missing from the 2011 standards is that of student motivation in relation to course design in online learning environments. There is also some redundancy found across the standards, at which time suggestions were made to reduce said redundancy.
- The use of instructional videos in K-12 classrooms was the focus of Allison's work (2015). The study looked specifically at how the videos were used, as well as teachers' perceptions of the pluses and negatives for incorporating them in their instruction. Educators who responded mentioned using videos for educational purposes. Those who responded had a collection of go-to videos that they used for reinforcement, motivation, meeting student needs, providing authentic content, and demonstrating skills. Instructional videos helped to maximize teachers' time, as well as provide motivation and options for varied instructional approaches. Negatives included access issues, as well as lack of interaction and learning barriers. "Although the principles of voice, politeness, pre-training, personalization, and signaling were present the majority of the time in the instructional videos used by K-12 teachers, the principles of redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation were used less frequently."
- Barbour (2007) explored teacher and developer perceptions of effective web-based content for secondary school students and found that the following guidelines were key for course developers to keep in mind and use for future design work: simple navigation but diverse content presentation; summarizing and personalizing content; clear instructions; and content targeted to average and below average students.
- Taking into account the importance of considering higher education research findings, Barbour (2018) looks at what higher education studies could be replicated in K-12 settings, including use of validated instruments as well as established theoretical and conceptual frameworks.
- Barbour and Adelstein (2013) focused on secondary student perspectives of the design of their online courses and found that the students wanted more multimedia and web-based content as well as self-assessment tools. The variety of tools and resources provided to students was the main concentration of the feedback.
- Barbour et al. (2014) looks critically at how online and blended schools/programs evaluate and approve third party courses and providers. The report looked at all 50 states and some international examples of what evaluation strategies are in place. Five constructs were identified as part of the evaluation and approval process, including level (provider or course); optional or required approval; multi-district, multi district and single district, or single district; fully online or blended; and front-end approval, front-end approval and ongoing monitoring, or annual monitoring/audits.
- Barbour et al. (2012) found that secondary students enjoyed their virtual school experiences but found that the community was not really cultivated in an asynchronous manner, which is how the courses were designed.
- Barbour et al. (2014) explores the teachers who develop courses in a virtual school after they've shifted away from using third-party providers for content. The teachers' tendency was to use interactive media, and they enjoyed working in a team to design. While they didn't like using a template, they also realized that they needed that help when first starting out as designers and knew that they would eventually have enough PD to be able to do things without a template.

- Social networking was used in a cyber charter school to enhance social interactions among students. Barbour and Plough (2012) share the development and use of this social networking program.
- Basham et al. (2018) provided an overview of the concept of Universal Design for Learning (UDL), illustrating the field's journey over the 20 years UDL has been around. This chapter looks at the use of UDL as a way to design with all student differences in mind; where the field has been, where it is now, and where the field could go in the future; and implications specifically for practice, research, and policy.
- Basham et al. (2015) takes a look at a variety of projects that were happening simultaneously at the Center on Online Learning and Students with Disabilities. The report was a way to inform stakeholders of the work being done by the Center as well as to continue conversation, reflection, and debate around the understandings of all involved in order to move the systems, policies, and practices forward with a focus specifically on student supports.
- In a dissertation focused on interaction and presence in secondary online classrooms, Blaine (2017) explored data out of a larger study taking place about the New York State Virtual AP Program, its effectiveness, and evaluation of it. A focus group shared that there was varied quality and frequency within the classes. There was substantial negativity surrounding the quality of interaction, specifically between teachers and students.
- Borup (2016) looks at learner-to-learner engagement using the teacher's lens. Shifting the focus from independent online learning to more interactive and collaborative learning, a full-time online charter school looked critically at the amount of learner-to-learner interaction and its quality. During the case study, teachers identified interaction behaviors that were positive for engagement and learning and those that were not; positive interactions included befriending, motivating, instructing, and collaborating, while the negative interactions included bullying and cheating. The teachers also found it difficult to incorporate collaborative projects while continuing to meet an individual student's needs.
- Borup's (2013) dissertation looks at three topics specifically: (1) student interactions with content, peers, and instructors; (2) parent-instructors and learner-parent interactions; and (3) a theoretical framework called the Adolescent Community of Engagement (ACE) framework that builds on pre-existing theories in higher education as well as K-12 and looks at student, teacher, and peer, as well as parental engagement.
- Borup et al. (2014) look critically at the construct of teacher engagement, which included identifying what practices were most effective in a successful online charter school, including teachers' "(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*."
- Boyer and Kelly (2018) delve into the importance of incorporating libraries and librarian services in online and blended schools, including but not limited to the roles librarians play in curating resources and designing activities in online and blended learning environments.
- Cavanaugh (2013) highlights factors that have an effect on student achievement in elementary and high school. The section specifically on course design shares results from other studies related to project-based learning, flexible pacing, and maximizing of communication.

- Cavanaugh et al. (2018) focused on the use of mobile devices in learning and the design of the learning space in order to be compatible with mobile learning. Included in the discussions within the chapter are design of assessments that are student-centered, as well as design that prepares students to be independent learners.
- Cavanaugh et al. (2013) share an approach to supporting students with disabilities in online learning environments. The framework includes five Cs, including "learner *control*, a flexible and rigorous *curriculum*, a safe *climate*, a *caring community*, and *connection* to students as individuals and their future goals." Design elements linked to the five Cs are discussed.
- Chiu (2013) used multiple theories to explore design of online instruction. Included in the theories considered were Cultural Historical Activity Theory (CHAT), Human Computer Interaction (HCI), Cognitive Theory of Multimedia Learning (CTML), Cognitive Load Theory (CLT), Universal Design for Learning (UDL), Kosslyn's (2007) eight Psychological Principles, and Wicken's (1999) 13 Principles of Display Design. Based on the review, the five factors that stem from these eight theories help to inform design of online learning environments: learner variability, cognitive strategies, prerequisites for teaching/learning, context for learning, and media presentation.
- While Czerkawski (2015) concentrated on higher education courses designed to incorporate networked learning, the implications for instructional design using networked learning for K-12 could be applied from this study.
- Czerkawski and Lyman (2016) introduced an instructional design framework that fosters students' engagement in online learning. This framework focused on how to encourage high levels of student engagement.
- Darabi et al. (2013) emphasized the need to design discussion strategies in online environments with the goal of students' use of higher order thinking as well as cognitive presence.
- Davis et al. (2018), while focused on the larger school ecosystem as a whole, encouraged educators to purposefully map a learning environment back to the school ecosystem so that everything is designed and integrated in a cohesive way.
- de los Arcos et al. (2016) shared how important the incorporation of open educational resources in online and blended learning environments is. Especially with the GoOpen initiative at the state and district level, helping educators understand how to use OER meaningfully to personalize learning for students is key for this type of initiative to work.
- Dikkers' (2018) chapter focused on social interaction in K-12 online learning. Rather than differentiated content interaction from social interaction with peers, teachers, and parents, she brought these together to really emphasize the importance of any interaction that occurs in online learning environments as well as the importance of designing with this distinction in mind.
- Drexler (2018) clearly explicated in this chapter the difference between personal learning environments and personalized learning, something that gets easily confused in the field. Within her chapter, she explained what educators and designers must keep in mind when developing a learning environment with a focus on personal learning environments.
- Dunlosky et al.'s (2013) focused on learning techniques and the implications for designing with these tools in mind, including problem-based learning, self-explanation, reflection, elaborative interrogation, and more.
- Eseryel et al.'s (2014) explored game-based learning and the interaction of that with motivation, engagement, and problem solving. The design of game tasks enhances motivation, engagement, and problem solving skills, leading to implications for designing gaming tasks in order to encourage engagement.

- Ferdig (2010) explored designing for credit recovery students, who are often at-risk students and need additional supports. The study talks about what learning elements, design strategies, and supports can help or hurt students who are in the process of recovering credits.
- Gaytan and McEwen (2007) looked at effective assessment and instructional strategies in online learning. The key aspects of the findings included timely feedback and clear directions for assessments and assignments. Additionally, suggestions included allowing for a variety of ways for students to represent their knowledge acquisition.
- Golden explored a variety of discussion modes, including asynchronous discussion forums, synchronous audio conferencing, and face-to-face group settings. These findings give educators and designers an idea of the interaction patterns and preferences of students, which also helps to inform the design of these environments.
- Gyabak et al. (2015) discussed the importance of online teachers being involved in online learning design in a process called designerly thinking, where teachers put on the instructional designer hats to understand the design process as they engage with it to create their online courses for secondary students.
- Hawkins and Graham (2010) discussed correlations between teacher-student interaction and academic performance. The three types of interaction discussed included feedback, procedure explanations, and teacher-student interaction. An increase of interaction increased course completion but did not influence the grade earned by the student.
- Heikkilä et al. (2017) explored teachers' use of design in primary and secondary education. The study explored how design work could be implemented by educators for the learning environment to encourage the development of self-regulation in students.
- Helms (2012) reviewed literature to find specific recommendations for those educators and designers who are working in blended or hybrid courses. Recommendations include those focused on scheduling in both the online and face-to-face environments, communication strategies, course content, and then a general area for anything not pertaining to the other three areas.
- Jones (2011) explored factors that are perceived to have helped credit recovery students be successful in online courses. Students felt that they didn't have enough control over the environment in their online course, including not being able to have varied options to demonstrate what they know. The findings have implications for design of courses.
- Kennedy and Archambault (2012) share the design and development of field experiences for preservice and inservice teachers who will be teaching in online environments. The design of the field experience includes design work for teachers if their contextual settings warrant the need for them to design.
- Kereluik (2013) explored the implementation and utilization of self-regulated learning (SRL) scaffolds (i.e., videos, journals, surveys) in online K-12 mathematics courses. She found that exposure to interventions had no effect on self-efficacy, motivation, individual, or environmental control outcomes, nor did initial preparedness for online learning.
- Kim, Park, and Cozart (2014) investigated what factors would be related to students' achievement in mathematics courses offered at a virtual high school. The purpose of their study was to attempt to understand why some students succeed and some do not and to suggest what interventions should be used to increase student success. They found that emotions accounted for 37% of the variance in student achievement. Specifically, anger was the strongest predictor of student achievement. According to Kim, Park, and Cozart (2014),

since this math course did not allow for interactions with peers, this may have resulted in students' anger hindering their studying behaviors.

- Koehler and Mishra (2005) developed and administered a survey that assessed the advancement of student- and faculty-participants' learning and perceptions about the learning environment, theoretical and practical knowledge of technology, online course design, group dynamics, and the growth of Technological Pedagogical Content Knowledge (TPCK). They found that participants perceived that working in design teams to solve authentic problems of practice is useful, challenging, and fun.
- Kosko, Sobolewski, and Amiruzzaman (2018) described how online and blended mathematics learning (OBML) research has commonly focused on OBML as a treatment for learning rather than a context for it. They note that research has suggested a combination of positive, negative, and no significant differences in mathematical learning outcomes for OBML and traditional face-to-face learning environments.
- Lawrence (2017) explored the ways in which culturally responsive teaching can occur online in the practices of four full-time online high school teachers. While some characteristics of culturally responsive pedagogy, including infusing students' cultures into the curriculum and helping students to challenge power and hegemony, did not emerge, Lawrence did observe teachers engaging in responsive instructional design by modifying and adjusting their course content and activities based on how their students engage in the course. According to Lawrence (2017), "Teachers adjust, revise, and supplement to meet the needs of their learners. This is one way that online teachers communicate instructively in dialog with their students" (p. 243).
- Lefevre and Cox (2017) investigated learners' preferences related to the timing of feedback provided to multiple-choice questions within technology-based instruction. They found that, while there is existing evidence that delaying feedback following a student's response to multiple-choice questions can lead to an increased future performance, students prefer immediate feedback following their response to multiple-choice questions. They suggest that catering course design to learner preferences is important as it can affect student motivation and engagement.
- Lin, Zheng, and Zhang (2016) examined the relationship between online interactions and learning outcomes for students enrolled in high school-level online language courses at a Midwestern virtual school. Their study focused on how learner-instructor, learner-learner, and learner-content interactions affected students' perceived progress and satisfaction. They found that learner-instructor and learner-content interactions positively affected students' perceived satisfaction, and learner-content interaction affected students' perceived progress.
- As part of their study, Liu and Cavanaugh (2012) investigate the influence teacher comments had on student academic achievement in four algebra classes. The researchers found that teacher comments had a positive and significant effect on student's final scores in Algebra I. The researchers suggest that (a) this finding indicates the importance of instructor feedback for student success in the online courses and that (b) it explains the development of online courses that integrate teacher feedback and student–teacher interaction as central components during the course design.
- Liu and Cavanaugh (2011) investigated the effect of various variables including students' demographic information and the use of the LMS on student science achievement in a K-12 online learning environment. They found that the time students spent in the LMS

positively affected their final score in a high school biology course. The authors also noted that this finding can help direct the creation of more user-friendly LMSs with interfaces that encourage students to spend more time engaging with content delivered via the LMS.

- The purpose of this study was to analyze the "effectiveness of adaptive formative feedback to boost strategic search decisions and performance when students are asked to answer a set of questions in a task-oriented reading situation." Llorens, Cerdan, and Vidal-Abarca (2014) compared automatic feedback that included information about the right answer with feedback that also included the relationship between the students' strategic search decisions and their performance. They found that strategic search decisions feedback improved strategic decisions over right-answer and placebo feedback, which in turn improved question-answering performance.

- In this study, Louwren and Hartnett (2015) sought to address the gap in research related to understanding student engagement in the online and distant learning environments. Specifically, it investigated three key dimensions of student engagement—behavioral, cognitive, and emotional. This study found that students tended to engage (a) behaviorally (i.e., do what was expected of them) with all required activities, (b) cognitively (i.e., students' personal investment in their own learning) in the giving and receiving of feedback and the interest and relevance certain activities generated for learners, and (c) emotionally through the design and facilitation of the activities.

- Mayse (2015) observed 7th grade students completing a series of lessons. Mayse further explored students' thinking and strategies for (1) using curriculum resources for learning, (2) developing thinking and strategies for self-assessing "assessment readiness", and (3) exploring the relationship between resource use and student grade in science, end-of-lesson assessment score, and student learning style. She found (a) that students preferred to use multimedia learning resources compared to notes-based resources, and (b) that use of at least 70% of lesson resources reveal a relationship with higher grades and end-of-lesson scores.

- McLaughlin and Yan (2017) conducted a review of literature on online formative assessment (OFA). According to McLaughlin and Yan (2017) online formative assessment can be delivered via a variety of traditional assessment methods as well as with the help of various programs and software. They note that gains in achievement scores and the development of essential complex cognitive processes, such as self-regulation are a couple benefits of using OFA.

