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Aligning Information Literacy Assessment with Metacognitive Strategies

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Aligning Information Literacy Assessment with Metacognitive Strategies

Abstract

Despite the popularity of metacognitive research, and the inclusion of similar concepts in professional guidelines, librarians have not incorporated metacognitive tools into their assessment strategies. This systematic literature review found (1) metacognitive assessments can act as a learning aide in encouraging higher-order thinking; (2) metacognitive assessments can be effective measurements under proper conditions with experienced learners; and (3) librarians have limited options when selecting assessment tools even as the demand for demonstrating the library's value to stakeholders is increasing. The paper concludes with gaps in the literature and areas for future directions.

Keywords

metacognition, information literacy

Introduction

When the Association of College and Research Libraries (ACRL) adopted new guidelines for information-literacy (IL) competencies in 2016, the organisation fundamentally transformed the way librarians approached IL instruction. The newly rescinded IL Competency Standards for Higher Education – originally adopted in 2000 – were not without flaws, nor were they universally beloved, but they did provide specific, measurable performance indicators that were used to determine whether a student could be considered information-literate. In place of these quantifiable outcomes, the Framework for Information Literacy for Higher Education (Association of College and Research Libraries [ACRL] 2016) intentionally avoided providing prescriptive instruction, instead offering a more flexible model that allowed individual libraries to determine what assessment strategies were appropriate.

The framework exposed librarians to pedagogical approaches that encourage higher-order thinking and engagement with self-reflective techniques. This aligned library science with trends in related areas that had already begun metacognitive research, one of the most extensively studied frameworks across educational, instructional and developmental psychology fields (Tobias & Everson 2009). The frames added a second challenge of placing assessment solely in the hands of individual libraries at a time when government agencies, funders, accreditation organisations and other external stakeholders increasingly required metrics for accountability to demonstrate the library's value in achieving learning and institutional outcomes.

Despite this shift toward recognising the importance of metacognition and the emphasis on assessment, librarians suffer from a dearth of tools to measure IL skills and assess the impact of IL instruction on students. When selecting assessment techniques, librarians have limited options to pay for fixed-answer quizzes that have gone through validation testing or, for a homegrown alternative, create their own tests, use a performance assessment or design IL rubrics. In higher education, libraries are given the mandate to ensure that students become information-literate and measure their success, but are not given the tools or skills – not to mention the funds – to properly choose measurement techniques (Oakleaf 2008).

Just over a year after the framework was ratified, Catalano (2017) published the first validated tool measuring metacognitive skills for use during library instruction targeting information-literacy skills. The Metacognitive Strategies for Library Research Skills Scale (MS-LRSS) was developed in response to the natural alignment between research, metacognition and student success. By developing this tool, Catalano made the first step toward representing reflective strategies during the research process and addressing the gap in how librarians evaluate an “information-literate” student. This systematic literature review seeks to build upon this momentum toward metacognition in IL by fully identifying and analysing research trends in this area. We investigated the essential elements of metacognition as it relates to assessment, adding value to the literature by making the connection to IL instruction.

Review of key concepts

With such a unique blend of larger, overlapping concepts, in this section we clarify definitions of essential constructs discussed in this review. The wide-ranging research into metacognition has made it difficult for one agreed-upon definition to emerge from the literature. However, it is clear that the study of metacognition can be traced back to the research of Flavell (1979). Generally, metacognition has been referred to as self-regulation, perceived learning and self-monitoring, and can be summarised as the ability to think about one's own cognition and the extent to which one

has control over it (Evans & Rosenbaum 2008; Ibabe & Jauregizar 2010; Kruger & Dunning 1999). Flavell (1979) placed metacognition at the centre of the learning process, concluding that it “plays an important role in oral communication of information, oral persuasion, oral comprehension, reading comprehension, writing, language acquisition, attention, memory, problem solving, social cognition, and various types of self-control and self-instruction” (p. 906). Considering and regulating one’s own thought process plays an important role in researching for information-literate students.

While metacognition is a much more scrutinised concept, IL can be equally as inscrutable to define. As part of the release of the Framework, the authors provided context with a flexible, expansive definition:

Information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning (Association of College and Research Libraries 2016, para. 6).

This more holistic view asked librarians to view IL through affective, attitudinal approaches and values. The Framework also expanded on this definition of IL by introducing the concept of metaliteracy. Metaliteracy further aligns library science with metacognition by asking information-literate students to be reflective and self-aware as content creators and participants in the same information landscape where they research.

