Approaches to Assessment in Higher Education

Colin Madland

2022-03-30

Table of Contents

# Introduction

Assessing learning is both a critical component of the work of teaching in higher education and also a major factor in learners’ experiences of higher education ([Biggs, 1999](#ref-biggsWhatStudentDoes1999); [Woldeab & Brothen, 2019](#ref-woldeab21stCenturyAssessment2019)). Faculty and instructors’ approaches to assessment in higher education are shaped by a variety of factors, including the approaches to assessment that they experienced as learners ([Lipnevich et al., 2020](#ref-lipnevichWhatGradesMean2020); [Massey et al., 2020](#ref-masseyAssessmentLiteracyCollege2020)), pressure from our increasingly technological society to integrate digital tools into the teaching and learning process ([Pellegrino & Quellmalz, 2010](#Xd3220b3c4c74762840488f1ab7714e7e895bc2e)), and the changing needs of 21st-century employers and objectives of higher education institutions, who seek employees and graduates with demonstrated ability in collaboration, creative problem-solving, analytical thinking, and the ability to learn ([Forum, 2020](#Xaf0f34faf6db1662e8da0b9850d3b9cfe5dbeed); [Shute et al., 2010](#ref-shute21stCenturyAssessment2010)), competencies not easily measured in traditional testing formats.

Massey et al., ([2020](#ref-masseyAssessmentLiteracyCollege2020)) contend that instructors in higher education typically have few opportunities to engage in formal preparation for the task of assessing learning, and consequently there is high variability in how instructors assess learning in their courses. This is congruent with Coombs et al.’s ([2020](#ref-coombsSeaSeaCanadian2020)) findings that even preservice teachers in teacher preparation programs are often unprepared for the challenge of assessing learning. If pre-service teachers, who complete a program of formal academic preparation for teaching, are under-prepared, it follows that those who exit doctoral programs with no formal preparation for teaching or assessment ([Lipnevich et al., 2020](#ref-lipnevichWhatGradesMean2020)) will be even less adequately prepared. This lack of formal preparation generally means that higher education instructors assess learning in the only way they know how, which is to follow the example of their supervisors and professors from graduate school.

In her important article, Shepard ([2000](#ref-shepardRoleAssessmentLearning2000)) argues that traditional assessment structures originated in past models of curriculum and instruction which were popular in the early 1900s. These curricular models emphasized the work of psychologists like Thorndike ([Thorndike, 1905](#ref-thorndikeElementsPsychology1905)) and Skinner ([Skinner, 1938](#ref-skinnerBehaviourOrganisms1938)) who viewed the process of learning as being grounded in the mechanistic view of behaviourism where learning is the result of the precise and controlled input of ‘knowledge’ and reinforced with rewards for correct responses. As such, instructors (appropriately) designed their assessments to align with the curricular goals of the time and assessed learning by determining whether or not a learner could provide the single correct response to a given question at a time removed from the instruction. However, in the latter half of the 20th century, when western psychologists discovered the ideas of Lev Vygotsky ([Vygotsky, 1978](#ref-vygotskyMindSociety1978)), curricula began to take a more social-constructivist approach that emphasized higher-order thinking, problem-solving in social contexts, and metacognitive skills over rote memorization.

Unfortunately, it seemed that the efficiencies of testing memory, recognition, and recall through selected-response tests were too deeply embedded in the practices of higher education instructors who resisted changing their assessments to match the new curricular goals ([Shepard, 2000](#ref-shepardRoleAssessmentLearning2000)). Shepard argues for the need to integrate assessment and instruction in such a way as to engage learners in authentic performance tasks more suited to modern understandings of cognition. It appears now that, in the twenty years since Shepard wrote her paper, the goals of early 21st century curricula have continued to diverge from those of the 20th century with the World Economic Forum identifying competencies in collaboration, analytical thinking, creative problem-solving, and the continual learning as being priorities for 21st century employers ([Forum, 2020](#Xaf0f34faf6db1662e8da0b9850d3b9cfe5dbeed)). Models of assessment which mimic and re-inscribe traditional assessment practices and prioritize testing skills in a manner aligned with 20th century curricular models are no longer adequate because they no longer align with the priorities of modern higher education ([Broadfoot, 2016](#X51a879b1b801bbc5ad6e7fc588f4456f2973b2d); [Crooks, 1988](#ref-crooksImpactClassroomEvaluation1988); [Pellegrino & Quellmalz, 2010](#Xd3220b3c4c74762840488f1ab7714e7e895bc2e); [Timmis et al., 2016](#X9783eef1c37e492f1192ce9092108eb526b7f44)).