- Means, Toyama, Murphy, and Bakia (2013) conducted a meta-analysis of existing research with the purpose of producing a statistical synthesis of studies contrasting learning outcomes for either fully online or blended learning conditions with those of face-to-face classroom instruction. While they did find that students in online learning environments performed reasonably better than those receiving face-to-face instruction, several practices were not found to be significant moderators of effects in this meta-analysis of web-based online learning, such as the incorporation of instructional elements of computer-based instruction (e.g., online practice opportunities and feedback to learners).

- Means, Toyama, Murphy, Bakia, and Jones (2010) conducted a meta-analysis of existing research with the purpose of providing policy-makers, administrators and educators with research-based guidance about how to implement online learning for K–12 education and teacher preparation. After a review of experimental and quasi-experimental studies contrasting different online learning practices, one key finding was that elements such as video or online quizzes do not appear to influence the amount that students learn in online classes.

- According to Miller (2013), even though existing empirical research indicates little difference in student achievement when rich multimedia is included in an online course, institutions are working to include these elements in the development of online courses. Miller (2013) noted that many existing studies only investigated the presence of these elements, not whether or not they were accessed, so in this study, he investigated student access of three categories of supplemental multimedia in an online course and used access data as a filter for comparing student final grades.
- Oliver and Kellogg (2015) summarized evaluation findings about a high school credit recovery program as solicited by a state-sponsored virtual school in the United States. One key finding that emerged from the research was that there is a role for "pre-programmed, asynchronous scaffolds" in the design of the online course that provide a technical orientation or supports or promote recommended learning strategies.
- Orlando (2016) compared student and faculty perceptions of text, voice, and screencasting feedback provided to online students.
- Using the Adolescent Community of Engagement (ACE) framework as a lens for identifying interactions, Oviatt, Graham, Borup, and Davies (2016) surveyed K-12 independent study students to determine their perception of the need for interaction with a support community while completing an online course. They found that (a) students understood the benefits of interacting with a support community and anticipated receiving support from parents, teachers, and counselors proximate to their location and (b) the perception of the need was significantly greater for students taking a course for credit recovery than those taking the course for the first time.
- In an attempt to understand better how to support student success in online courses, Pazzagalia et al (2016) developed and conducted a study on how students engage with online learning and how student engagement patterns are associated with online course outcomes. Their analyses revealed six engagement patterns among student enrollments in Wisconsin Virtual School online courses. More specifically, they found that students who engaged in their online course for at least 1.5 hours per week typically earned a high enough percentage of possible points to pass the course even though they varied in total time logged in each week.
- Pytash and O'Byrne (2018) examined and synthesized the relevant research related to literacy teaching and learning best practices in virtual, blended, and hybrid environments in K-12 settings. The researchers provide specific recommendations and implications for reading and writing instruction in online learning environments in addition to implications for future research.
- Rector-Aranda and Raider-Roth (2015) engaged in an educational action research study that examined the effectiveness of one online, classroom-based role-play simulation (specifically, the Jewish Court of All Time [JCAT]) that offers middle school students the opportunity to strengthen their agency and voice. This web-mediated simulation is intended to develop middle school students' skills in writing, critical thinking, perspective-taking, historical empathy and communication, and subject literacy in social, historical, and cultural contexts. Rector-Aranda and Raider-Roth (2015) examined how, with the use of JCAT, students use their agency and voice in the online environment and accompanying classroom activities. They found that with the use of this simulation students built knowledge of democratic ideals and were able to employ their agency and voice in both the online and traditional classroom environments.
- In this chapter, Repetto, Spitler, and Cox (2018) present research and essential strategies that allow online programs to better meet the needs of at-risk learners and increase their likelihood of success.
- In this chapter, Rice and Dykman (2018) provide some context for serving students with disabilities online, summarize previous research reviews on this topic, and update research findings since the previous edition of the *Handbook of K12 Online and Blended Learning*

Research. According to Rice and Dykman (2018), these updated findings suggest that students with disabilities are taking coursework online, but gaps persist in the understanding of student outcomes, accommodation and service delivery, and educator preparation.

- Rice (2006) conducted a review of existing literature focused on the current state of K-12 distance education. Several recommendations emerged from this review, including a need to develop valid and reliable tools for identifying interactive qualities in course design and instruction.
- Roberts et al. (2018) described emerging practices related to open educational resources and open learning in K-12 online and blended environments.
- Rozitis (2017) sought to identify specific competencies that are beneficial to online high school teachers who are able to modify their courses. Because most online teachers are not trained as instructional designers, they lack the knowledge of online instructional design. Through his study, Rozitis was able to compile a checklist of instructional design competencies for online high school teachers and questions they should ponder when modifying learning objects.
- Sailors (2014) investigated the effects of adding advance organizers in an online setting on middle school students' self-regulation. Sailors found that, on average, students who received the advance organizer first viewed the online content more frequently than those who did not receive the advance organizer. This suggests that being provided with the advance organizer first actually changed students learning behaviors. Furthermore, students completed a feedback survey about the online unit, and overall, the responses were positive towards the advance organizer and the online units.
- Shattuck (2015) conducted a review of existing research most related to K-12 online course design and online learning with the purpose of informing the K-12 secondary Quality Matters Rubric Committee of themes and emerging issues of the scholarly published research. She identified five themes (professional development, leadership, design-related issues, interaction, and engagement) that emerged from the literature review and listed key findings for each.
- In order to examine the accessibility and appropriateness of online learning for students who have identified disabilities, Smith and Harvey (2014) developed and used a UDL Scan Tool to measure lesson content and alignment with UDL principles, guidelines, and checkpoints. The study focuses on applying this tool to measure lesson content and alignment with UDL principles in several Khan Academy lessons.
- In this report, Speak Up (2014) examines the experiences of learners enrolled in virtual schools or who have enrolled in an online class in addition to their traditional face-to-face classes. Two key findings include the following: (a) students learning online demonstrate greater usage of digital tools, and (b) students desire learning environments that replicate the way that they use digital tools outside of school to communicate and collaborate.
- Tay, Lim, Nair, and Lim (2014) explored the integration of Information Communication Technology (ICT) into the teaching and learning of English, mathematics and science in an elementary school in Singapore. They observed three interesting phenomena: (a) the ICT usage rates for the various subjects (i.e., English, mathematics, and science) peaked at the primary 4 level when the computer ownership program was introduced and declined in primary 5; (b) use of blogs, communication applications, online educational games, and Internet searches were used more frequently than were the learning management systems or videos in the students' learning of English, mathematics and science; and (c) ICT usage rates were also different for the different classes of Primary 5.

- Theunissen and Stubb (2014) described the theoretical basis and development of the iSELF: an Internet-tool for Self-Evaluation and Learner Feedback to stimulate self-directed learning in ubiquitous learning environments. To benefit from possibilities provided by ubiquitous learning, learners need to develop competencies for self-directed learning. iSELF attempted to develop those competencies and contained a card-sort module, a profile module to evaluate core competencies, and a feedback module to suggest learning possibilities. Some findings include the following: (a) the card-sort module and iSELF's playful appearance was highly appreciated by participants; user-friendly operation and the clear, relevant content increased motivation to use it; and (b) the profile module helped learners gain insight in their development in relation to the competencies important for their work. This research was not K-12 focused.
- Tseng, Liang, and Tsai (2014) investigated connections among high school students' perceptions of self-regulated learning (SRL), online information evaluative standards (OIES) and online information searching strategies (OISS) when they were engaged in online academic information searching. They found that students' basic SRL guided their cognitive domain OISS and their advanced SRL guided their metacognitive OISS. Since students lacking skill in using OISS are likely in a competitively disadvantaged position, educators should consider using online tools to help students gain better SRL ability.

- U.S. Department of Education, Office of Educational Technology (2016). In order to realize the transformative power that technology can have on our education system and to provide authentic learning experiences, educators need to use technology effectively in their practice. The National Education Technology Plan (NETP) sets a national vision and plan for learning enabled by technology through building on the work of leading education researchers; district, school, and higher education leaders; classroom teachers; developers; entrepreneurs; and nonprofit organizations. Several recommendations are made in five specific areas: learning, teaching, leadership, assessment, and infrastructure. Two of these key recommendations include the following: (a) states, districts, and post-secondary institutions should take inventory of and align all learning technology resources to intended educational outcomes. Using this inventory, they should document all possible learner pathways to expertise, such as combinations of formal and informal learning, blended learning, and distance learning, and (b) "education stakeholders should develop a standard of learning resource design to help educators select and evaluate learning resources for accessibility and equity of learning experience."

- Vytiacil (2013) explored factors that online elementary educators, online elementary curriculum coordinators and developers, and virtual school administrators believe influence elementary learner engagement in the design of online programs. Each of these three groups were surveyed, and the data was analyzed and categorized by four themes tied to the research questions. Based on the data, the researchers found that the participants' answers supported the inclusion of interactivity, games, and bright colors and did not support primary colors or cartoon figures in the design of online programs.
- Wang, Shannon, and Ross (2013) examined the relationship among students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning settings. They had several key findings: (a) students with previous online learning experiences tended to have more effective learning strategies and had higher levels of motivation in their online courses; (b) when students had higher levels of motivation in their online courses, their levels of technology self-efficacy and course satisfaction increased; and (c) students with higher levels of technology self-efficacy and course satisfaction also earned better final grades.
- Wayer, Crippen, and Dawson (2015) investigated the ways in which four K-12 teachers who had blended learning professional development designed the online portion of their blended learning courses and how these online components were ultimately enacted

with students. One notable finding was that there was more online activity outside the face-to-face classroom, a higher degree of blendedness, more student activity and engagement, and more use of technology as a tool with which to learn was evident in the practice of teachers who had more blended teaching experience.

- Winter et al. (2013) identified areas of ongoing research related to issues and opportunities around computer-based assessments that would be capable of being delivered via the Internet. The assessment issues were chosen because they are having or will have a significant impact. They include the following: (a) new item types, (b) automated item generation, (c) accessibility of computer-delivered tests for students, (d) use of artificial intelligence in scoring, and (e) increased efficiency with accountability testing.
- Rubric creation can be a complex task that requires teachers to "think metacognitively about their goals for a writing assignment, identify the assignment's purpose, weight the importance of various textual features, and align these elements to analytic scores." Woodard, Magifico, and McCarthey (2013) conducted a textual analysis of initiating texts (i.e., rubrics and assignments) that teachers designed for use with a *Scholar* writing and peer response assignment. They found that writers will be more likely to revise their work if teachers can design rubrics that encourage formative feedback. Furthermore, data suggest that teachers need professional development that supports teacher metacognition and an iterative writing process in online writing environments.
- Xiao (2017) explored the interrelationships and interplay between three types of interactions in distance learning: learner–content, learner–instructor, and learner–learner. The author calls for more empirical research that focuses on how distance learners study course materials or content. This research will guide course developers in designing and producing learning resources that will appeal to and engage learners.
- Zheng (2018) explored how a mix of three main online education components – student, instructor, and course design – contribute to students' online learning success in high school English language and literature courses. A few key findings included that (a) all students in online English language learning benefited from project-based assignments; (b) instructor guides and other text-based learning resources helped increase student success; and (c) "giving students autonomy in their own learning, promoting discussions and feedback exchange, and strengthening students' sense of audience and authorship were of vital importance for students' learning."
- Zheng, Lin, Hsu (2018) explored and synthesized research related to K-12 online world-language learning that focused on course effectiveness and challenges surrounding the maintenance of quality online world language course offerings.

From iNACOL Standards for Quality Online Courses, 2011

A. **Content**
    1. Academic Content Standards and Assessments

    2. Course Overview and Introduction
    3. Legal and Acceptable Use Policies
    4. Instructor Resources

B. Instructional Design
    1. Instructional and Audience Analysis
    2. Course, Unit, and Lesson Design
    3. Instructional Strategies and Activities
    4. Communication and Interaction
    5. Resources and Materials

C. Student Assessment
    1. Evaluation Strategies
    2. Feedback
    3. Assessment Resources and Materials

D. Technology
    1. Course Architecture
    2. User Interface
    3. Technology Requirements and Interoperability
    4. Accessibility
    5. Data Security

E. Course Evaluation and Support
    1. Assessing Course Effectiveness
    2. Course Updates
    3. Certification
    4. Instructor and Student Support

From The Quality Matters K-12 Secondary Rubric, Fourth Edition, 2016

General Standard 1: Course Overview and Introduction
General Standard 2: Learning Objectives (Competencies)
General Standard 3: Assessment and Measurement
General Standard 4: Instructional Materials
General Standard 5: Course Activities and Learner Interaction
General Standard 6: Course Technology

General Standard 7: Learner Support
General Standard 8: Accessibility and Usability

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	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
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Appendix

Arslan-Ari, I. (2017). Learning from instructional animations: How does prior knowledge mediate the effect of visual cues? *Journal of Computer Assisted Learning, 34,* 140–149.
[Author-provided abstract] – The purpose of this study was to investigate the effects of cueing and prior knowledge on learning and mental effort of students studying an animation with narration. This study employed a 2 (no cueing vs. visual cueing) × 2 (low vs. high prior knowledge) between-subjects factorial design. The results revealed a significant interaction effect between prior knowledge and cueing on learning. Low prior knowledge learners had higher scores after studying an instructional animation with visual cues, compared to those who studied the same instructional animation without visual cues. Conversely, when cues were not provided, high prior knowledge learners outperformed those high prior knowledge learners who studied with the cued version of an instructional animation. These results indicated that the effects of cueing in an instructional animation change depending on the learners' level of prior knowledge. Specifically, low prior knowledge learners benefited more when visual cues were provided, whereas cues did not facilitate learning for high prior knowledge learners.

Adelstein, D., & Barbour, M. K. (2016). Building better courses: Examining the content validity of the iNACOL National Standards for Quality Online Courses. *Journal of Online Learning Research, 2*(1), 41-73.
[Author-provided abstract] – In 2011, the International Association for K-12 Online Learning released the second iteration of the *National Standards for Quality Online Courses*. These standards have been used by numerous institutions and states around the country to help design and create K-12 online courses. However, there has been no reported research on the validity of the standards or the accompanying rubric. This study compares all elements under the five main standards to contemporary K-12 or higher education online course literature. The research concludes with suggested changes and additions, as well as an explanation as to how the research connects to a larger study on K-12 online course design.