Purpose of the review

Given the increasing relevance of metacognition to the field and the ever-present need for assessment, this literature review provides insight into significant research on an expansive topic. Using the literature as a guide, our purpose is to explore how self-reported measurements affect assessment. Additionally, based on our findings of current library assessment strategies, we seek to learn how libraries currently incorporate metacognitive approaches. The following four questions guided this review’s analysis:

1. To what extent are self-assessment report measurements an effective performance assessment?
2. How do metacognitive self-assessments provide additional benefits for cognitive abilities?
3. How do novice and expert learners’ experiences affect self-assessments?
4. What are current assessment needs and strategies for academic libraries?

Methodology

Selection criteria

Due to the expansive nature of the guiding questions, the literature selected for review spanned multiple disciplines of instructional design, educational and developmental psychology and library and information science. We used the following standards in determining the articles to include in this review: content overlaps with information literacy; provides insight into metacognitive self-assessments in varying environments, including multiple grade levels, institution types and businesses; has been published within the last five years to represent the shift in instructional directions in the field to the ACRL framework or, if less recent, found to be influential to the

literature through citation chaining; and has been published in English-language journals. While the research questions emphasise academic libraries operating under the guidance of the ACRL framework, this review did not exclude articles with a metacognitive focus if the studies were set in secondary-school environments. School librarians belong to the American Association of School Librarians (AASL), which has adopted its own standards framework to guide information-literacy instruction. However, despite this division between school librarians and academic librarians in higher education, school librarians have the same mission, and their framework has significant overlap with ACRL's. Additionally, librarians in these environments are preparing today's high-school students for metacognitive awareness when they enter college, and we wanted to recognise any important work on this topic in these settings. Ultimately, two articles outside of higher education were included in this review.

Search strategies

The search for sources was conducted in three rounds, summarised here. (A more thorough description of search strategies can be found in Appendix A.) During the first round, four databases and Google Scholar were searched: *Academic Search Complete*, *Education Resource Complete*, *ERIC* and *LearnTechLib*. We used an iterative search strategy to identify effective keywords as well as appropriate controlled vocabularies. Keywords included: *metacognitive*, *self-regulation*, *self-assessment*, *self-estimation*, *self-awareness*, *measurement*, *evaluation*, *assessment*, *psychometric data*, *academic performance*, *information literacy*, *metaliteracy* and *library*.

For round two, we used citation chaining to identify significant works sourced in articles found in round one. This method ensured that the review would not miss seminal works that had an impact on the field. Google Scholar was helpful in establishing the articles' metrics. After round two, content analysis began on the articles found during the first two rounds; at this point, themes began to emerge. We identified trends that were not fully addressed in sources from the first two rounds of searching and completed a third round of more-directed searching to address the gaps. Ultimately, 17 articles were selected for inclusion in this review.

Results

Efficacy of self-assessment report measures

An area of concern for many researchers was determining whether a metacognitive self-assessment tool could effectively measure competency. A frequent comparison was determining whether there was psychometric support for the accuracy of a metacognitive self-report measurement. Mokhtari and Reichard (2002) wanted to create a self-assessment tool that completed validation testing and evaluated self-perception of reading comprehension. The authors conducted an extensive literature review to create a list of 100 questions to include in the assessment. After they edited the list for redundancy amongst the authors and subject-matter experts, 60 questions remained; these were field tested twice ($n_1 = 825$, $n_2 = 443$). The samples for both rounds of testing were randomly selected from 10 school districts across five midwestern states. Mokhtari and Reichard found that students who completed the metacognitive self-assessment were able to gain insight into their own reading strategies, described as "consciousness-raising" (p. 255). However, while this was an important usage and implication of the tool, the authors warned against using the scores as an indication of students' abilities and usage of reading-comprehension methods. Due to the self-reporting nature of this tool, it is clear that awareness of strategies does not equate with understanding of how to apply them nor use them consistently, which can add an affective quality to assessment, but is not a reliable measure of skill as found in tools emphasising psychometric properties.