Furthermore, pressures from our increasingly technological society have also impacted instructors’ approaches to their assessment practice. O’Donnell ([2020](#Xb8ef97dcd64a46920c7df0026dc0b714b2ee92d)) argues that *all* learning in higher education is now mediated in some way by technology, even if it is the superficial use of a word processor an instructor uses to create course materials or a learner uses to compose an essay. Even so, he claims that the use of technology often does little more than increase the efficiency (a term which he declines to define) of existing practices (an example might be reducing the time it takes to score a selected-response exam by using bubble sheets for examinee responses). This critique echoes Timmis et al. ([2016](#X9783eef1c37e492f1192ce9092108eb526b7f44)) who argue that prioritizing superficial characteristics of technology, like ‘efficiency,’ comes at the cost of more innovative applications.

Additionally, the datafication of higher education has made very large data sets available to individual instructors as well as to learning technology administrators. This is often in the form of log data from learning management systems (LMS) which has been used to explore relationships between learner behaviours in the LMS and achievement ([Pardo & Reimann, 2020](#ref-pardoBidirectionalEffectData2020); [Stadler et al., 2020](#ref-stadlerFirstEqualsLog2020)). Shute and Rahimi reported on their exploration of what they call “stealth assessments” ([2021, p. 4](#ref-shuteStealthAssessmentCreativity2021)) where large amounts of data are collected as learners interact in game-based learning environments. They argue that stealth assessments, which learners do not notice because they are woven seamlessly into the learning materials and automatically scored based help to alleviate test anxiety for learners, leading to greater achievement ([Shute et al., 2010](#ref-shute21stCenturyAssessment2010)). Milligan writes about the optimism with which early learning analytics researchers advocated for using big data that ([2020](#X176a232588f05c4bc332011296c94f6bd1d0211))

# A Review of the Literature on Assessment in Technology-mediated Higher Education

## Topic

* Approaches to assessment in technology-mediated higher education

## Problem

* We don’t know how the increased use of technology in higher education has impacted higher education instructors’ approaches to assessment.

## Purpose

* the purpose of this literature review will be to analyze, synthesize and critique the literature since 2010 related to how instructors in higher education approach classroom assessment in increasingly technology-mediated environments.

## Questions

1. What are the major themes or patterns in the literature related to assessment in higher education?
2. What are the major themes or patterns in the literature related to the impact of technology on assessment in higher education?
3. What gaps exist in the literature related to assessment in technology-mediated higher education?