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)
[Author-provided abstract] – The purpose of this study was to explore the use of instructional videos in K - 12 classrooms. This study sought to determine how often the use of instructional videos occurred in K-12 classrooms, how the instructional videos were used, teachers' perceptions of the advantages and disadvantages of using instructional videos, and the frequency with which the cognitive theory of multimedia learning recommendations were included in the design of the videos that were being used. A mixed-method study was used to answer the research questions. The superintendents at two different school districts in southwestern Pennsylvania distributed an online, researcher-created survey via a mass e-mail system. A total of 324 classroom teachers were invited to participate in the study, and 73 teachers responded to the survey creating a 23 % response rate. Based on the findings, 85 % of the K-12 educators who responded used instructional video technology for educational purposes. The frequency of use results indicated that the teachers used instructional videos frequently and maintained a collection of different video titles. Teachers reported using instructional videos to reinforce, motivate, meet student needs, provide authentic content, and demonstrate. Advantages to using instructional videos included maximize instructional time, teacher and student control, multi-modal instruction, and motivation. Teachers reported the following disadvantages to using instructional videos: lack of access, full group viewing, lack of interaction, and learning barriers. The cognitive theory of multimedia learning is a theory of how people learn from multimedia messages and

defines specific design features that, based on empirical research, improve learning. This study investigated the use of the design principles recommended by the cognitive theory of multimedia learning. Although the principles of voice, politeness, pre-training, personalization, and signaling were present the majority of the time in the instructional videos used by K - 12 teachers, the principles of redundancy, spatial contiguity, temporal contiguity, coherence, and segmentation were used less frequently.

Barbour, M. K. (2007). Principles of effective web-based content for secondary school students: Teacher and developer perceptions. *Journal of Distance Education, 21*(3), 93-114.
[Author-provided abstract] – In this article, I describe findings from a study of the perceptions of course developers and electronic teachers on the principles of effective asynchronous web-based content design for secondary school students. Through interviews, participants' perceptions of various web-based components and instructional strategies and the effectiveness of both based upon the experiences of the participants were investigated in a virtual high school context for the purpose of generating a list of guidelines that future course developers might utilize.

Barbour, M. K. (2018). Examining online research in higher education: What can we replicate in K-12? Lansing, MI: Michigan Virtual University. Retrieved from https://mvlri.org/research/publications/examining-online-research-in-higher-education-what-can-we-replicate-in-k-12/
[Author-provided abstract] – One of the best ways for practitioners and scholars to understand what is already known in a field is to undertake a review of the existing literature. The existing literature related to K-12 distance, online, and blended learning is still developing. What has been published is heavy on the practitioner experience – either the direct telling of the experience by the practitioner or through the use of researcher surveys designed to capture the perceptions of the practitioners' experience. Further, the available research rarely makes use of validated instruments or established theoretical and conceptual frameworks to guide their studies. However, research into distance, online, and blended learning with adult populations has a much richer and longstanding history. This report seeks to describe a series of studies that have been conducted with adult populations that may be of particular interest to researchers and practitioners in the K-12 distance, online, and blended environments.

Barbour, M. K., & Adelstein, D. (2013). High-school students' perceptions of effective online course design. *The Morning Watch, 41*(1-2), 56-65.
[Author-provided abstract] – The purpose of the study reported on in this paper was to examine student perceptions of effective online course design in the CDLI. Analysis of interviews and focus groups with six CDLI students resulted in the identification of four categories of perceptions of the course design. These categories pointed to a lack of use of asynchronous web-based content; the need for multimedia; the need for content beyond the text and the need for self-assessment tools. We compared these four categories of students' perceptions with seven recommendations for designing online courses identified through a study of the perceptions of teachers, and administrators by Barbour (2005b; 2005c; 2007). There was no congruence between recommendations 4 and 7 and any of the results of this study. All other recommendations were supported by students' perceptions. The student perceptions provide some insights for online course design including more careful consideration of the type of content to which students are given access; provision of notes that explain content; the need for content in different formats and that explains concepts in different ways, incorporation of links, videos and pictures. Although most of students' comments were referenced in the recommendations, one category of comments (i.e., regarding self-assessment tools) was not. Students appreciated

having tools that they could use to check their understanding, keep them on track, and reinforce their learning. The addition of such tools to online course design may represent a recommendation that could be added to the seven already proposed.

Barbour, M. K., Clark, T., DeBruler, K., & Bruno, J. A. (2014). *Evaluation and approval constructs for online and blended courses and providers.* Lansing, MI: Michigan Virtual Learning Research Institute at MVU. Retrieved from http://media.mivu.org/institute/pdf/eval_constructs.pdf
[Author-provided abstract] – A new report released by the Michigan Virtual Learning Research Institute™ at Michigan Virtual examines existing policies and practices related to the evaluation and approval of online and blended learning in the 50 states as well as relevant international examples, such as those arising from Canada's province-based K-12 education systems. Entitled Evaluation and Approval Constructs for Online and Blended Courses and Providers, the report leverages policy examples from Georgia; Maryland; California; Washington; Minnesota; Colorado; and British Columbia, Canada; to inform cyber, online, and blended provider evaluations in the state of Michigan. The report was written by Dr. Michael Barbour of Sacred Heart University, Dr. Tom Clark of TA Consulting, and Dr. Kristen DeBruler and Justin Bruno of Michigan Virtual. Based on their policy analysis, the authors identified five areas for evaluating and approving online and blended course providers. The areas are intended as a starting point for states to better understand their own processes and to identify strengths, weaknesses, and areas of excellent coverage while also discovering possible areas to omit. The report concludes with potential models and key guidelines states might consider in order to ensure a quality online education is available for all of their pupils. "As states continue to adopt and refine their policies governing online and blended learning, awareness of what is occurring in other states and reflection of the reasons and results of such policy is critical," says Dr. Joe Freidhoff, Executive Director of MVLRI. "This report not only illuminates a variety of enacted state-level policies regarding online and blended learning, but does so through a framework the helps states consider different dimensional aspects that are important in the evaluation process."

Barbour, M. K., McLaren, A., & Zhang, L. (2012). It's not that tough: Students speak about their online learning experiences. *Turkish Online Journal of Distance Education, 13*(2), 226-241.
[Author-provided abstract] – K-12 online learning is growing in Canada and elsewhere in the world. However, the vast majority of literature is focused on practitioners and not on systematic inquiry. Even the limited published research has largely excluded the perspectives of students engaged in virtual schooling. This study examines secondary student perceptions of components of virtual schooling that were beneficial and challenging. Students largely enjoyed their virtual school courses and found the synchronous classes, the technology, and the ability to control their own learning as positive aspects of their experience. Students also found the lack of a sense of community, working during their asynchronous class time, and the asynchronous course content to be challenging and made suggestions for improvement to each, along with advice to future virtual school students.

Barbour, M. K., Morrison, J., & Adelstein, D. (2014). The forgotten teachers in K-12 online learning: Examining the perceptions of teachers who develop K-12 online courses. *International Journal of Online Pedagogy and Course Design, 4*(3), 18-33.
[Author-provided abstract] – Like many K-12 online learning programs, the Illinois Virtual High School (IVHS) began by utilizing vendor content to populate its online courses. In its fourth year, the IVHS began a concerted effort to design more of its own online course content internally. The

aim of this study was to examine the nature of the support needed and application of tools used by IVHS course developers. The data consisted of a two-part, web-based survey and telephone interviews that were analyzed using descriptive statistics and inductive analysis. The results showed these developers had a strong desire to use interactive elements in their courses, as well as to work in cooperative teams. Further, developers were opposed to using a forced template but indicated a need for general structural guidance and additional professional development. Finally, developers recommended that subject matter teacher-developers and multimedia specialists be split into two separate roles and these individuals work together as a part of a design team. Further research should be conducted on the intended use of technology tools requested.

Barbour, M. K., & Plough, C. (2012). Odyssey of the mind: Social networking in a cyber school. *International Review of Research in Open and Distance Learning, 13*(3), 1-18.
[Author-provided abstract] – K-12 online learning and cyber charter schools have grown at a tremendous rate over the past decade. At the same time, these online programs have struggled to provide the social spaces where students can interact that K-12 schools are traditionally able to provide. Social networking presents a unique opportunity to provide these kinds of social interactions in an online environment. In this article, we trace the development and use of social networking at one cyber charter school to extend the space for online instruction and provide opportunities for social interaction that online schools are often unable to provide.

Basham, J. D., Blackorby, J., Stahl, S., & Zhang, L. (2018). Universal Design for Learning. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Universal Design for Learning (UDL) as articulated by researchers at CAST has been in the lexicon of education for nearly 20 years (Orkwis & McLane, 1998; Pisha & Coyne, 2001; Hitchcock, Meyer, Rose, & Jackson, 2002). Originally formulated as an approach for ensuring the effective inclusion of students with disabilities and diverse learning needs in general education classrooms, UDL has steadily gained traction as a framework for addressing the variability inherent in all learners. UDL promotes educational systems that offer multiple ways of engaging students, representing information, and demonstrations of mastery, and is most recently energized as a fundamental framework for ensuring learning environments responsive to the needs of all students in the Every Students Succeeds Act (ESSA) of 2015. This chapter explores the role of UDL as a framework for inclusive K-12 learning design across all four aspects of the curriculum — its goals, assessments, instructional practice and materials — and how the unique capabilities of online learning can actualize UDL in practice. In this chapter, we highlight some key issues within the evolving landscape of elementary and secondary education, in general, and the expanding impact of online learning, in particular. Some of the primary issues discussed include:
- The variability of K-12 students engaged in online learning, their abilities/disabilities, their native languages and cultures of origin, and their prior learning experiences is steadily increasing.
- Elementary and secondary students with higher levels of variability enrolled in online learning are demonstrably less successful than their brick and mortar counterparts.

- Online curricula including goals, assessments, methods, and materials designed for a hypothetical "average" student are often insufficient to address the variability of today's learners.
- On a whole, online learning can provide an efficient and effective vehicle for individualizing learning trajectories, based on real-time student progress data that leads to student-centered decision-making.
- Online learning offers unique affordances for supporting and extending UDL aligned implementation practices.

We detail how these factors present significant opportunities and challenges for educators, students, and families and how addressing these changes by applying UDL-aligned policies, curriculum design, and instructional practices can proactively prepare learning environments for the new reality of K-12 education and online education.

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 https://kuscholarworks.ku.edu/handle/1808/22627
[Author-provided abstract] – Equity Matters: Digital and Online Learning for Students with Disabilities presents some preliminary understandings from a number of Center research projects and experiences to inform the various stakeholder groups of the emerging trends, outcomes, challenges, and promising practices in this developing field of practice. Special education was founded on, and continues to operate as, a collaboration among students with disabilities, families, professionals, and policymakers. In addition, the digital education industry's growing, major influence in this realm of education makes collaboration with this sector critical. The overall goal of this publication is to spark discussion, reflection, and debate, with a focus on enhancing understanding within all participant groups, leading to the design of more responsive systems, practices, and policy to support enhanced outcomes for all learners—especially students with disabilities.

Blaine, A. M. (2017). Interaction and presence in the secondary online classroom (Order No. 10684770). Available from ProQuest Dissertations & Theses A&I. (2008509399).
[Author-provided abstract] – Interaction has been shown to be a key component to the success of online and blended learning, so it is crucial to understand how teachers and students perceive the interaction taking place in online and blended K-12 courses. The following study is part of a larger study of the effectiveness and evaluation of the New York State Virtual AP Program, which used a mixed-methods approach to understand the implementation of online and blended AP courses throughout districts across New York State. Grantees of the Virtual AP program included large individual districts, small individual districts, BOCES, and BOCES consortia, which combined to offer courses in a broad region of the state. Within that study, we conducted focus group interviews with students and teachers to inquire into the interaction experiences of both groups of stakeholders. I analyzed the transcripts of those focus group interviews using a qualitative content analysis coding and analysis process. Results show that students and teachers had very different perceptions of the quality and frequency of interaction within the Virtual AP courses, with teachers largely having a positive outlook on the interaction within the courses and students having a prevailingly negative view of the interaction between students and teachers in the course. I discuss the significance of the findings in this study using the community of inquiry framework, focusing specifically on the teaching and social presence within the courses. In both cases, students reported that there was less community and less teacher guidance than was desirable for them, while teachers either reported that the opposite was true or expressed their thoughts in alternate ways. Though this study is limited in a number of ways, results of this qualitative content analysis coding scheme shows

that we can do more to communicate both the expectations and the process of communication between students and teachers in online and blended coursework, especially at the K-12 level. I also suggest one possible revision to the community of inquiry framework based on the results of this study.

Borup, J. (2016). Teacher perceptions of learner-learner engagement at a cyber high school. *The International Review of Research in Open and Distributed Learning, 17*(3).
[Author-provided abstract] – Distance education has historically contained little or no learner–learner interactions. Currently the Internet allows for unprecedented levels of learner–learner interaction and has the potential to transform how students learn online. However, many courses offered online focus more on flexibility and independence than on interaction and collaboration. Often it is up to the teacher to decide how much learner–learner interaction their courses contain. However, little research has examined how online high school teachers perceive, value, and facilitate learner–learner interactions. This case study used teacher surveys and interviews at a full-time online charter high school to examine teacher perceptions of learner–learner interactions. The analysis identified four student behaviors that positively impact student engagement and learning: befriending, motivating, instructing, and collaborating. Teachers also identified several drawbacks to learner–learner interactions such as bullying and cheating. Furthermore, there appeared to be tension between providing for students' individual needs and requiring collaborative learning opportunities.

Borup, J. A. (2013). Types, Subjects, and Purposes of K-12 Online Learning Interaction. All Theses and Dissertations. Paper 3711. http://scholarsarchive.byu.edu/etd/3711
[Author-provided abstract] – Although K-12 online learning has experienced exceptional growth, research in the area has lagged behind. This dissertation addressed this gap in the literature using a multiple-article dissertation format. The first article used survey data from two online English courses at the Open High School of Utah (OHSU) to examine students' reported interactions with content, peers, and instructors. The large majority of students viewed all investigated types of interaction as educational and motivational. 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. The second article examined learner-parent and parent-instructor interactions within the same context. Similar to the first article, survey data was used to measure parents' and students' perceived quantity and quality of parental interactions with students and teachers. It was found that generally students and parents viewed parent–instructor and learner–parent interactions as motivational. Students viewed learner–parent interaction as significantly more motivational than did their parents. The quantity of reported parental interactions tended to negatively correlate with course outcomes. These negative correlations may be the result of parents' tendency to increase interaction levels following poor student performance and may not reflect the actual impact of parental interactions on individual student learning. When discussing the results in the second article, the claim was made that future research should look beyond the quantity of interactions and develop a theoretical framework that identifies and categorizes the roles of individuals in improving student outcomes. The third article of this dissertation presents such a framework that can help guide K-12 online research and design. The Adolescent Community of Engagement (ACE) framework consists of four main constructs that make up a K-12 online learning

community. The first three (student engagement, teacher engagement, and peer engagement) build on previously established online frameworks that originally emerged from higher education contexts. In addition, the ACE framework recognizes the role of parents in their child's learning and introduces a fourth construct, parent engagement, which builds on two previously established face-to-face frameworks.