This was a common thread in much of the literature, which was reiterated in Freund and Kasten's (2012) meta-analysis review of studies comparing self-estimated cognitive ability to psychometric test scores looking at effect sizes, measured with a significance test of r . The authors ultimately included 42 studies in their review and developed a coding scheme looking at methodology, ability type, assessment, gender of sample participants, sample composition and year of publication. While the analysis demonstrated a medium-sized effect (following Cohen's effect guidelines) for the relationship between self-estimated cognitive ability and tested intelligence ($r = .33$), the validity of self-assessments improved when given a reference point to compare self-estimates. Freund and Kasten's analysis demonstrated that given favorable circumstances, self-estimates were moderately comparable to psychometric-assessed cognitive ability, though confounding variables such as stereotype threat and the better-than-average effect made it difficult to maximise this relationship. More research should be conducted to determine the proper environment to deliver an assessment.

Importance of self-assessment on cognitive abilities

Five studies included in this review reported on the effect of self-assessment of various cognitive abilities. Evans and Rosenbaum (2008) established the importance of metacognitive and self-regulatory behavior by reporting on two studies that looked at the impact on the income and achievement gaps. The first study ($N = 97$) oversampled lower-income nine-year-olds in rural, upstate New York. Cognitive ability was measured using GPA on a 4.0 scale, and self-regulatory behavior was measured using an adapted version of Mischel's (1989) famous Stanford Marshmallow Experiment. The findings from this first study demonstrated a significant correlation between lower socioeconomic class, decreased self-regulatory behavior and diminished academic achievement. For the second study ($N = 774$), fifth-grade students from 10 representative geographic areas across the United States were given the Woodcock Johnson Psychoeducational Battery for a cognitive measure and the same Mischel procedure used in the first study for self-regulatory behavior assessment. The results from the second study demonstrated the same correlation found in the first. The implications from Evans and Rosenbaum's studies illustrate the importance of metacognitive ability not just for development of cognitive abilities that equal success in the classroom, but also for broader life skills.

Ibabe and Jauregizar (2010) examined a voluntary self-assessment exercise linked to recall, recognition and problem-solving used in a required undergraduate psychology course ($N = 116$) at the University of Basque Country. The assessment tool also incorporated immediate feedback for several multiple-choice questions. Frequent use of the voluntary tool was significantly correlated to better academic performance, as was the final self-reported perception of class performance and student effort. While this was a non-experimental design and, therefore, could not produce causal conclusions, the authors noted that those students who engaged in repeated attempts at self-reflection demonstrated an engagement and motivation to create ownership over their learning. Ibabe and Jauregizar also recommended continuous self-reflective check-ins with students throughout a course to allow for an awareness of skills and encourage students to spontaneously self-assess.

Grounded in the literature on self-assessment, Mok et al. (2006) developed five case studies ($n_1 = 32$, $n_2 = 20$, $n_3 = 25$, $n_4 = 30$, $n_5 = 25$) of pre- and in-service early-childhood educators at the Hong Kong Institute of Education. The authors used the Know-Learn-Want (KLW) metacognitive approach – a quick method to encourage learners to reflectively think about what they know, what they want to know and what they learned – and conducted a content analysis on the language used

in the responses. Based on the results, the authors found that, in line with what they found in their literature review, self-assessment opportunities as simple as the KWL model can contribute to greater development of metacognitive skills. While a metacognitive self-assessment can be used to reflectively evaluate performance, Mok et al. also recommended incorporating this approach into the classroom as a learning tool.

Shore et al. (1992), which was frequently cited in other works, presented a unique setting of a job assessment and placement centre. The authors looked at employees of a petroleum company ($N = 394$) who participated in an assessment centre to determine management potential at an early stage in their careers. Cognitive ability was measured using the School and College Ability Test Verbal and Quantitative sections; additionally, participants were given the Sixteen Personality Factor Questionnaire and asked to rank themselves and their peers on a scale of 1 to 6 for overall effectiveness. Based on the results, the authors saw weakened evidence of construct validity for self-evaluations versus peer assessments, and found that self-assessment can be most beneficial when participants are given information to provide perspective on their own performance. Shore, Shore and Thornton suggested that once participants were given that context, a self-assessment could aid with developmental progress.

Wilson and Bai (2010) took a mixed-methods approach to survey graduate students ($N = 105$) in an education program at a large southeastern university in the United States using the Teachers' Metacognition Scale with 20 Likert-scale questions. The purpose of the study was to determine early-career teachers' knowledge of metacognition and how a metacognitive tool could enhance the classroom. Participants recognised the importance of metacognition as an essential element in learning. When students control their own cognitive processes and strategies, they can easily identify gaps in knowledge and problem-solve on how to bridge them. The responses also demonstrated an understanding that engaging students' metacognitive processes requires active-learning techniques, and that the teacher's role would be to coach students and prompt them to engage in reflection. Ultimately, it was clear that the teachers placed a value on metacognitive skills as they related to other fundamental processes in learning.