## Defining Assessment

### Historical Definitions

* Among the more influential publications related to modern views of assessment (then usually called “evaluation”) was Scriven’s ([1967](#ref-scrivenMethodologyEvaluation1967)) article in which he drew distinctions between “formative” and “summative” evaluation.
* This distinction was quickly incorporated into Bloom’s ([1968](#ref-bloomLearningMasteryInstruction1968)) ideas related to mastery learning and began to be promoted as a model for educational reform.
* However, by the late 1990s, when Black and Wiliam ([1998](#ref-blackAssessmentClassroomLearning1998)) published their thorough review of the literature, the idea of formative assessment was still not well-defined or implemented. Black and Wiliam framed formative assessment as “encompassing all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged” ([1998, pp. 7–8](#ref-blackAssessmentClassroomLearning1998)).
* The National Research Council’s (NRC) 2001 report *Knowing what students know*, advanced understanding of assessment with their definition of assessment as “a process of drawing reasonable inferences about what students know on the basis of evidence derived from observations of what they say, do, or make in selected situations” ([Pellegrino et al., 2001, p. 112](#ref-pellegrinoKnowingWhatStudents2001)) or, more simply, “reasoning from evidence” ([Pellegrino et al., 2001, p. 43](#ref-pellegrinoKnowingWhatStudents2001)), based on Mislevy’s assertion that “test theory is machinery for reasoning from students’ behavior to conjectures about their competence, as framed in a particular conception of competence.” ([1994, p. 4](#ref-mislevyTestTheoryReconcieved1994)).
* The NRC models assessment as a triangle composed of three interdependent components of any assessment (Figure 1): *cognition*, or a model of the domain to be learned; *observation*, or the performance task learners will complete to demonstrate their competence; and an *inference* or *interpretation* of the data produced by the observation. The interdependent nature of the three components requires that both the observation and interpretation components be grounded in the nature of the cognitive model of the domain.

### Modern Conceptions of Assessment

* Since ~2010, there has been a shift in how researchers view assessment towards assessment being a complex, multi-faceted construct in which instructors bring with them a host of experiences and beliefs about assessment, some of which were passed down from their own instructors ([Lipnevich et al., 2020](#ref-lipnevichWhatGradesMean2020); [Massey et al., 2020](#ref-masseyAssessmentLiteracyCollege2020)), but others are based in course and institutional policies and the social dynamics within their department ([G. T. L. Brown et al., 2011](#X7545160f175b9eeeaf92f7a1f4f6c5a1f4f7d20)).
* Earl ([2013](#ref-earlAssessmentLearningUsing2013)) further clarified the role assessment can play in learning by highlighting a distinction between assessment *of* learning (summative assessment) and assessment *for* learning (formative assessment by way of feedback) and also distinguishing both of those from assessment *as* learning (a subset of assessment *for* learning in which learners employ metacognitive skills to regulate their own learning tasks).
* DeLuca et al. ([2013](#X32b95a94fb3076f8d0c577bd9276160db2e95e5)) argue that there are categories of conceptions exhibited by K-12 preservice teachers: assessment as testing, assessment as format, assessment purpose, and assessment as process. These conceptions are seen as increasingly complex, with those who see assessment as testing believing that assessment is primarily concerned with summative assessment of learning, usually using teacher-created selected-response tests. Those who see assessment as format tend to focus on whether the assessment is a “performance, product, or objectively-scored assessment” (p. 110). Assessment as purpose is delineated according to the summative/formative binary or Earl’s ([2013](#ref-earlAssessmentLearningUsing2013)) assessment *of/for/as* learning model. DeLuca et al. also identify other purposes of assessment such as accountability, gatekeeping, and teacher evaluation. Lastly, assessment as process, which is based on the National Research Council’s description of assessment being a process of reasoning from evidence ([2001](#ref-pellegrinoKnowingWhatStudents2001)).
* Fletcher et al. ([2012](#Xa55a5d631b402fa2c3fda6e3997bc5d48ccd027)) used Brown’s ([2017](#X398061bedf4ca6ea011494eb395f9026963cd42)) abridged *Conceptions of Assessment* (CoA) questionnaire to measure learners’ and instructors’ conceptions as follows: “assessment makes institutions accountable, assessment makes students accountable, assessment describes improvements in student abilities, assessment improves student learning, assessment improves teaching, assessment is valid, assessment is irrelevant and bad, assessment is irrelevant and ignored, and assessment is irrelevant and inaccurate” (p. 122). They report that instructors were more likely than learners to view assessment as consistent and trustworthy methods to understand and improve learning and that learners were more likely to have negative views of assessment and viewed it as a measure of student and institutional accountability.
* Massey et al. ([2020](#ref-masseyAssessmentLiteracyCollege2020)) used DeLuca et al.’s ([2013](#X32b95a94fb3076f8d0c577bd9276160db2e95e5)) framework of conceptions in their study of HE instructors’ conceptions of assessment before and after an instructional development course focussed on assessment. They also considered the idea that there are two general orientations towards assessment in HE, an “assessment culture” and a “testing culture” [Massey et al.](#ref-masseyAssessmentLiteracyCollege2020) ([2020](#ref-masseyAssessmentLiteracyCollege2020)). They report that they saw significant shifts in participants’ conceptions of assessment from more simplistic views of assessment as testing pre-treatment, to more complex and nuanced views of assessment as process post-treatment.