Borup, J., West, R.E., Graham, C.R. & Davies, R.S. (2014). The adolescent Community of Engagement Framework: a lens for research on K-12 online learning. *Journal of Technology and Teacher Education, 22*(1), 107-129. Waynesville, NC, USA: Society for Information Technology & Teacher Education. Retrieved from https://www.academia.edu/attachments/53684518/download_file?st=MTUyMzU1MzM4Niw2Ny4yMzQuNS4xNjQsNTcxMTQyMTQ%3D&s=work_strip&ct=MTUyMzU1MzM4OCwxNTIzNTUzMzk3LDU3MTE0MjE0
[Author-provided abstract] – This paper describes the Adolescent Community of Engagement (ACE) framework as a lens to guide research and design in adolescent online learning environments. Several online learning frameworks have emerged from higher education contexts, but these frameworks do not explicitly address the unique student and environmental characteristics of the adolescent online learning environment. The ACE framework consists of four main constructs that make up an adolescent online learning community. The first three (student engagement, teacher engagement, and peer engagement) build on previously established online frameworks that originally emerged from higher education contexts. In addition, the ACE framework recognizes the role of parents in their children's learning and introduces a fourth construct, parent engagement, which builds on two previously established face-to-face frameworks.

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.
[Author-provided abstract] – Little research has examined the critical components of successful K-12 online schools, due in part to the theoretical focus of current frameworks on higher education rather than characteristics of K-12 online learners and environments. Using K-12 online research, this paper examined *teaching presence* as explained by the Community of Inquiry framework and identified additional teacher roles that needed stronger emphasis. We termed the new construct *teacher engagement*. Teacher engagement was shown to be helpful in describing and identifying effective teacher practices at the Open High School of Utah (OHSU), a successful online charter school. Through a series of 22 interviews with over half of the OHSU faculty, 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*.

Boyer, B., & Kelly, R. (2018). K-12 online and blended learning, school libraries, and school librarians. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Despite the proliferation of K-12 online learning options and the strides school libraries have made toward virtualization of resources and online information fluency instruction, there is not a significant body of research specific to libraries in K-12 online

environments. The stage is set, however, for this research to occur. The shifting library landscape, evidence of the connection of school libraries to student achievement, the expanded instructional technology and curation roles of librarians, and the foundational instructional design concepts aligned to the incorporation of libraries in digital learning environments all support the necessity for research in this area. This chapter is updated from the previous one published in 2014 and includes new information related to expanding school librarian roles, open education resources, and Future Ready Schools. Research discussed in this chapter includes studies exploring the need for and formats of embedded library services, as well as expanding roles for librarians in blended and online environments. This relatively small but emerging body of literature suggests multiple paths for new research in this field.

Cavanaugh, C. (2013). Student achievement in elementary and high school. In M. G. Moore (Ed.), *Handbook of distance education* (3rd ed.) (pp. 157-168). New York: Routledge. Retrieved from http://www.academia.edu/2337539/Student_Achievement_in_Elementary_and_High_School
[Author-provided abstract] – This chapter is a review of research on teaching and learning online by children in elementary and high schools, commonly referred to in the United States as K–12, that is, from kindergarten to high school graduation.

Cavanaugh, C., Maor, D., & McCarthy, A. (2018). Mobile learning. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Mobile devices have been the focus in many nations and internationally as part of efforts to achieve greater literacy and numeracy among students as core goals and increasingly in support of non-cognitive skills and the flexible and mastery learning pathways being adopted in schools. Research has shown a strong link between Internet usage, the spread of broadband in a country, and its GDP. Those countries that are the highest performing educationally already integrate mobile devices in their education. This paper synthesizes empirical research on mobile devices from 2010 to 2017 in K-12 schools by focusing on studies that demonstrate emerging themes in this area. It is clear that the pedagogy needed to be effective with mobile learning has to be student-centered with the aim of personalizing the learning experience, including rethinking assessment of learning and design of learning spaces. Research found that students could become collaborators in designing their own learning process. As students become independent learners, they become more prepared in the skills needed for college and in their careers.

Cavanaugh, C., Repetto, J., Wayer, N., & Spitler, C. (2013). Online learning for students with disabilities: A framework for success. *Journal of Special Education Technology, 28*(1), 1-8.
[Author-provided abstract] – Students with disabilities increasingly are choosing online learning experiences. Research-based interventions need to be applied to online learning to keep these students engaged in school. From the literature on students with disabilities who are at risk, we have identified five areas of impact that can contribute to student engagement. These "5 Cs" are learner *control*, a flexible and rigorous *curriculum*, a safe *climate*, a *caring community*, and *connection* to students as individuals and their future goals. The 5 Cs are discussed along with their application to online learning environments, and examples of current online programs employing these strategies are given.

Chiu, C.-H. (2013). Verification of theory based design features for designing online instruction for students with learning disabilities and other struggling learners. https://kuscholarworks.ku.edu/bitstream/handle/1808/15127/CHIU_ku-0099D_12758_DATA_1.pdf?sequence=1&isAllowed=y: Unpublished dissertation.

[Author-provided abstract] – This study involved a comprehensive review of the literature on multimedia design to identify theory based design principles applicable to online instruction. Seven theories were reviewed. They included Cultural Historical Activity Theory (CHAT), Human Computer Interaction (HCI), Cognitive Theory of Multimedia Learning (CTML), Cognitive Load Theory (CLT), Universal Design for Learning (UDL), Kosslyn's (2007) eight Psychological Principles, and Wicken's (1999) thirteen Principles of Display Design. The focus was on all learners including those with disabilities. Forty theory based design principles, supported by research, were verified through Q methodology model (Brown, 1980; McKeown & Thomas, 1988). Three panels of experts in 1) multimedia theory, 2) design/development of online instruction for all K12, and 3) design/development of online instruction for students with learning disabilities rated the importance of each principle. The Q-sort involved sorting along the dimensions of a quasinormal distribution scale. This prevented the experts from placing a disproportionate number of principles in any single category. The response rate for experts was 81.1%. An Analysis of Variance was carried out to ascertain differences among the rating of experts by group and in combination and followed by a Post-Hoc Test. The result showed that only one principle had the p value = .042 between Group 1 Multimedia and Group 2 All K-12 Learners at the $p < .05$ significant level. The implications are that there was little differentiation between the focus on all students and the focus on students with learning disabilities. A correlation analysis was conducted with the correlation matrix indicating only six observed relationships were very strong. There were three principles with the most positive correlation coefficients ranging from $r = .529$ to $r = .554$. In contrast, there were three negative correlations coefficient between principles, ranging from $r = .462$ to $r = .503$. These results imply that there was considerable independence among the principles. The factor analysis resulted in five factors being identified i.e., Factor 1: Learner variability, Factor 2: Cognitive strategies, Factor 3: Prerequisites for teaching/learning, Factor 4: Context for learning, and Factor 5: Media presentation.

Czerkawski, B. C. (2015). Networked learning: design considerations for online instructors. *Interactive Learning Environments*, 1-14.
[Author-provided abstract] – The considerable increase in web-based knowledge networks in the past two decades is strongly influencing learning environments. Learning entails information retrieval, use, communication, and production, and is strongly enriched by socially mediated discussions, debates, and collaborative activities. It is becoming critical for educators to better understand and become skilled at utilizing online networks and their affordances to improve the quality of learning experiences for their students. Along the same lines, networked learning could be seen as an effort to respond to the advances in electronic networks by putting the focus on the students and paying close attention to their educational needs, learning preferences, and social interactions. The aim of this paper is to review and synthesize empirical research on networked learning for online higher education courses and offer suggestions for future studies based on the gaps found in the literature. Implications of networked learning for instructional design are also discussed.

Czerkawski, B. C., & Lyman, E. W. (2016). An instructional design framework for fostering student engagement in online learning environments. *Techtrends, 60*(6), 532-539.

[Author-provided abstract] – Many approaches, models, and frameworks exist when designing quality online learning environments. These approaches assist and guide instructional designers through the process of analysis, design, development, implementation, and evaluation of instructional processes. Some of these frameworks are concerned with student participation, some with motivation and some with student success. All these variables affect active participation and engagement of the student to some degree, but the main concern is how to design online instruction conducive to high levels of engagement. Therefore, this paper presents an instructional design framework along with a set of strategies that could be used to foster learner engagement in online learning. This framework is the result of an extensive literature review on student engagement and is aimed at summarizing the results in a cohesive way for online instructors. For e-learning design and development to be successful online designers and instructors need better approaches to increasing student engagement and its authors hope the proposed framework provides such an approach.

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
[Author-provided abstract] – This study addressed the argument that online courses rarely use discussion strategies that are specifically designed and constructed for soliciting learners' cognitive presence and higher-order thinking. Prompted by this argument, the authors conducted a meta-analysis of the empirical studies that examined the effectiveness of discussion strategies in online learning. More specifically, the meta-analysis was to reveal whether learners perform better in a strategic discussion session than when they engage in a conventional online discussion and under what conditions the learners' differences in performance are greater or smaller. Furthermore, the investigation examined the extent to which the online discussion strategies that included instructional elements and the pedagogy recommended by the literature make a difference in learners' performance.

Davis, N., Mackey, J., & Dabner, N. (2018). Understanding changes in school culture. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – School culture can be conceptualized in the phrase "the way we do things around here," which includes the roles of the teacher and students as well as others with whom they interact such as administrators and parents. The behavior of participants in the ecosystems of education has changed with the evolution of education and of digital technologies, particularly virtual schooling. This chapter reviews such changes, moving from a traditional classroom within which a teacher worked in relative isolation, into innovative models of schooling where teaching is more collaborative and many partnerships extend beyond school campuses. When viewed in a global perspective, the influences of interacting ecosystems are far-reaching, with the most influential being the closest to the learners. Mapping a class of a virtual school within Davis' (2018a) global arena provides a better understanding of the changes in school cultures with the emergence of virtual schooling.

de los Arcos, B., Farrow, R., Pitt, R., Weller, M., & McAndrew, P. (2016). Personalising learning through adaptation: Evidence from a global survey of K-12 teachers' perceptions of their use of open educational resources. *Journal of Online Learning Research, 2*(1), 23-40. Association for the Advancement of Computing in Education (AACE).
[Author-provided abstract] – It has been suggested that open educational resources (OER) can lower cost and lead to greater flexibility; however, while there has been significant investment in opening up content, there have been few studies looking at how these resources are perceived by those who might use them. This quantitative article contributes to fill a gap in our knowledge of how K-12 educators teaching in face-to-face, online, and blended contexts currently think about and use OER. It is part of the research carried out by the Hewlett-funded OER Research Hub (OERRH) Project to examine the impact of OER on teaching and learning practices. The authors report findings from a survey of 600+ schoolteachers who answered a set of attitudinal and behavioural questions in relation to how they use OER, what types of OER they use, and what influences their selection of content; in addition to the purpose, challenges, and perceived impact of OER in the K-12 classroom. The research highlights how OER allow schoolteachers to personalise learning through adaptation and argues that mainstreaming OER in K-12 education is not only a matter of raising awareness but of changing teachers' habits.

Dikkers, A. G. (2018). Social interaction in K-12 online learning. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Connecting Moore's (1989, 1993) foundational understandings of interaction, transactional distance, and pedagogy with an awareness of the importance of social learning (Vygotsky, 1978, 1986; Wenger, 1998) and social presence (Whiteside, Garrett Dikkers, & Swan, 2017) brings us to the focus of this chapter – social interaction in online learning. Although some may see social interaction as being separated from content interaction, for the purposes of this chapter, social interaction may truly be social in nature or interaction with peers or instructors that is content-connected. For the author, social equals the social in social presence, that of community, connection, awareness of self, and others.

Drexler, W. (2018). Personal learning environments in K-12. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Personalization is a trending topic in educational technology. The definition is so broad, it has become a catch phrase to describe many different transformation initiatives and promote new tools. While the concept of personalization as it relates to mastery and student data is gaining traction, the actual application of student-constructed personal learning environments (PLEs) remains limited in the K-12 literature and practice. This chapter explores existing research on PLEs and networked learning in children and adults. Research-based examples in K-12 are presented along with the processes required to support student-constructed personal learning environments. Implications for teaching practice, learning, and education policy are shared along with a call for additional research specific to K-12 students.

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14*(1), 4-58.

[Author-provided abstract] – Many students are being left behind by an educational system that some people believe is in crisis. Improving educational outcomes will require efforts on many fronts, but a central premise of this monograph is that one part of a solution involves helping students to better regulate their learning through the use of effective learning techniques. Fortunately, cognitive and educational psychologists have been developing and evaluating easy-to-use learning techniques that could help students achieve their learning goals. In this monograph, we discuss 10 learning techniques in detail and offer recommendations about their relative utility. We selected techniques that were expected to be relatively easy to use and hence could be adopted by many students. Also, some techniques (e.g., highlighting and rereading) were selected because students report relying heavily on them, which makes it especially important to examine how well they work. The techniques include elaborative interrogation, self-explanation, summarization, highlighting (or underlining), the keyword mnemonic, imagery use for text learning, rereading, practice testing, distributed practice, and interleaved practice. To offer recommendations about the relative utility of these techniques, we evaluated whether their benefits generalize across four categories of variables: learning conditions, student characteristics, materials, and criterion tasks. Learning conditions include aspects of the learning environment in which the technique is implemented, such as whether a student studies alone or with a group. Student characteristics include variables such as age, ability, and level of prior knowledge. Materials vary from simple concepts to mathematical problems to complicated science texts. Criterion tasks include different outcome measures that are relevant to student achievement, such as those tapping memory, problem solving, and comprehension. We attempted to provide thorough reviews for each technique, so this monograph is rather lengthy. However, we also wrote the monograph in a modular fashion, so it is easy to use. In particular, each review is divided into the following sections: 1a. General description of the technique and why it should work, 1b. How general are the effects of this technique? 2a. Learning conditions, 2b. Student characteristics, 2c. Materials, 2d. Criterion tasks, 3a. Effects in representative educational contexts, 3b. Issues for implementation, and 3c. Overall assessment. The review for each technique can be read independently of the others, and particular variables of interest can be easily compared across techniques. To foreshadow our final recommendations, the techniques vary widely with respect to their generalizability and promise for improving student learning. Practice testing and distributed practice received high utility assessments because they benefit learners of different ages and abilities and have been shown to boost students' performance across many criterion tasks and even in educational contexts. Elaborative interrogation, self-explanation, and interleaved practice received moderate utility assessments. The benefits of these techniques do generalize across some variables, yet despite their promise, they fell short of a high utility assessment because the evidence for their efficacy is limited. For instance, elaborative interrogation and self-explanation have not been adequately evaluated in educational contexts, and the benefits of interleaving have just begun to be systematically explored, so the ultimate effectiveness of these techniques is currently unknown. Nevertheless, the techniques that received moderate-utility ratings show enough promise for us to recommend their use in appropriate situations, which we describe in detail within the review of each technique. Five techniques received a low utility assessment: summarization, highlighting, the keyword mnemonic, imagery use for text learning, and rereading. These techniques were rated as low utility for numerous reasons. Summarization and imagery use for text learning have been shown to help some students on some criterion tasks, yet the conditions under which these techniques produce benefits are limited, and much research is still needed to fully explore their overall effectiveness. The keyword mnemonic is difficult to implement in some contexts, and it appears to benefit students for a limited number of materials and for short retention intervals. Most students report rereading

and highlighting, yet these techniques do not consistently boost students' performance, so other techniques should be used in their place (e.g., practice testing instead of rereading). Our hope is that this monograph will foster improvements in student learning, not only by showcasing which learning techniques are likely to have the most generalizable effects but also by encouraging researchers to continue investigating the most promising techniques. Accordingly, in our closing remarks, we discuss some issues for how these techniques could be implemented by teachers and students, and we highlight directions for future research.