Novice versus expert learner experience

While metacognitive assessments were frequently used, another theme in the literature emerged: how the experience of the learner influenced the efficacy and usefulness of the assessment. Garcia-Madruga et al. (2013) created an intervention design using pre- and post-testing on third-grade students ($n_1 = 35$; $n_2 = 46$) looking at how novice readers' comprehension and metacognition could be improved with a training program. The authors discussed how working memory reduces the capacity to reflect on one's own thoughts while processing incoming information. Thus when a novice learner was encouraged to actively self-assess while learning new material, the working memory could overload, reducing comprehension-monitoring abilities. Students exposed to the training program in this study gained experience in the comprehension strategies and could participate in the metacognitive exercise differently, possibly gaining more insight while also retaining more content.

Kruger and Dunning (1999) studied how novices could not just misjudge their abilities through self-assessment but actually overestimate their competence. Included in the article were four quasi-experimental designs ($n_1 = 65$, $n_2 = 45$, $n_3 = 84$, $n_4 = 140$) looking at Cornell University undergraduate students from multiple disciplines who were given extra credit to participate. Each of the studies asked participants to complete an exercise – evaluating a joke's humor, completing two logical reasoning exams or taking a grammar test – and then reflect on how their scores would

compare to their peers. The author's noted that across the four studies, the greater the inexperience with the content, the more the participants rated themselves as above average, which Kruger and Dunning related to a lack of metacognitive skills among the novices. In the fourth study, the authors provided training on metacognitive reflection and then retested the participants, increasing the accuracy of their self-assessments. On the opposite end of the spectrum, participants who were more experienced consistently underestimated their performances.

Sitzmann et al. (2010) conducted a meta-analysis of the literature to determine the construct validity of self-evaluations, looking not just at education but also work environments. The authors stated that one purpose of the review was to determine how self-assessments correlated to affective and cognitive learning outcomes. The results indicated that there was a small to moderate effect between self-assessed ability and cognitive skills, but a large effect between self-assessed ability and affective and motivational states. This was true across domains, and especially true for novices. The authors suggested that the inexperienced learners lowered the correlation between self-assessed knowledge and performance-based tests as such learners are often inaccurate in their evaluations. To calibrate for this effect, the literature showed how multiple opportunities for self-assessment, as well as feedback and peer comparisons, improved the accuracy of these self-reporting tools.

Library assessment needs

To better understand how a metacognitive tool could be incorporated into the library environment, it was necessary to review current library assessment needs. Mezick (2014) surveyed the 123 member libraries of the Association of Research Libraries (with a 60% response rate, $N = 74$) asking about the libraries' assessment plans and usage of assessment data. From the responses, 81% of libraries were engaged in some type of assessment activity for a period of five or more years, while 71% of respondents had no library-wide plan guiding that activity, and 35% had no assessment training provided to staff. Mezick recommended that libraries provide a more strategic direction for assessment and tie the library and its contributions to student outcomes and institutional goals, such as retention and degree completion. While this proposal was considered crucial for libraries to demonstrate value, the author also acknowledged that linking library services to students' academic success through a causal relationship is difficult and requires additional research to make recommendations.

In their much-cited commentary article, Oakleaf and Kaske (2009) presented six questions that all librarians should ask themselves when they engage in assessment, representing themes found elsewhere in the literature. The authors recommended that libraries approach assessment with a strategic plan, knowing their stakeholders, intentions, usages of the data, sustainability of projects, and the implications of the assessment prior to even engaging in an assessment plan. These are common pitfalls that librarians do not consider prior to starting short- and long-term projects. Oakleaf and Kaske recommended approaching assessment from multiple angles, using different approaches to acknowledge that each method brings strengths and weaknesses. Additionally, the authors reminded librarians that no assessment project is perfect and that they should begin the cycle to work on any issues and make improvements along the way.

As part of a larger grant project called Assessment in Action, an initiative from ACRL, Prorak (2015) phased a study into two parts. The first examined student bibliographies from a first-year experience seminar, scoring student submissions on a normed rubric from a class without a library intervention and one with a library instructional session. During the second part of the project, the library gave students in another introductory course a confidence survey on using library services,

which indicated increased positive feelings about using the library and asking for assistance. Prorak wrote about the benefits of collaborating with other departments to ensure successful assessment and ensuring sustainable efforts for a continuous-assessment strategy. The author also noted that the original intention was to measure a library's impact on student retention, but she was unable to accomplish that connection with this project, continuing to look for measures that would address that research goal.