## Assessment Literacy

* The idea of AL is relatively recent in the K-12 literature and is nascent and under-theorized with respect to HE contexts ([Medland, 2015](#X5c86252aa4ff917d9cc0a272767d26b88512cd6)). AL has been defined variously as “the skills and knowledge teachers require to measure and support student learning through assessment” ([DeLuca et al., 2016](#Xedee9bc10fe7ddda531b14b05542852ae9f5f1e)), “a basic understanding of educational assessment and related skills to apply such knowledge to various measures of student achievement” ([Xu & Brown, 2016](#ref-xuTeacherAssessmentLiteracy2016)), “an individual’s understandings of the fundamental assessment concepts and procedures deemed likely to influence educational decisions” ([Popham, 2011](#X2ef0bb9d5e3fccea0cf8ddd6c54b6184255abbf)) and “a dynamic context-dependent social practice that involves teachers articulating and negotiating classroom and cultural knowledges with one another and with learners, in the initiation, development and practice of assessment to achieve the learning goals of students” ([Willis et al., 2013](#X731be6e2e0895c79e0f034fc829fd623ca4b0d3)). Key to these definitions are the ideas that AL is a complex, multi-faceted construct, that AL requires *adequate* (not high) levels of psychometric or statistical analyses, and that it is intended to enable learner success.
* conceptualizations of AL have tended to be based on sets of standards to which K-12 teachers are obligated. The first set of standards was the *Standards for Teacher Competence in Educational Assessment of Students* (the *Standards*), published by a committee of representatives from the American Federation of Teachers, the National Council on Measurement in Education, and the National Education Association ([AFT et al., 1990](#ref-StandardsTeacherCompetence1990)).
* Shortly after the publication of the *Standards*, the term *assessment literacy* appeared in the literature with Stiggins’ ([1991](#ref-stigginsAssessmentLiteracy1991)) article called *Assessment Literacy*. Stiggins initial article was an account of his observation that teacher education programs at the time spent very little time training teachers in the methods and dispositions of educational measurement. -Stiggins followed this with another article ([Stiggins, 1995](#ref-stigginsAssessmentLiteracy21st1995)) where he outlined five characteristics of sound assessments
* At around the same time, a group of Canadian educators published the *Principles for Fair Student Assessment Practices for Education in Canada*, Part A of which was a list of 37 guidelines related to five principles of fair student classroom assessment and was based on the 1990 *Standards*
* Twenty years following the publication of the *Standards*, Brookhart ([2011](#X36e21314cdda5af289172df8b2fdcbf83ba9ea4)) argued that the *Standards* had become outdated because they did not address either the growing practices and ideas of formative assessment (assessment *for* and *as* learning) or standards-based assessment and that they needed to be revised. Brookhart suggested a list of 11 skills (see Appendix A) to adjust the focus of the 1990 *Standards* to be in greater alignment with more modern conceptions of assessment.
* Finally, in 2015, the Joint Committee on Standards for Educational Evaluation (JCSEE), with key representatives from both Canada and the USA, published the most recent set of standards, called the *Classroom Assessment Standards for PreK-12 Teachers* (see Appendix A). The JCSEE standards are grouped into three broad domains (foundations, use, and quality), each with five or six related standards. Despite the similarities to the *Principles for Fair Student Assessment Practices for Education in Canada*, including at least one common committee member, the JCSEE Standards are specifically not intended for use in HE.
* As traditional conceptions of assessment and the standards expected of teachers, grounded in behaviourism and the need for objectivity tended to focus on assessment as a set of skill-based competencies to be employed by instructors, so AL could be defined as a set of sequential tasks in which instructors should engage to ensure objectivity and fairness (e.g. ([Natriello, 1987](#X949dc1c922451eed515cca009b0e2211dbab978))). Recently, as curriculum and pedagogy have changed, several researchers have proposed models related to AL grounded in socio-constructivist views of learning ([DeLuca, 2012](#ref-delucaPreparingTeachersAge2012); [Pastore & Andrade, 2019](#ref-pastoreTeacherAssessmentLiteracy2019); [Xu & Brown, 2016](#ref-xuTeacherAssessmentLiteracy2016)).