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
[Author-provided abstract] – Digital game-based learning, especially massively multiplayer online games, has been touted for its potential to promote student motivation and complex problem-solving competency development. However, current evidence is limited to anecdotal studies. The purpose of this empirical investigation is to examine the complex interplay between learners' motivation, engagement, and complex problem-solving outcomes during game-based learning. A theoretical model is offered that explicates the dynamic interrelationships among learners' problem representation, motivation (i.e., interest, competence, autonomy, relatedness, self-determination, and self-efficacy), and engagement. Findings of this study suggest that learners' motivation determine their engagement during gameplay, which in turn determines their development of complex problem-solving competencies. Findings also suggest that learners' motivation, engagement, and problem-solving performance are greatly impacted by the nature and the design of game tasks. The implications of this study are discussed in detail for designing effective game-based learning environments to facilitate learner engagement and complex problem-solving competencies.

Ferdig, R. E. (2010). Understanding the role and applicability of K-12 online learning to support student dropout recovery efforts. Lansing, MI: Michigan Virtual University. Retrieved from https://mvlri.org/wp-content/uploads/2017/09/DropoutRecoveryEfforts.pdf
[Author-provided abstract] – Recent, daunting reports suggest that the true high school graduation rate is substantially lower than the official rate and that it has been declining for the last 40 years. These findings suggest that one-third of all public high school students and nearly one-half of minority students fail to complete their high school experience. K-12 online learning, a method of delivering teaching and learning through electronic means, has been touted as a potential solution for reaching students who might be considered lost to the traditional education system. This report describes what we currently know about high school dropout and retention, what solutions have been proposed, and how online learning might impact the retention rate. Drawing on existing work from Michigan Virtual School, data are provided to discuss performance of credit recovery students and conditions under which such students succeed and struggle in online learning environments. Results suggest that online learning can impact retention and dropout recovery; however, simply replicating existing face-to-face environments often replicates the negative behavioral, affective, and cognitive outcomes of at-risk students.

Gaytan, J., & McEwen, B. C. (2007). Effective online instructional and assessment strategies. *The American Journal of Distance Education, 21*(3), 117-132. Retrieved from http://onlinelearningassessment.pbworks.com/f/gaytan.pdf

[Author-provided abstract] – The purpose of this study was to better understand the instructional and assessment strategies that are most effective in the online learning environment. Faculty and students identified several strategies for maintaining instructional quality in the online environment, including the importance of using a variety of instructional methods to appeal to various learning styles and building an interactive and cohesive learning environment that includes group work. Online assessment strategies include having a wide variety of clearly explained assignments on a regular basis and providing meaningful and timely feedback to students regarding the quality of their work. Effective assessment techniques include projects, portfolios, self-assessments, peer evaluations, and weekly assignments with immediate feedback. The role of meaningful feedback cannot be overemphasized. (Contains 5 tables.)

Golden, S. (2014). Impact of communication modes on discussion in K-12 online education. Retrieved from https://etd.ohiolink.edu/!etd.send_file?accession=kent1405679223&disposition=inline
[Author-provided abstract] – With the growth of online education, decision makers inside and outside of academia raise questions about the methodologies involved with this approach to learning. This study explores the views of high school students who attend a K–12 school regarding the effect of communication and delivery modes in problem-solving discussions. Participants are given scenarios to discuss in a peer-group environment in a face-to-face setting, synchronous audio conferencing, and asynchronous discussion forums. From student surveys, individual interviews, researcher evaluation, and transcription analysis a deeper understanding of how the different modes influence interaction among students were explored. 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.

Gyabak, K., Ottenbreit-Leftwich, A., & Ray, J. (2015). Teachers using designerly thinking in K-12 online course design. *Journal of Online Learning Research, 1*(3), 253-274. Association for the Advancement of Computing in Education (AACE).
[Author-provided abstract] – Teachers are typically abstracted from the design process and not referred to as instructional designers. However, they are constantly designing instruction (or adapting instructional materials) on a daily basis. Teachers provide a unique perspective as instructional designers: instructional design, content experts, and instruction delivery. Thus, describing their design process is important to help support teachers as they design online courses. This case study examined and described the design process of eleven high school teachers as they designed, developed, and implemented their first online courses. Findings from this study present the online course design processes of these high school teachers and highlight the resources perceived as valuable when embarking on their first online courses: teachers face constraints; teachers use a variety of technological tools; teachers use a variety of pedagogical strategies; belonging to a community of practice helps; teachers report valuing the support of an Online Learning Coordinator, although, given similar guides and resources, teachers make independent design decisions; and teachers rely on feedback from a variety of sources. Recommendations are made for K-12 online learning coordinators, school administrators, and for first-time online teacher/designers related to the processes involved in designing online courses.

Hawkins, A., & Graham, C. R. (2010). Correlations between teacher–student interaction and student academic performance in a large virtual high school. In D. Gibson & B. Hodge (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2010 (pp. 2934–2940). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/33814 [Author-provided abstract] – This study examined the

relationship between students' perceptions of teacher– student interaction and academic performance at an asynchronous, self-paced, statewide virtual high school. Academic performance was measured by grade awarded and course completion. There were 2269 students who responded to an 18-item survey designed to measure student perceptions on the quality and frequency of teacher–student interaction. Quality of interaction was subdivided into three constructs representing feedback, procedural, and social interaction. A confirmatory factor analysis helped to establish the fit of the statistical model for teacher–student interaction. Hierarchical logistical regression indicates that an increase in the quality and frequency of interaction resulted in an increased likelihood of course completion but had minimal influence on grade awarded. The estimated effect for quality and frequency composite items on completion was .83 and .56 respectively. Low practical significance of student–teacher interaction on grade awarded may be the result of mastery-based teaching approaches that skew grades for the completers toward the high end.

Heikkilä, A. S., Vuopala, E., & Leinonen, T. (2017). Design-driven education in primary and secondary school contexts. A qualitative study on teachers' conceptions on designing. *Technology, Pedagogy and Education*, 1-13.
[Author-provided abstract] – Design in educational contexts is a relatively new topic. The basic idea of design and design-driven education is that students and teachers participate together in the planning, implementation, and evaluation of learning projects. However, how design-driven education should be carried out in practice is yet to be established. Therefore, the aim of this study is to gain insights into how such practice could be implemented. Through a qualitative study, the authors examined primary and secondary school teachers' (*N* = 5) conceptions on various aspects of design in educational contexts. The results indicate that design-driven education emphasises the need for collaboration between students and teachers and the teachers' active roles as facilitators for learning. Furthermore, in order for such design-driven practices to be successful, the learning process requires students to be self-regulative learners. The use of technology was also experienced as a natural part of design-driven education. The results present the participating teachers' understanding of how design-driven education in school contexts could be organised.

Helms, S. A. (2012). Blended/hybrid courses: A review of the literature and recommendations for instructional designers and educators. *Interactive Learning Environments.* Doi:10.1080/10494820.2012.745420. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/10494820.2012.745420#.UvZ1kj1dWSo
[Author-provided abstract] – This article explores some of the literature on blended/hybrid learning and identifies recommendations for instructional designers and faculty. Terminology and definitions are discussed, first, including the debate between the words "blended" and "hybrid." A working definition for the article is discussed, but the article does not propose a standard definition for the field. The learning advantages of using a blended/hybrid format are identified from the literature, including improved grades, retention, and communication and teamwork. The recommendations are discussed in four broad categories: (a) face to face and online scheduling, (b) communication, (c) course content, and (d) other recommendations. The article concludes with a call for future research into blended/hybrid learning and how to best construct blended/hybrid courses from an instructional design standpoint.

Jones, E. L. (2011). A second chance to graduate on time: High school students' perceptions on participating in an online credit recovery program (Doctoral dissertation). Retrieved from https://scholarscompass.vcu.edu/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=3578&context=etd

[Author-provided abstract] – High schools in the United States are facing increased scrutiny to increase the number of students graduating with a diploma in four years. This pressure comes from many sources. First, the No Child Left Behind Act instituted graduation as a measure of a high school's success at the federal level. States soon followed by increasing accountability in this area. Differences in how graduation rates were measured and advancements in data tracking technology led to many states measuring cohort groups of students who enter high school in the ninth grade and tracking them to see how many graduate in four years. This measure became known as an on-time graduation rate and, in many states, became a measure used to determine high schools' accreditation. School districts responded to these changes in accountability by instituting new programs designed to increase graduation rates and decrease the number of students dropping out. One type of program that has increased in popularity across the country is the online credit recovery program. Online credit recovery programs utilize an asynchronous online learning platform that is designed for students who are repeating a course they failed in a traditional classroom setting. Features of an online credit recovery program include a one-to-one learning environment where students interact with digital curriculum that includes text, audio, video, and graphic information. Online credit recovery courses are designed so that students can demonstrate mastery of known content quickly and focus on material they did not master the first time they took the course. This instructional approach, along with the asynchronous design that allows students to work through course content at their own pace, enables students to earn a course credit in a reduced period of time. The purpose of the current study was to capture the perceptions of students who are enrolled in an online credit recovery program. The goal of the study was to document what factors they believed contributed to their success. The study was driven by research questions, which sought to analyze the (1) factors students attributed to their success in the online credit recovery program, (2) perceived chances of graduating from high school on-time after successfully completing the course, (3) relationship between the credit recovery course and the one-to-one laptop computing initiative supported by the school district, and (4) online learning environment of the credit recovery program, as compared to a traditional classroom setting. A qualitative, phenomenological, design was used to explore the research questions. Twenty retained ninth grade students were interviewed. Ten came from each of the two schools that first implemented the online credit recovery program in the school district. The researcher inductively coded these interviews, which allowed themes to emerge through the voices of these students. These themes included a sense of control of the learning environment in the online credit recovery program that students did not feel in a regular classroom. This control was manifested by the self-paced, distraction-free, learning environment that was enhanced by the district's one-to-one laptop computing initiative. Also, increased and varied opportunities to demonstrate mastery fostered this sense of control. Another major theme that emerged is that students believed that their chances to graduate on time were improved because they were able to earn a credit in a course quickly that they had previously failed. The ability to recover this credit allowed students to avoid traditional credit recovery options in which they felt they would not be successful. Students also perceived that they would continue to experience success if they were allowed to take other courses through the online credit recovery program.

Kennedy, K., & Archambault, L. (2012). Design and development of field experiences in K-12 online learning environments. *Journal of Applied Instructional Design, 2*(1), 35-49.

[Author-provided abstract] – This study provides a status report on the state of field experiences in K-12 online learning programs in the United States. After developing a survey instrument, teacher education programs and K-12 online learning programs were surveyed to find out what they are doing to help prepare pre-service teachers for K-12 online learning environments. While teachers are currently coming from the traditional classroom to teach in K-12 online settings, as the demand for K-12 online teachers increases, it is likely that more educators will be recruited directly from undergraduate programs. Colleges of education would benefit from addressing the growing need to prepare future K-12 online teachers, and the current study highlights the importance of continued research in this area. Important ramifications exist for the field of K-12 online learning as well as for programs of teacher education who are, whether it is realized or not, preparing tomorrow's educators for fully online, hybrid, and blended classrooms.

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

[Author-provided abstract] – This research explores the implementation and utilization of self-regulated learning (SRL) scaffolds (i.e., videos, journals, surveys) in online K-12 courses. This project is grounded in research on online education as well as theory and research around self-regulated learning in both online and offline contexts. This research is conducted through Michigan Virtual School's (MVS) learning management system (LMS) over two academic terms in six high school mathematics courses. Participating students (N=69) completed the pre-survey consisting of the PISA Student Characteristics Questionnaire (Artelt, Baumert, Julius-McElvany, & Peschar, 2003), a self-regulated learning assessment (Cleary and Zimmerman, 2004), and an online learning readiness assessment (Roblyer & Davis, 2008). Following the pre-survey participants were randomly assigned to one of three conditions (experimental, control I, control II) and received either self-regulatory, general interventions (in the form of videos, journals, and short surveys), or no interventions--respective of condition. Research questions were as follows: 1) can computer mediated contexts be designed to fully facilitate and support adolescents' use of self-regulated learning processes in learning; 2) does the presence of SRL scaffolding in online K-12 courses lead to gains in adolescent learners' a) self-efficacy and motivation or b) individual and environmental control, do a. and b. vary across dimensions of preparedness; 3) does the presence of SRL scaffolding lead to greater a) domain knowledge b) student retention in online K-12 courses; 4) how does SRL scaffolding influence adolescent learners' ability to successfully regulate their learning to produce improved student achievement outcomes in computer mediated contexts? 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. 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.

Kim, C., Park, S. W., & Cozart, J. (2014). Affective and motivational factors of learning in online mathematics courses. *British Journal of Educational Technology, 45*(1), 171-185.