Current assessment strategies

After determining a general assessment strategy, librarians then must select a tool from a limited pool to meet their objectives. Sobel and Sugimoto (2012) conducted a national survey of academic libraries, using a random stratified sampling ($N = 75$), questioning respondents' assessment methods, preparation and tools. Based on the participants in this study, tools that had completed validation testing were not a significant resource, meaning most librarians relied on creating their own methods. Tools included self-made worksheets completed during library instruction (54%), quizzes given after library instruction (48%), quizzes given before library instruction (40%) and performance on an assignment created by the instructor completed during library instruction (38%). None of the tools used were considered for longitudinal assessment, and they focused on undergraduate students demonstrating IL skills in a one-hour instructional session.

Oakleaf (2008) conducted a summative literature review of assessment strategies that echoed Sobel and Sugimoto's findings. Of the options available, Oakleaf found there were three varieties: fixed-choice tests, performance assessments and rubrics. Of the three, fixed-choice tests tended to be the only option that included locally developed and non-locally developed choices, and non-locally developed tests were more likely to offer high-predictive validity. At the other end of the spectrum, performance assessments and rubrics could measure higher-order thinking, affective qualities and deep learning.

For librarians using both pre- and post-test options, Portmann and Roush (2004) conducted a quantitative analysis on an adapted non-locally created quiz from Madland and Hagness (1998), using voluntary community-college students enrolled in a 200-level sociology course ($N = 38$). The authors noted the difficulties in their study, but also across library literature, in developing a truly random sample population that was willing to participate in all levels of a survey through completion. Additionally, Portmann and Roush observed the difficulties of controlling for confounding variables with a pre- and post-test model and, once again, focused specifically on short-term instructional interventions rather than the larger impact of library services on institutional goals.

One article included in this review that used a longitudinal approach to assessment was Stonebraker and Fundator's (2016) study of student performance across a sequence of two undergraduate one-credit courses with IL outcomes ($N = 26$). The authors found that the pre- and post-test model worked best to determine retention of foundational IL skills, but did not consider higher-order, metacognitive abilities. The authors found that student learning improved with the librarian intervention, but commented that further research should be conducted to determine the long-term impact on student performance. Additionally, Stonebraker and Fundator wrote that librarians are in a unique position to cross paths with students at multiple stages in their college careers and, therefore, should capitalise on this opportunity in their assessment plans.

Discussion

The present review aimed to identify emerging themes from the growing body of metacognitive assessment research and determine implications for usage in the field of library and information science. Generally, metacognitive assessments are effective tools for measuring ability under specific, favorable circumstances and with more-experienced learners. However, despite the limitations, metacognitive assessment tools have value added as a learning tool that allows respondents to become more reflective in their thought processes with practice and greater exposure to the metacognitive tool. For librarians, higher-order thinking is a fundamental construct of their professional framework and is an important element to demonstrating value when planning for assessment. However, current options available for assessment are limited, and typically focus on shorter-term, skill-based evaluations. Not incorporating metacognitive abilities neglects to incorporate the ACRL Framework's emphasis on metaliteracy. Additionally, reducing assessment to only measuring outcomes of one-shot instruction or credit courses does not allow librarians to consider their larger value to institutional outcomes and student success as recommended by the literature (Mezick 2014; Prorak 2015).

Literature gaps and methodological limitations

Only two articles (Mokhtari & Reichard 2002; Freund & Kasten 2012) relevant to comparing self-estimated assessments to more-objective data measurements were included in this review, but both suggested that metacognitive tools could increase efficacy under certain circumstances, such as providing a reference point with which to compare students' own assessments. However, no further information was provided in those two articles to define the specific circumstances under which these tools flourish. Additional investigations could clarify how to create the proper situation to ensure greater construct validity for the metacognitive assessments. To incorporate the metacognitive approaches into the library literature, more research should be conducted on the greater impact of academic library services to students' success outcomes. These studies should recommend ways of determining a causal relationship to institutional objectives, such as retention, and look beyond shorter-term instructional session assessments.