## Approaches to Assessment

## Assessment and Measurement

### Validity

### Reliability

### Fairness

## Assessment in Higher Education

## Impact of Technology on Assessment in Higher Education

# Assessment and Digital Technology in Higher Education: A Review of the Literature

## Abstract

Assessment is a core component of teaching and learning in higher education which has been impacted in various ways by the growth of technology in society and education. While technology is often employed in society to increase efficiency, this may not be a helpful goal or metric when applying technology to the process of assessing learning. This review of the literature explores how technology has impacted assessment practices in higher education and how faculty, instructors, and educational technologists encourage ethical approaches to using technology for assessment.

## Proposal

Higher education has been significantly impacted by the advent and growth of digital technologies. Student Information Systems (SIS), such as Banner or Jenzabar, have created efficiencies in how learners are registered in programs and courses, how learners plan their programs, and how administrators create timetables and schedules. Learning Management Systems (LMS), such as Moodle, Blackboard, Canvas, and Desire2Learn, have created efficiencies in connecting SISs with front-line staff and faculty by automating the process of ensuring that learners show up in the proper section of a given course, giving faculty and instructors relatively robust tools for communicating with learners, and distributing and gathering documents. Data analysis platforms such as Tableau and R have created efficiencies in how universities analyze learner behaviour in courses ([Watson et al., 2017](#ref-watsonSmallDataOnline2017)). Customer Relationship Management (CRM) software such as Salesforce have created efficiencies in how universities connect with alumni, manage donor relations, and recruit new learners. In each of these cases, increases in efficiency have been the point, or the end goal of the implementation of technology. Efficiency has amplified the impact of peoples’ work and is virtuous if your goal is profitability.

However, if your goal is the betterment of human beings, doing the same things more efficiently may be counter-productive, and it may be preferrable to instead do different things ([Oldfield et al., 2012](#ref-oldfieldAssessmentDigitalAge2012); [Pellegrino & Quellmalz, 2010](#Xd3220b3c4c74762840488f1ab7714e7e895bc2e)). The tri-partite goals of the modern university: research, teaching, and service, have traditionally had as their end goal the betterment of society and the individuals within. Teaching and learning are profoundly inefficient tasks subject to myriad influences and personal characteristics of both the teacher and the learner. As a key component of the teaching and learning process, assessment is also subject to many influences, making efficiencies detrimental to the process.