[Author-provided abstract] – We investigated what factors would be related to students' achievement in mathematics courses offered at a virtual high school. This was an attempt to understand *why* some succeed and some do not as well as to suggest what should be done to help with student success. Seventy-two students responded to a self-report survey on motivation (i.e., self-efficacy, intrinsic value), mathematics

achievement emotions (i.e., anxiety, anger, shame, hopelessness, boredom, enjoyment, pride), and cognitive processes (i.e., cognitive strategy use, self-regulation). A three-step hierarchical multivariate regression was employed to examine which of the factors predict student achievement. Results showed that motivation accounted for approximately 13% of the variance in student achievement and self-efficacy was the significant individual predictor of student achievement. However, when achievement emotions were added to the analysis, self-efficacy failed to predict student achievement, and emotions accounted for 37% of the variance in student achievement. Cognitive strategy use and self-regulation did not explain any additional variance in the final scores. Findings are discussed and implications for future research and development are also suggested.

Koehler, M.J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131-152.
[Author-provided abstract] – We introduce *Technological Pedagogical Content Knowledge* (TPCK) as a way of representing what teachers need to know about technology and argue for the role of authentic design-based activities in the development of this knowledge. We report data from a faculty development design seminar in which faculty members worked together with master's students to develop online courses. We developed and administered a survey that assessed the evolution of student- and faculty-participants' learning and perceptions about the learning environment, theoretical and practical knowledge of technology, course content (the design of online courses), group dynamics, and the growth of TPCK. Analyses focused on observed changes between the beginning and end of the semester. Results indicate that participants perceived that working in design teams to solve authentic problems of practice to be useful, challenging and fun. More importantly, the participants, both as individuals and as a group, appeared to have developed significantly in their knowledge of technology application, as well as in their TPCK. In brief, learning by design appears to be an effective instructional technique to develop deeper understanding of the complex web of relationships between content, pedagogy, and technology and the contexts in which they function.

Kosko, K. W., Sobolewski, & Amiruzzaman, M. (2018). Growing in number: Research on mathematical teaching and learning in the online setting. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from
https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – In this chapter, we describe how research focusing on online and blended mathematics learning (OBML) has generally focused on OBML as a treatment for learning rather than a context for it. Within this focus, research has generally suggested a mix of positive, negative, and no significant differences in mathematical learning outcomes for OBML and traditional face-to-face learning environments. Further, the majority of OBML research and practice resides in secondary mathematics. We discuss reasons for the current focus on OBML research, recommendations for building upon this literature base, and implications for practice.

Lawrence, A. D. (2017). Toward culturally responsive online pedagogy: Practices of selected secondary online teachers (Order No. 10618276). Available from ProQuest Dissertations & Theses A&I. (1957414178).
[Author-provided abstract] – Proponents of K-12 online learning claim that it can provide more equitable learning opportunities by offering access to courses that might not otherwise be available to students and by providing personalized learning experiences. Despite the growth of

online learning in K-12 public schools, very little is known about what constitutes good online teaching. The purpose of this interpretivist investigation was to learn about some of the ways in which culturally responsive teaching can occur online. This study focused on the practices of four full-time online high school teachers. Using the methods of grounded theory research, I analyzed data generated through observations of online courses, interviews with teachers, and teacher-written narratives in order to learn how four instructors practiced culturally responsive online pedagogy in one state-supported online program. Results indicated that the teachers engaged in frequent and ongoing dialogue with their students. The teachers used multiple strategies to get to know their students, to build class community, to adapt instruction to students' learning needs and preferences, and to make learning relevant. Teachers also discussed contextual factors (e.g., program structure and student enrollment) that impacted their practice. However, some characteristics of culturally responsive pedagogy, including infusing students' cultures into the curriculum and helping students to challenge power and hegemony, did not emerge. A discussion of these results includes potential implications for educational leaders at the state, district, and program levels, as well as recommendations for future research on culturally responsive online pedagogy (CROP).

Lefevre, D., & Cox, B. (2017). Delayed instructional feedback may be more effective, but is this contrary to learners' preferences? *British Journal of Educational Technology, 48*, 1357-1367.
[Author-provided abstract] – This research investigates learners' preferences for the timing of feedback provided to multiple-choice questions within technology-based instruction, hitherto an area of little empirical attention. Digital materials are undergoing a period of renewed prominence within online learning, and multiple-choice questions remain a common component. There is evidence that a delay in the provision of feedback following a learner's response to multiple-choice questions leads to an increase in subsequent performance. However, the learner's perspective on delayed feedback is yet to be explored. Learner preferences are pertinent as learning designs that run contrary to preferred learning behaviours can have a negative effect on motivation and therefore engagement. During a series of formative tests, subjects were presented with a choice of viewing either immediate or delayed feedback, and their choices were recorded. Over a 2-year period data were collected relating to 599 subjects. Qualitative interviews were also conducted to investigate why subjects made their choices. In this research, subjects expressed a marked preference for immediate feedback, 95.33% chose to view feedback immediately following their response to a question. The reasons for this preference are explored and the implications for learning design are considered.

Lin, C. H., Zheng, B., & Zhang, Y. (2016). Interactions and learning outcomes in online language courses. *British Journal of Educational Technology*.
[Author-provided abstract] – Interactions are the central emphasis in language learning. An increasing number of K-12 students take courses online, leading some critics to comment that reduced opportunities for interaction may affect learning outcomes. This study examined the relationship between online interactions and learning outcomes for 466 students who were taking high-school level online language courses in a Midwestern virtual school. Regression analysis was employed to examine how three broad types of interactions, learner-instructor, learner-learner, and learner-content (Moore, 1989), affected students' perceived progress and satisfaction. After controlling for demographic information, motivation, and learning strategies, the results of multiple regression showed that learner-instructor and learner-content

interactions had significantly positive effects on satisfaction, whereas learner-learner interaction did not affect satisfaction. Learner-content interaction was the only factor that affected perceived progress.

Lin, C.H. & Zheng, B. (2015). Teaching practices and teacher perceptions in online world language courses. *Journal of Online Learning Research, 1*(3), 275-303. Association for the Advancement of Computing in Education (AACE).
[Author-provided abstract] – Online teaching and learning have become widespread with the emergence of the Internet and other new technologies. However, online environments pose new challenges to those seeking to develop or choose suitable teaching approaches, and this is especially true in the case of language courses. Using survey and interview data, this study examines online language teachers' teaching practices, their adjustments toward online teaching, and the professional development (PD) that they received and expected to receive in a virtual high school in the United States. The findings suggest that online teachers generally used more non-content-related teaching practices than content-related teaching practices in online language courses and that instructors in Chinese – the only language course that offered weekly synchronous sessions – exhibited more frequent use of content-related teaching practices than teachers of other world languages. The study also sheds light on teachers' adjustment to the online environment, which impacts their management, social, and pedagogical roles. Lastly, our analysis of the PD that teachers felt they needed, as against what they actually received, underscores the need for more PD in the areas of online-course design and content-related technology integration. The results of this study could be useful to online language teachers and researchers and point the way to improvements in teacher education vis-à-vis online language teaching.

Liu, F., & Cavanaugh, C. (2012). Success in Online High School Algebra: Factors influencing student academic performance. *Open Learning: The Journal of Open, Distance and e-Learning, 27(*2), 149-167.
[Author-provided abstract] – This paper describes the effect of teacher comments, students' demographic information, and learning management system utilisation on student final scores in algebra courses in a K–12 virtual learning environment. Students taking algebra courses in a state virtual school in the Midwestern US region during 2007–2008 participated in this study. Student final scores on these courses were collected using tests administered at the end of semester in the virtual school courses. The hierarchical linear modelling technique was used for data analysis to account for the influence of school characteristics on student final scores. The results show these factors have different influences on student final scores in different algebra courses. The discussion of the findings addresses the implications for teaching.

Liu, F., & Cavanaugh, C. (2011). Success in online high school Biology: factors influencing student academic performance. *Quarterly Review of Distance Education, 12*(1), 37-52.
[Author-provided abstract] – This article describes the effect of teacher comments, students' demographic information, and utilization of learning management system (LMS) on student academic performance in a K-12 virtual learning environment. Students who completed biology courses in a Midwestern state virtual school during 2007-08 and took the end-of-course test participated in this study. The hierarchical linear modeling (HLM) technique was employed for data analysis. The results show these factors can influence student academic performance in

biology courses in different ways. The implications for teaching were addressed. Further research is proposed based on the results and limitations.

Llorens, A. C., Cerdan, R., & Vidal-Abarca, E. (2014). Adaptive formative feedback to improve strategic search decisions in task-oriented reading. *Journal of Computer Assisted Learning*. Doi:10.1111/jcal.12050. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/jcal.12050/abstract
[Author-provided abstract] – This study analyses the effectiveness of adaptive formative feedback to boost strategic search decisions and performance when students are asked to answer a set of questions in a task-oriented reading situation. We compared automatic feedback that included information about the right answer with feedback that also included the connection between the students' strategic search decisions and their performance. Ninety-two high school students read two non-continuous texts. They received feedback during a training phase, and then they read and also received feedback with a similar text in a final phase. Text and questions were presented using a new computer-based technology that provided automatic adaptive feedback depending on the experimental condition: *right-answer feedback*, *strategic-search-decisions feedback,* and *placebo feedback*. We found that *strategic-search-decisions feedback* improved strategic decisions over *right-answer* and *placebo feedback* in the final text, which in turn improved question-answering performance. Some positive effects were also found during training. These results open new possibilities to adaptive automatic procedures to teach task-oriented reading skills to students.

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.
[Author-provided abstract] – 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. Indeed, most of what is currently known about online engagement has come from research with older students in tertiary education contexts. This study directly addresses this gap in the research by exploring student engagement in an online, middle school in a New Zealand distance education context. By considering three key dimensions of student engagement—namely, behavioural engagement, cognitive engagement, and emotional engagement—this in-depth investigation explores what engages middle school students when they learn online. Data collection techniques comprised student and teacher interviews, online asynchronous discussion transcripts, and statistical data from the learning management system (LMS). Results found that students in this study tended to engage behaviourally (i.e., do what was expected of them) with all required activities. Cognitive engagement (i.e., students' personal investment in their own learning) was evident in the giving and receiving of feedback as well as the interest and relevance certain activities generated for learners. Emotional engagement was elicited through the design and facilitation of the activities, and through the ongoing development of a learning community in which students felt safe to contribute.

Mayse, D. (2015). How 7th grade students are using resources for learning in an online science course. *Journal of Online Learning Research, 1*(3), 337-363. Association for the Advancement of Computing in Education (AACE).
[Author-provided abstract] – In this study, 7th grade students were observed completing a series of lessons in an online science course to explore their thinking and strategies for: (1) using curriculum resources for learning, (2) developing thinking and strategies for self-assessing "assessment readiness," and (3) exploring the relationship between resource use and student grade in science, end-of-lesson assessment score,

and student learning style. A convergent-parallel mixed methods research design was used to collect both qualitative and quantitative data in the same phase of this study, in order to merge the results and gain a greater understanding of student learning in the online environment. Observations of students completing lessons online, survey, and interview data were collected. Qualitative results indicate that students demonstrated various levels of metacognitive strategy use in choosing online curriculum resources and in determining their readiness for lesson assessment. Quantitative results indicated that resource use was higher for multi-media learning resources and lower for notes-based resources. Use of at least 70% of lesson resources overall showed a relationship with a higher student grade in science and higher end-of-lesson assessment score. Student learning style showed mixed results related to resource use. Continued mixed-methods research observing student learning in the online environment is needed to better understand the individual student experience of learning online and to inform specific interventions within the online learning environment to support learning as students transition into more effective self-directed learners.

McLaughlin, T., & Yan, Z. (2017). Diverse delivery methods and strong psychological benefits: A review of online formative assessment. *Journal of Computer Assisted Learning*.
[Author-provided abstract] – This article is a review of literature on online formative assessment (OFA). It includes a narrative summary that synthesizes the research on the diverse delivery methods of OFA, as well as the empirical literature regarding the strong psychological benefits and limitations. Online formative assessment can be delivered using many traditional assessment methods. These assessments can be delivered using a variety of programs and software. The benefits of using OFAs include both gains in achievement scores and the development of essential complex cognitive processes, such as self-regulation. While attention is paid to both K–12 and higher education settings, this article highlights how OFA has been used distinctly in each. This paper has high utility for both academics and practitioners.

Means, B., Toyama, Y., Murphy, R., & Bakia, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record, 115*(3), 1-47.
[Author-provided abstract] – Background/Context: Earlier research on various forms of distance learning concluded that these technologies do not differ significantly from regular classroom instruction in terms of learning outcomes. Now that web-based learning has emerged as a major trend in both K–12 and higher education, the relative efficacy of online and face-to-face instruction needs to be revisited. The increased capabilities of web-based applications and collaboration technologies and the rise of blended learning models combining web-based and face-to-face classroom instruction have raised expectations for the effectiveness of online learning. Purpose/Objective/Research Question/Focus of Study: This meta-analysis was designed to produce a statistical synthesis of studies contrasting learning outcomes for either fully online or blended learning conditions with those of face-to-face classroom instruction.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2010). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. Washington, DC: U.S. Department of Education Office of Planning Evaluation and Policy Development. Retrieved from http://www2.ed.gov/rschstat/eva/tech/evidence-based-practices/finalreport.pdf
[Author-provided abstract] – A systematic search of the research literature from 1996 through July 2008 identified more than a thousand empirical studies of online learning. Analysts screened these studies to find those that (a) contrasted an online to a face-to-face condition, (b)

measured student learning outcomes, (c) used a rigorous research design, and (d) provided adequate information to calculate an effect size. As a result of this screening, 50 independent effects were identified that could be subjected to meta-analysis. The meta-analysis found that, on average, students in online learning conditions performed modestly better than those receiving face-to-face instruction. The difference between student outcomes for online and face-to-face classes—measured as the difference between treatment and control means, divided by the pooled standard deviation—was larger in those studies contrasting conditions that blended elements of online and face-to-face instruction with conditions taught entirely face-to-face. Analysts noted that these blended conditions often included additional learning time and instructional elements not received by students in control conditions. This finding suggests that the positive effects associated with blended learning should not be attributed to the media, per se. An unexpected finding was the small number of rigorous published studies contrasting online and face-to-face learning conditions for K–12 students. In light of this small corpus, caution is required in generalizing to the K–12 population because the results are derived for the most part from studies in other settings (e.g., medical training, higher education).