When generalising the findings of this review, the methodological limitations of the included studies should be considered. Among the 17 reviewed articles, 12 articles contained smaller populations and non-experimental designs that either oversampled certain populations or did not include representative samples. Due to these limitations of a majority of articles included, it is difficult to generalise results to larger populations.

Included articles were disproportionately from an American perspective, which has an impact on how participants view and use self-reflection tools. In Sitzmann et al.'s (2010) meta-analysis, the authors warned against making larger inferences from metacognitive research using samples of US learners, as Western or individualistic cultures tend to demonstrate the better-than-average effect at a greater frequency.

Future research

This review identified several gaps and limitations present in the current literature. One of the guiding purposes of this paper was to determine how metacognitive assessments could support library assessment needs. However, the library literature has not addressed this area, nor has it fully explored measuring higher-order thinking within IL. With the framework incorporating these concepts and the research's demonstration that metacognition can be tied to higher academic and income achievement, library science could demonstrate greater value by pursuing this topic.

As this review was being written, Catalano (2017) published the MS-LRSS, the first metacognitive assessment instrument aimed at librarians. The tool was developed because the author recognised “the importance of metacognitive strategies to successful information searches and information literacy skills” (p. 178). Not only was metacognition linked to information literacy, it also contributed to student success. And yet, of the tools measuring metacognitive awareness generally, “...no specific measure presently exists that incorporates library research” (p. 179). While Catalano had limitations in the small sample size used for validation as well as a lack of representative sampling across student experience, the findings were largely in line with the trends identified in this review. More research can still be done to further validate the MS-LRSS and this review’s conclusions. Incorporating self-reflective components in the literature would demonstrate librarians’ commitment to move toward measuring the ACRL-recommended metaliteracy frame and more general metacognitive abilities. By doing so, librarians would create opportunities for comprehensive, coherent and meaningful assessment. A more holistic approach to assessment would align professional values with metacognition and could create a new understanding of IL.

Conclusion

This literature review summarises research on the efficacy and use of metacognitive self-reflection as well as the assessment strategies that libraries currently use to measure information-literacy outcomes. Taking into consideration issues such as stereotype threat, better-than-average effect and learner experience, metacognitive self-assessments are moderately correlated to accurately measure respondents’ competencies. Despite the connection between information literacy and metacognition, the library-science literature has not integrated metacognition into library assessment. We recommend further research examining the ideal circumstances for giving metacognitive self-assessments to counter the issues raised in the literature. Additionally, we see an opportunity for libraries to demonstrate greater value to their institutions’ missions and student success by expanding current techniques. Transitioning from skill-based quizzes and rubrics to metacognitive tools creates a medium for building information literacy into an assessment strategy that also supports metaliteracy and reflection.

References

- Association of College and Research Libraries 2016, ‘Framework for information literacy for higher education’, viewed 4 April 2017, http://www.ala.org/acrl/sites/ala.org/acrl/files/content/issues/infolit/Framework_ILHE.pdf
- Catalano, A 2017, ‘Development and validation of the metacognitive strategies for Library Research Skills Scale (MS-LRSS)’, *Journal of Academic Librarianship*, vol. 43, no. 3, pp. 178-183.
- Evans, G W & Rosenbaum, J 2008, ‘Self-regulation and the income-achievement gap’, *Early Childhood Research Quarterly*, vol. 23, no. 4, pp. 504-514.
- Flavell, J H 1979, ‘Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry’, *American Psychologist*, vol. 34, no. 10, pp. 906-911.
- Freund, P A & Kasten, N 2012, ‘How smart do you think you are? A meta-analysis on the validity of self-estimates of cognitive ability’, *Psychological Bulletin*, vol. 138, no. 2, pp. 296-321.
- García-Madruga, J, Elosúa, M R, Gil, L, Gómez-Veiga, I, Vila, J O, Orjales, I., Contreras, A, Rodríguez, R, Melero, M A & Duque, G, 2013, ‘Reading comprehension and work memory’s executive processes: An intervention study in primary school students’, *Reading Research Quarterly*, vol. 48, no. 2, pp. 155-174.