This presentation will be a summary of a literature review conducted to explore current research on the impact of technology on assessment in higher education. A preliminary review shows that there are multiple ways that technology has impacted assessment practices in higher education. First, Large Scale Assessments (LSA) used as entrance exams to university (Scholastic Aptitude Test), or to specific programs (Law School Admissions Test, Medical College Admission Test), have benefitted from the use of digital data analysis tools to improve validity and reliability and also from advances in automated item generation. Assessments used for admission into specific professions, such as the National Council Licensure Examination (NCLEX) for those wishing to enter the nursing profession after completing a degree in Nursing utilize computerized adaptive testing ([Smith Glasgow et al., 2019](#X88b1c0c95c5ecb040b63ac0eab37de36c7ef351)) where the difficulty of questions the candidate sees is determined by their previous performance. Second, instructors are using digital tools to revise their assessment practices to align with curricular goals of collaboration, problem-solving, creativity, and divergent thinking ([Broadfoot, 2016](#X51a879b1b801bbc5ad6e7fc588f4456f2973b2d)). Third, some instructors and institutions are using technology to allow for remote exam candidates to write exams in proctored environments ([Selwyn et al., 2021](#ref-selwynNecessaryEvilRise2021)). Finally, instructors are using technology to enhance and also to capture evidence of learner interactions in remote, asynchronous learning environments ([Pellegrino & Quellmalz, 2010](#Xd3220b3c4c74762840488f1ab7714e7e895bc2e)). Each of these uses will be explored in relation to one of the foundational goals of higher education, the betterment of individuals for the good of society.

## Statement of Engagement

Participants will be given the opportunity in small groups to discuss how they might apply the findings of the literature review to their own teaching or research practice, followed by a short debrief with the full group.

AFT, NCME, & NEA. (1990). *Standards for Teacher Competence in Educational Assessment of Students*.

Biggs, J. (1999). What the Student Does: Teaching for enhanced learning. *Higher Education Research & Development*, *18*(1), 57–75. <https://doi.org/drgphk>

Birenbaum, M. (1996). Assessment 2000: Towards a pluralistic approach to assessment. In M. Birenbaum & F. J. R. C. Dochy (Eds.), *Alternatives in assessment of achievements, learning processes and prior knowledge* (Vol. 42, pp. 3–29). Kluwer Academic/Plenum Publishers.

Birenbaum, M. (2003). New insights into learning and teaching and their implications for assessment. In M. Segers, F. Dochy, & E. Cascallar (Eds.), *Opti- mising new modes of assessment: In search of qualities and standards* (pp. 13–36). Kluwer Academic Publishers.

Black, P., & Wiliam, D. (1998). Assessment and Classroom Learning. *Assessment in Education: Principles, Policy & Practice*, *5*(1), 7–74. <https://doi.org/fpnss4>

Bloom, B. (1968). Learning for Mastery. Instruction and Curriculum. Regional Education Laboratory for the Carolinas and Virginia, Topical Papers and Reprints, Number 1. *Evaluation Comment*, *1*(2), 12.

Broadfoot, P. (2016). Assessment for Twenty-First-Century Learning: The Challenges Ahead. In M. J. Spector, B. B. Lockee, & M. D. Childress (Eds.), *Learning, Design, and Technology* (pp. 1–23). Springer International Publishing. <https://doi.org/10.1007/978-3-319-17727-4_64-1>

Brookhart, S. M. (2011). Educational Assessment Knowledge and Skills for Teachers. *Educational Measurement: Issues and Practice*, *30*, 3–12. <https://doi.org/cwcqj4>

Brown, G. (2017). *Teachers Conceptions of Assessment - Secondary Schools Long and Abridged*. <https://doi.org/gj4tz6>

Brown, G. T. L., Lake, R., & Matters, G. (2011). Queensland teachers’ conceptions of assessment: The impact of policy priorities on teacher attitudes. *Teaching and Teacher Education*, *27*(1), 210–220. <https://doi.org/c3k8f5>

Coombs, A., Ge, J., & DeLuca, C. (2020). From sea to sea: The Canadian landscape of assessment education. *Educational Research*, 1–17. <https://doi.org/gh5k4z>

Crooks, T. J. (1988). The Impact of Classroom Evaluation Practices on Students. *Review of Educational Research*, *58*(4), 438–481. <https://doi.org/dvd8nf>

DeLuca, C. (2012). Preparing teachers for the age of accountability: Toward a framework for assessment education. *Action in Teacher Education*, *34*, 576–591. <https://doi.org/10.1080/01626620.2012.730347>