Miller, N. B. (2013). Student access of supplemental multimedia and success in an online course. *American Journal of Distance Education, 27*(4), 242-252.
[Author-provided abstract] – Institutions are developing online courses that contain rich multimedia, but research shows there is little difference in student achievement when these types of materials are included. However, many studies report the results of the presence, not the access, of multimedia learning objects. In addition, they do not categorize the multimedia as supplemental or required. To better understand the relationship between multimedia inclusion and student success, this study investigates student access of three categories of supplemental multimedia in an online course and uses access data as a filter for comparing student final grades. A summary of statistically significant differences in mean final grades at four levels of supplemental multimedia access is included.

Oliver, K. & Kellogg, S. (2015). Credit recovery in a virtual school: affordances of online learning for the at-risk student. *Journal of Online Learning Research, 1*(2), 191-218. Association for the Advancement of Computing in Education (AACE).
[Author-provided abstract] – This paper summarizes evaluation findings about a high school credit recovery (CR) program as solicited by a state-sponsored virtual school in the United States. Student and teacher surveys explained why CR students failed previous instances of face-to-face courses and defined how the online CR model helped these learners overcome both internal issues of self-direction and time management and external issues of teacher support and feedback. Comparisons between the CR course group and general studies and honors course groups suggested several significant differences of interest that were interpreted by qualitative comments and prior research. Comparative data helped to define unique needs of the CR population (e.g., may require added technology and support to participate online), areas of success in the CR program (e.g., CR students report learning more online), and areas for expansion in CR courses (e.g., may benefit from added collaborative, project-based work).

Orlando, J. (2016). A Comparison of Text, Voice, and Screencasting Feedback to Online Students. *American Journal of Distance Education, 30*(3), 156-166.

[Author-provided abstract] – The emergence of simple video and voice recording software has allowed faculty to deliver online course content in a variety of rich formats. But, most faculty are still using traditional text comments for feedback to students. The author launched a study comparing student and faculty perceptions of text, voice, and screencasting feedback. The results provide some interesting insights into the advantages and disadvantages of different forms of feedback. The author finishes with best practices for providing screencasting feedback to students.

Oviatt, D. R., Graham, C. R., Borup, J., & Davies, R. S. (2016). Online student perceptions of the need for a proximate community of engagement at an independent study program. *Journal of Online Learning Research, 2*(4), 333-365.
[Author-provided abstract] – Research suggests that collaborative learning designs for online courses, which require interaction with teachers and peers promotes engagement and learning. K-12 students seek supplemental online courses to meet graduation requirements and desire flexibility which, often conflicts with required interactions. This paper asserts that online independent study learners may create a Proximate Community of Engagement (PCE) in order to derive the benefits of collaboration and interactions. Using the Adolescent Community of Engagement (ACE) framework as a lens for identifying interactions, this study surveyed K-12 independent study students to assess their perception of the need for interaction with a support community while completing an online course. The study showed that students perceive the benefits of such a community and plan to receive support from parents, teachers, and counselors proximate to their location. The study also finds that the perception of the need is significantly greater for students taking a course for credit recovery than those taking the course for the first time. Course providers can coach independent study students and family on how to create a Proximate Community of Engagement.

Pazzaglia, A. M., Clements, M., Lavigne, H. J., & Stafford, E. T. (2016). An analysis of student engagement patterns and online course outcomes in Wisconsin. REL 2016-147. Regional Educational Laboratory Midwest.
[Author-provided abstract] – Student enrollment in online courses has increased in the past 15 years and continues to grow (Watson, Pape, Murin, Gemin, & Vashaw, 2014). However, little is known about students' education experiences or online course outcomes. These are areas of particular interest to the Midwest Virtual Education Research Alliance, whose goal is to understand how to support student success in online courses. Members of the alliance partnered with Regional Educational Laboratory Midwest to develop and conduct this study on how students engage in online learning and how student engagement patterns are associated with online course outcomes. Findings from this study may help inform policymakers, state and local education agencies, and online learning providers as they seek ways to support student success in online courses. This study analyzed learning management system data and student information system data for all core, elective, and Advanced Placement online high school course enrollments during the fall 2014 semester. The data were collected by Wisconsin Virtual School, a state-level online learning program that partnered with 194 Wisconsin districts to serve 5,511 student enrollments in 256 supplemental online courses during the 2014/15 school year. Analyses looked for student engagement patterns in online courses and the percentage of student enrollments that followed each pattern; differences among student engagement groups (groups of student enrollments that followed a given pattern) in course type taken, gender, or grade level; and associations between student engagement in online learning and online course outcomes. Engagement refers to behavioral engagement and was defined as the amount of time a student was logged in to the online course each week. Course outcomes were measured by the percentage of possible points earned in the course (which students' home schools use to assign a letter

grade based on the local grading scale) and the percentage of course activities completed. Analyses revealed six engagement patterns among student enrollments in Wisconsin Virtual School online courses. Each pattern represents an average of the total time a student spent logged in to the online course each week, as well as how that amount varied across the semester (for example, increasing, decreasing, or remaining steady). The six student engagement patterns and the percentage of student enrollments in each were as follows: • Initial 1.5 hours with decrease (8 percent). Engagement of approximately 1.5 hours per week at the beginning of the semester that drops off to near 0 hours midway through the semester. • Steady 1.5 hours (39 percent). Steady engagement of approximately 1.5 hours per week, with a slight increase toward the end of the semester. • Initial 2 hours with spike (4 percent). Engagement of approximately 2 hours per week at the beginning of the semester that increases steadily after the midpoint of the semester to nearly 12 hours per week in the final week. • Steady 2.5 hours (38 percent). Steady engagement of approximately 2.5 hours per week across the semester. • Steady 4+ hours (8 percent). Consistent engagement of approximately 4 hours or more per week across the semester. • Variable 6+ hours (2 percent). High but variable engagement ranging from approximately 6 hours per week at the beginning, middle, and end of the semester and peaking to near 10 hours between those points (during weeks 3 and 17). Students who engaged in their online course for at least 1.5 hours per week (all groups but the initial 1.5 hours with decrease group) typically earned a high enough percentage of possible points to pass the course even though they varied in total time logged in each week initially and across the semester. However, the steady 1.5 hours group performed significantly worse than the initial 2 hours with spike, steady 2.5 hours, steady 4+ hours, and variable 6+ hours groups in percentage of possible points earned in the course and percentage of course activities completed. Although this study is not designed to determine whether the relationship between student engagement patterns and course outcomes is causal, educators may want to use the findings to identify students who need additional support to succeed—for example, the initial 1.5 hours with decrease and steady 1.5 hours engagement groups, which had poorer course outcomes. In addition, online learning programs across the country may be able to use the findings as a framework for investigating the data available in their learning management systems and student information systems.

Pytash, K. E., & O'Byrne, W. I. (2018). Research on literacy instruction and learning in virtual, blended, and hybrid environments. In K. Kennedy & R. E. Ferdig (Eds.), Handbook of Research on K-12 Online and Blended Learning. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – Drawing on current literacy research, the goals of this chapter are to examine and synthesize the relevant research and best practices associated with literacy learning and teaching in virtual, blended, and hybrid environments in K-12 settings. While the research base for literacy education in virtual schools, blended, and hybrid learning environments is significantly limited, it is supported by research done in the field of literacy education investigating reading and writing in online spaces. This chapter provides specific recommendations and implications for writing instruction and reading instruction in online education spaces and, in addition, implications for future research are provided.

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

[Author-provided abstract] – This article presents an educational action research study examining how one online, classroom-based role-play simulation offers middle school students the opportunity to strengthen their agency and voice. The Jewish Court of All Time (JCAT) is a web-mediated simulation designed for middle school classrooms where students take on roles of various characters throughout the world, history and literature to address an imaginary court case. JCAT is meant to develop students' skills in writing, critical thinking, perspective-taking, historical empathy, and communication, as well as subject literacy in social, historical, and cultural contexts. Our research question focuses on how JCAT further encourages and supports the middle school students' agency and voice. We examine how students exercise their agency and voice both in the online environment and in accompanying classroom activities. As an educational action research study, we focus on simulations in which at least one of the authors was a participant and also pay special attention to how our findings can enhance future simulations. Findings suggest that students constructed knowledge of democratic ideals and were able to exercise their agency and voice, specifically, both in the online environment and in accompanying classroom activities.

Repetto, J. B., Spitler, C. J., & Cox, P. R. (2018) Research on at-risk learners in K-12 online learning. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813

[Author-provided abstract] – Students who fail to graduate high school with a diploma or its equivalent set in motion a pattern of low wages, poor health, and risk of incarceration that will impact their future quality of life. This pattern negatively impacts society with fewer wage earners, lower taxes, and less spending, along with a strong potential of needing to support these students through some form of welfare. Due to its flexible scheduling, individual mentoring, safe communities in which to learn, and varied methods of teaching, online learning has shown promise as a conduit to engage at-risk students in learning so that they stay in school and earn a diploma. In this chapter, research along with essential strategies that allow online programs to meet the needs of at-risk learners to improve their educational outcomes are presented. Additionally, implications for policy, practice, and future research are discussed.

Rice, M. F., & Dykman, B. (2018). The emerging research base on online learning and students with disabilities. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813

[Author-provided abstract] – Students served under federal civil rights laws (i.e., IDEA, Section 504) are entitled to enroll in the full range of online learning environments and receive mandated services. Attending to these students' needs has presented challenges for educators in online schools, but research that would inform decision-making and planning has been scarce. This chapter provides some context for serving students with disabilities online and summarizes previous research reviews of this topic. In addition, this chapter updates research findings from an original chapter in the first Handbook of K12 Online and Blended Learning Research. New findings suggest that students with disabilities are enrolling in online courses, but gaps in understanding about student outcomes, accommodation and service delivery, and educator preparation and support persist. The chapter ends with suggestions for applying research to practice, engaging in additional research, and forming policies ensuring students with disabilities receive services.

Rice, K. L. (2006). A comprehensive look at distance education in the K-12 context. *Journal of Research on Technology in Education, 38*, 425–448. Retrieved from http://www.iste.org/learn/publications/journals/jrte

[Author-provided abstract] – This review provides a comprehensive examination of the literature surrounding the current state of K–12 distance education. The growth in K–12 distance education follows in the footsteps of expanded learning opportunities at all levels of public education and training in corporate environments. Implementation has been accomplished with a limited research base, often drawing from studies in adult distance education and policies adapted from traditional learning environments. This review of literature provides an overview of the field of distance education with a focus on the research conducted in K–12 distance education environments.

Roberts, V., Blomgren, C., Ishmael, K., & Graham, L. (2018). Open education practices in K-12 online and blended learning environments. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813

[Author-provided abstract] – Open educational practice is becoming a critical focus for K-12 technology-supported programs, both those strictly online at a distance and blended classroom practices extending into online learning environments. This chapter reviews the emerging practices influencing open learning in K-12 online and blended environments by considering the pedagogical foundations of open learning practices. An examination of current literature has led to the authors' call for a new focus on research on thoughtful use of an open pedagogy by K-12 teachers and supportive policies and legislation.

Rozitis, C. P. (2017). Instructional design competencies for online high school teachers modifying their own courses. *TechTrends, 61*(5), 428-437. doi:10.1007/s11528-017-0204-2

[Author-provided abstract] – This study identifies competencies specific and beneficial to online high school teachers that are modifying their own courses. Existing instructional design standards, available to guide online teachers, are not only too numerous, they are also inconsistent. Moreover, a lack of clarity exists about which specific standards benefit this emerging professional group in the process of developing and revising their courses. The Delphi design enabled participants in related fields and separated by physical distance to make and refine judgments without stress and with anonymity, to achieve consensus on specific competencies. Based on this consensus, online high school educators now have a clearly defined set of instructional design competencies that will support modifying learning objects within their classes.

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

[Author-provided abstract] – As the popularity and enrollment in online courses continues to expand, researchers have investigated strategies and methods to support student learning. Little attention has been focused on what instructional supports are needed for students enrolled in an online K-12 environment. The current research study investigated the effects of adding advance organizers in an online setting on middle school students' self-regulation. This quasi experimental study was designed using a repeated-measures counter-balanced method. During the study, 106 middle school students, living in the Midwest, participated in two online social studies units. The study included two online instructional units designed to include a treatment (inclusion of an advance organizer) and a control. Students were placed into two groups,

based on their school (TC: treatment-control; CT: control treatment). Each group was exposed to both the treatment and control but in opposite order. Students were asked to complete the self-regulation survey at the beginning of the study, as a baseline, and at the end of each instructional unit to determine if the advance organizer changed the student perception about self-regulation. Additional data collected during this study recorded how students interacted with the online materials and the frequency with which they viewed the content. At the conclusion of the data collection process, 45 students had completed the online required elements, fewer than estimated for adequate power, therefore limiting the results of the study. The analyses of student perception of self-regulation revealed no statistically significant effect for the advance organizer. Results indicated on average students (TC group) who received the advance organizer first viewed the online content more frequently than those in the CT group. This evidence could be interpreted that the TC group were exposed to the advance PREVIEW organizer first actually changed their learning behaviors in the control unit and therefore recorded greater activity than the CT group. At the conclusion of the study students completed a feedback survey about the online unit. The majority of respondents were positive towards the advance organizer and the online units. Results from this study are encouraging and may be used by others to further investigate the implications for advance organizers on middle school student self-regulation.

Shattuck, K. (2015). *Review of K-12 online and blended education research literature.* Annapolis, MD: Author. Retrieved from https://www.qualitymatters.org/node/3136/download/K-12%20review%20of%20research%20summary-updated%2012-31-2015-FINAL.pdf
[Author-provided abstract] – 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.

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. doi:10.1080/02680513.2014.992402
[Author-provided abstract] –The field of K-12 education is being transformed, with an influx of students, including those with identified disabilities, engaging in blended and fully online learning. While online learning shows promise for students with disabilities through flexible content and personalised instruction, concerns regarding accessibility and appropriateness of online learning for this population still exist. In order to examine this concern, researchers developed and used a Universal Design for Learning (UDL) Scan Tool to measure lesson content and alignment with UDL principles, guidelines and checkpoints. Four hundred and seventy-eight math, science, and world history Khan Academy lessons were randomly selected and evaluated for this study. The paper highlights the results of the study, in terms of the lessons' alignment with UDL principles and guidelines, as well as a discussion on limitations and future research.