- Ibabe, I & Jauregizar, J 2010, 'Online self-assessment with feedback and metacognitive knowledge', *Higher Education*, vol. 59, no. 2, pp. 243-258.
- Kruger, J & Dunning, D 1999, 'Unskilled and unaware of it: How difficulties in recognizing one's incompetence lead to inflated self-assessments', *Journal of Personality and Social Psychology*, vol. 77, no. 6, pp. 1121-1134.
- Mezick, E M 2015, 'Relationship of library assessment to student retention', *Journal of Academic Librarianship*, vol. 41, no. 1, pp. 31-36.
- Mok, M M C, Lung, C L, Cheng, D P W, Cheung, R H P & Ng, M L 2006, 'Self-assessment in higher education: Experience in using a metacognitive approach in five case studies', *Assessment & Evaluation in Higher Education*, vol. 31, no. 4, pp. 415-433.
- Mokhtari, K & Reichard, C A 2002, 'Assessing students' metacognitive awareness of reading strategies', *Journal of Educational Psychology*, vol. 94, no. 2, pp. 249-259.
- Oakleaf, M 2008, 'Dangers and opportunities: A conceptual map of information literacy assessment approaches', *Libraries and the Academy*, vol. 8, no. 3, pp. 233-253.
- Oakleaf, M & Kaske, N 2009, 'Guiding questions for assessing information literacy in higher education', *Libraries and the Academy*, vol. 9, no. 2, pp. 273-286.
- Portmann, C A & Roush, A J 2004, 'Assessing the effects of library instruction', *Journal of Academic Librarianship*, vol. 30, no. 6, pp. 461-465.
- Prorak, D 2015, 'Assessment of library instruction within general education learning outcomes and academic support programs: Determining impact on student research skills, confidence, and retention', in E Ackermann (ed.), *Putting Assessment into Action*, Association of College and Research Libraries, Chicago, pp. 51-56.
- Shore, T H, Shore, L M & Thornton, G C 1992, 'Construct validity of self- and peer evaluations of performance dimensions in an assessment center', *Journal of Applied Psychology*, vol. 77, no. 1, pp. 42-54.
- Sitzmann, T, Ely, K, Brown, K G & Bauer, K N 2010, 'Self-assessment of knowledge: A cognitive learning or affective measure?', *Academy of Management Learning & Education*, vol. 9, no. 2, pp. 169-191.
- Sobel, K & Sugimoto, C R 2012, 'Assessment of learning during library instruction: Practices, prevalence, and preparation', *Journal of Academic Librarianship*, vol. 38, no. 4, pp. 191-204.
- Stonebraker, I R & Fundator, R 2016, 'Use it or lose it? A longitudinal performance assessment of undergraduate business students' information literacy', *Journal of Academic Librarianship*, vol. 42, no. 4, pp. 438-444.
- Tobias, S & Everson, H T 2009, 'The importance of knowing what you know: A knowledge monitoring framework for studying metacognition in education', in D J Hacker, J Dunlosky & A C Graesser (eds), *Handbook of metacognition in education*, Routledge, New York, pp. 107-127.
- Wilson, N S & Bai, H 2010, 'The relationships and impact of teachers' metacognitive knowledge and pedagogical understandings of metacognition', *Metacognition Learning*, vol. 5, no. 3, pp. 269-288.

Appendix A

Detailed Description of Search Strategies

We began the process of identifying eligible studies by separately searching four major databases: *Educational Research Information Center* (ERIC), *Education Research Complete* (ERC), *Academic Search Complete* (ARC) and *LearnTechLib*. Keyword searches were conducted using combinations of “metacognitive”, “self-regulation”, “self-assessment”, “self-estimation”, “self-awareness”, “measurement”, “evaluation”, “assessment”, “psychometric data”, “academic performance”, “information literacy”, “metaliteracy” and “library”. This round of searching yielded 37 results in ERC, 369 in ERIC, 810 in ARC and 292 in *LearnTechLib*. We identified 13 articles that met the selection criteria and were therefore included for further analysis.

A second round of searching was conducted using Google Scholar’s citation index to identify seminal works and further expand the article pool. Reviewing articles with more than 100 citations allowed us to find an additional 15 eligible articles. At the end of this stage, a total of 28 articles were being considered for inclusion.

We then carefully screened the resulting pool of articles using the previously established selection criteria to determine the eligibility: content overlaps with information literacy; provides insight into metacognitive self-assessments in varying environments, including multiple grade levels, institution types and businesses; has been published within the last five years to represent the shift in instructional directions in the field to the ACRL framework or, if less recent, found to be influential to the literature through citation chaining; and has been published in English-language journals. The screening process was performed through reading the abstracts of each article. Articles that did not match the described guidelines were excluded. Seventeen articles remained eligible after the screening phase.