Speak Up. (2014). Trends in digital learning: students' views on innovative classroom models. *Project Tomorrow*. Retrieved from http://www.tomorrow.org/speakup/2014_OnlineLearningReport.html

[Author-provided abstract] – *Trends in Digital Learning: Students' Views on Innovative Classroom Models* highlights the latest Speak Up data with a particular focus on understanding the student perspective on the impact and benefits of innovative classroom models that are effectively leveraging technology. As a focused case point, this report examines the experiences of students who are in virtual schools or who have taken an online class in addition to their traditional face-to-face instruction. Since 2007, Project Tomorrow has partnered with Blackboard Inc. to create a series of annual reports that focus on the year-to-year trends in the use of digital learning tools to change the classroom learning paradigm through an in-depth analysis of the latest Speak Up national findings. In this latest update report, we examine the trends from our analysis of the Speak Up data collected in fall 2013. More than 403,000 K-12 students, parents, educators, and community members participated in Speak Up 2013, and their insights of students, particularly on online learning, are the impetus for this year's trends report. Key findings from this year's report include:

- Students in online learning environments demonstrate greater usage of digital tools, including use of those tools to develop enhanced writing skills.
- 53% of students would like their schools to let them use their own mobile devices within instruction to support their schoolwork.
- 50% of middle school students who have taken an online class on their own feel that online learning makes it easier for them to succeed.
- Students are looking for a classroom environment that more closely replicates the way they are using digital tools outside of school to support greater communications and collaboration.
- Nearly 50 percent of virtual high school students say they were interested in what they were learning in school, while only 32 percent of traditional high school students said the same.

Tay, L. Y., Lim, C. P., Nair, S. S., & Lim, S. K. (2014). Online software applications for learning: Observations from an elementary school. *Educational Media International, 51*(2). Retrieved from http://www.tandfonline.com/doi/abs/10.1080/09523987.2014.924663#.U_c3V8VdV8F
[Author-provided abstract] – This exploratory case study research describes the integration of Information Communication Technology (ICT) into the teaching and learning of English, mathematics and science in an elementary school in Singapore. The school in this case study research is one of the first primary-level future schools that was set up under the FutureSchools@Singapore program in 2008. The school has implemented a successful one-to-one program (i.e., one-to-one computer-to-student ratio) for all its students. The use of blogs, communication applications (e.g., online chats and email), online educational games, online learning management systems, online searches for information and educational related videos were commonly used to integrate ICT into the teaching and learning of the various subjects mentioned above. A total of 221 (Primary 3 and 4) and 466 (Primary 3, 4, and 5) students participated in an ICT usage survey conducted in 2011 and 2012, respectively. Three interesting phenomena were observed through the descriptive statistics. First, it was observed that the ICT usage rates for the various subjects (i.e., English, mathematics, and science) peaked at the primary 4 level when the computer ownership program was introduced and declined in primary 5. Second, descriptive statistical analysis suggested the use of blogs, communication applications, online educational games, and Internet searches were more frequently used, as compared to the learning management systems and the use of videos, in the students' learning of English, mathematics, and science. Thirdly, ICT usage rates were also different for the different classes of Primary 5. Follow-up interviews with

teachers and student open-ended survey responses were also analysed. The triangulated findings seemed to suggest that blogs were frequently used and acted as gateways to other online software applications. The findings also once again pointed to the importance of the sociocultural context – school leadership, curriculum planning and assessment, technological infrastructure and teachers' practices – in ICT usage and integration in schools.

Theunissen, N., & Stubb, H. (2014). ISELF: The development of an Internet-tool for self-evaluation and learner feedback. *The Electronic Journal of e-Learning, 12*(4), 326-338.
[Author-provided abstract] – This paper describes the theoretical basis and development of the iSELF: an Internet-tool for Self-Evaluation and Learner Feedback to stimulate self-directed learning in ubiquitous learning environments. In ubiquitous learning, learners follow their own trails of interest, scaffolded by coaches, peers, and tools for thinking and learning. Ubiquitous learning solutions include on- and off-line, formal and informal learning. To benefit from its possibilities, learners need to develop competencies for self-directed learning. To do so, a self-evaluation tool can help the learner to get insight in his/her own development, to manage and monitor his/her own learning process, to collaborate in learning, to relate the learning to "real life" needs, and to take control over educational decisions. The iSELF was developed in an iterative process, complying to the following high level requirements: (1) Enabling learning anytime, anywhere; (2) Supporting self-directed learning; (3) Evaluating learner, learning solutions and job-needs; (4) Assessing learner competencies; (5) Using card-sort method for questionnaires; (6) Facilitating questionnaires "under construction"; and (7) User-friendly design. The resulting online tool contained a card-sort module, looking somewhat like a solitaire game, a profile module to evaluate core competencies, and a feedback module to suggest learning possibilities. For illustration, 14 different studies that contributed to the development of iSELF and to the development of self-evaluation questionnaires compliant to iSELF are briefly discussed. These illustrative studies included various populations (e.g., students, employees from small and medium enterprises, crisis management organizations, and the military). Usefulness and usability of the self-evaluation tool were valued positively. The iSELF contributes to an adaptive ubiquitous learning environment in which the learner can make the educational decisions according to self-directed learning principles. The iSELF will stimulate self-directed learning in a ubiquitous learning environment and will help to create learners for life.

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 http://ascilite.org.au/ajet/submission/index.php/AJET/article/view/242
[Author-provided abstract] – Online information searching strategies (OISS) used by students can be viewed as a key indicator in online learning environments. Therefore, developments in their OISS may also involve variables such as self-regulated learning (SRL) and online information evaluative standards (OIES). Three instruments, an OISS, a SRL and an OIES were used to investigate the roles of SRL (including basic and advanced SRL) and OIES (including naive and advanced standards) in the OISS of 307 high school students in Taiwan. The results of a structural equation model confirmed that both students' SRL and OIES have positive predictions on their OISS. In addition, students' advanced OIES mediated the relationships between basic SRL and OISS. However, when the students took advantage of the advanced SRL in employing OISS,

the significance of the OIES was not shown. This study contributes to the understanding of students' online academic information searching strategies.

U.S. Department of Education, Office of Educational Technology (2016). 2016 National Education Technology Plan: Future Ready Learning-Reimagining the Role of Technology in Education. Retrieved from http://tech.ed.gov/
[Author-provided abstract] – Technology can be a powerful tool for transforming learning. It can help affirm and advance relationships between educators and students, reinvent our approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all learners. Our schools, community colleges, and universities should be incubators of exploration and invention. Educators should be collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students. Education leaders should set a vision for creating learning experiences that provide the right tools and supports for all learners to thrive. However, to realize fully the benefits of technology in our education system and provide authentic learning experiences, educators need to use technology effectively in their practice. Furthermore, education stakeholders should commit to working together to use technology to improve American education. These stakeholders include leaders; teachers, faculty, and other educators; researchers; policymakers; funders; technology developers; community members and organizations; and learners and their families. The National Education Technology Plan (NETP) sets a national vision and plan for learning enabled by technology through building on the work of leading education researchers; district, school, and higher education leaders; classroom teachers; developers; entrepreneurs; and nonprofit organizations. The principles and examples provided in this document align to the Activities to Support the Effective Use of Technology (Title IV A) of the Every Student Succeeds Act as authorized by Congress in December 2015.

Vytacil, K. (2014). Beyond minimum technology requirements: Characteristics for the instructional design of virtual programs at the elementary grade levels (Capella University).
[Author-provided abstract] – With virtual public school initiatives in each of the 50 states, there is an impetus to develop and implement online programs for the elementary grades (Cavanaugh, 2004, pp. 262-266; Oliver et al., p. 56). Yet, learner usability characteristics for successful online schooling for the elementary grades are unknown and/or unspecified. The purpose of this qualitative Delphi study was to explore factors that online elementary educators, online elementary curriculum coordinators and developers, and virtual school administrators believe influence elementary learner engagement in the design of online programs. This study used the classic qualitative Delphi method to answer the central research question by allowing experts to answer the research subquestions in three survey rounds until final consensus answers addressing the central research question were reached. The analysis procedures were based on the models of Hasson et al. (2000) and Kurubacak (2007). The data from each of the three survey rounds was analyzed with basic descriptive statistics (frequency and mean) and categorized by the themes of the four research study subquestions. It was expected that participant answers would include the desire and/or need for more engaging interactions and instructional games for the online elementary student. It was also expected that participant answers might indicate preference for childlike primary color design features and cartoon characters. Participant answers supported interactivity, games, and bright colors and did not support primary colors or cartoon figures. A possible result from this study includes improvements to the course development phase of instructional design for developers, administrators, and instructors of virtual school programs. Additionally, with a more

accurate development analysis for instructors and designers of elementary programs for online use, elementary students who experience barriers from multimedia and interactive features may gain additional e-learning options for differentiation, accessibility, and usability within the course design.

Wang, C.-H., Shannon, D. M., & Ross, M. E. (2013). Students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning. *Distance Education, 34*(3), 302-323. Doi:10.1080/01587919.2013.835779. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/01587919.2013,835779#.UvKG5D1dv8E
[Author-provided abstract] – The purpose of this study was to examine the relationship among students' characteristics, self-regulated learning, technology self-efficacy, and course outcomes in online learning settings. Two hundred and fifty-six students participated in this study. All participants completed an online survey that included demographic information, the modified motivation strategies learning questionnaire, the online technology self-efficacy scale, the course satisfaction questionnaire, and the final grades. The researchers used structural equation modeling to examine relationships among student characteristics, self-regulated learning, technology self-efficacy, and course outcomes. Based on the results from the final model, students with previous online learning experiences tended to have more effective learning strategies when taking online courses and, hence, had higher levels of motivation in their online courses. In addition, when students had higher levels of motivation in their online courses, their levels of technology self-efficacy and course satisfaction increased. Finally, students with higher levels of technology self-efficacy and course satisfaction also earned better final grades. Based on the findings, we recommend that instructors design courses in a way that can promote students' self-regulated learning behaviors in online learning settings and that students in online classes, as in traditional classes, set aside a regular time to concentrate on the course. Also, institutions should provide user-friendly online learning platforms and workshops for instructors and students to facilitate the teaching and learning experiences.

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).
[Author-provided abstract] – This study investigated the ways in which four K-12 teachers, following professional development in blended learning, designed the online portion of their blended learning courses and how these online components were ultimately enacted with students. Specifically, the study investigates what kind of content, resources, or activities were developed online; how content, resources, or activities were enacted with students; and how blended learning practices differed across content areas. Findings revealed that the online components of these courses varied in how much they were enacted as designed; levels of online student activity; the amount of control students had over time, place, path, and/or pace; and whether the online components were oriented towards learning from technology or learning with technology.

Winter, P. C., Burkhardt, A. K., Freidhoff, J. R., Stimson, R. J., & Leslie, S. C. (2013). Astonishing impact: An introduction to five computer-based assessment issues. Lansing: Michigan Virtual Learning Research Institute.
[Author-provided abstract] – Astonishing Impact: An Introduction to Five Computer-Based Assessment Issues is a primer on computer-based assessment research and the effect of rapidly developing technology on high- and low-stakes assessment development. The authors identify and

discuss five issues showing potential for significant impact on computer-based assessments that can be delivered via the Internet. They include: New Item Types, Automated Item Generation, Accessibility of Computer Delivered Tests for Students, Use of Artificial Intelligence in Scoring, and Increased Efficiency with Accountability Testing. Given existing technologies and the pace of technological change, wide-scale implementation of computer-based assessment opportunities will likely be limited primarily by human willingness to embrace and adopt such innovations.

Woodard, R., Mangifico, A. M., & McCarthey, S. (2013). Supporting teacher metacognition about formative assessment in online writing environments. *E-Learning and Digital Media, 10*(4), 442-469. Doi:10.2304/elea.2013.10.4.442. Retrieved from http://www.wwwords.co.uk/rss/abstract.asp?j=elea&aid=5678
[Author-provided abstract] – Rubrics have become popular tools for assessing student writing both in classroom and standardized testing environments. Rubric construction and efficacy, however, is a topic that has been largely sidestepped in the literature and in teacher professional development. Composing an effective rubric — particularly for instructional or formative contexts — is a complex task that requires teachers to think metacognitively about their goals for a writing assignment, identify the assignment's purpose, weight the importance of various textual features, and align these elements to analytic scores. In this article, the authors conduct a textual analysis of initiating texts (i.e., rubrics and assignments) that teachers designed for use with a *Scholar* writing and peer response assignment. They identify three types of mismatch among the assignments, assessments, and purposes for writing; discuss implications of these mismatches for student writing and learning; and, finally, suggest ways in which online e-learning environments like *Scholar* might be designed to better support teachers' metacognition around assessment construction.

Xiao, J. (2017). Learner-content interaction in distance education. The weakest link in interaction research. *Distance Education, 38*(1), 123-135.
[Author-provided abstract] – Interaction is a recurrent theme in the literature on distance education. Much of the research along these lines is dedicated to reciprocal interpersonal interaction, that is, learner-learner and learner-instructor interaction. But, there is far less research interest in learner-content interaction despite its fundamental and critical role in ensuring the effectiveness of the distance learning experience and education more generally. This article reflects on the interrelationship and interplay between learner-content, learner-instructor, and learner-learner interactions by drawing on the three-types-of-interaction framework, equivalency theorem, and other interaction research literature. It concludes by calling for more effort to be made to understand how distance learners study course materials or content, arguing that distance learning course materials may not be able to cater for distance learners and achieve their intended learning outcomes unless their design and production are informed by empirical research on learner-content interaction.

Zheng, B. (2018). *Exploring the impact of student-, instructor-, and course-level factors on student learning in online English language and literature courses*. Lansing, MI: Michigan Virtual University. Retrieved from https://mvlri.org/research/publications/exploring-impact-student-instructor-course-level-factors-student-learning
[Author-provided abstract] – The number of K-12 students taking online courses has increased tremendously over the past few years. However, while most current research in online learning focuses either on comparing its overall effectiveness with traditional learning or examining perceptions or interactions using self-reported data, scant research has looked into online design elements and students' learning outcome in K-

12 settings. This report seeks to explore how the combination of three main online education components – student, instructor, and course design – contribute to students' online learning success in high school English language and literature courses.

Zheng, B., Lin, C-H., & Hsu, Y-Y. (2018). World languages in online and blended K-12 education. In K. Kennedy & R. E. Ferdig (Eds.), *Handbook of Research on K-12 Online and Blended Learning*. Retrieved from https://figshare.com/articles/Handbook_of_Research_on_K-12_Online_and_Blended_Learning_Second_Edition_/6686813
[Author-provided abstract] – This chapter is a qualitative exploration and synthesis of research on online world-language courses in K-12 settings, focusing on such courses' effectiveness and the unique challenges of maintaining the quality of language courses as they move from face-to-face to online environments. It identifies two key factors contributing to K-12 students' world language online-learning success – self-regulated learning and interaction – while a thorough examination of teacher-level factors highlights the importance of professional development in both technological skills and pedagogical design. The chapter concludes with implications and detailed recommendations for policy and practice in K-12 world-language education, as well as future directions for research in this area.