DeLuca, C., Chavez, T., & Cao, C. (2013). Establishing a foundation for valid teacher judgement on student learning: The role of pre-service assessment education. *Assessment in Education: Principles, Policy & Practice*, *20*(1), 107–126. <https://doi.org/gj5v98>

DeLuca, C., LaPointe-McEwan, D., & Luhanga, U. (2016). Approaches to classroom assessment inventory: A new instrument to support teacher assessment literacy. *Educational Assessment*, *21*, 248–266. <https://doi.org/gfgtsg>

Earl, L. M. (2013). *Assessment as learning: Using classroom assessment to maximize student learning* (Second edition). Corwin Press.

Fletcher, R. B., Meyer, L. H., Anderson, H., Johnston, P., & Rees, M. (2012). Faculty and Students Conceptions of Assessment in Higher Education. *Higher Education*, *64*(1), 119–133. <https://doi.org/ctccpq>

Forum, W. E. (2020). *The Future of Jobs Report 2020*. World Economic Forum.

Lipnevich, A. A., Guskey, T. R., Murano, D. M., & Smith, J. K. (2020). What do grades mean? Variation in grading criteria in American college and university courses. *Assessment in Education: Principles, Policy & Practice*, *27*(5), 480–500. <https://doi.org/ghjw3k>

Massey, K. D., DeLuca, C., & LaPointe-McEwan, D. (2020). Assessment Literacy in College Teaching: Empirical Evidence on the Role and Effectiveness of a Faculty Training Course. *To Improve the Academy*, *39*(1). <https://doi.org/gj5ngz>

Medland, E. (2015). Examining the assessment literacy of external examiners. *London Review of Education*. <https://doi.org/gk5sph>

Milligan, S. (2020). Standards for Developing Assessments of Learning Using Process Data. In M. Bearman, P. Dawson, R. Ajjawi, J. Tai, & D. Boud (Eds.), *Re-imagining University Assessment in a Digital World* (Vol. 7, pp. 179–192). Springer International Publishing. <https://doi.org/10.1007/978-3-030-41956-1_13>

Mislevy, R. J. (1994). Test theory reconcieved. *ETS Research Report Series*, *1994*(1), i–38. <https://doi.org/gjm236>

Natriello, G. (1987). The Impact of Evaluation Processes on Students. *Educational Psychologist*, *22*(2), 155–175. <https://doi.org/cgqtqx>

O’Donnell, M. (2020). Assessment as and of Digital Practice: Building Productive Digital Literacies. In M. Bearman, P. Dawson, R. Ajjawi, J. Tai, & D. Boud (Eds.), *Re-imagining University Assessment in a Digital World* (Vol. 7, pp. 111–125). Springer International Publishing. <https://doi.org/10.1007/978-3-030-41956-1_9>

Oldfield, A., Broadfoot, P., Sutherland, R., & Timmis, S. (2012). *Assessment in a Digital Age: A research review*. Graduate School of Education, University of Bristol.

Pardo, A., & Reimann, P. (2020). The Bi-directional Effect Between Data and Assessments in the Digital Age. In M. Bearman, P. Dawson, R. Ajjawi, J. Tai, & D. Boud (Eds.), *Re-imagining University Assessment in a Digital World* (Vol. 7, pp. 165–178). Springer International Publishing. <https://doi.org/10.1007/978-3-030-41956-1_12>

Pastore, S., & Andrade, H. L. (2019). Teacher assessment literacy: A three-dimensional model. *Teaching and Teacher Education*, *84*, 128–138. <https://doi.org/gh5k7b>

Pellegrino, J. W., Chudowsky, N., & Glaser, R. (2001). *Knowing What Students Know: The Science and Design of Educational Assessment*. National Academies Press. <https://doi.org/10.17226/10019>

Pellegrino, J. W., & Quellmalz, E. S. (2010). Perspectives on the Integration of Technology and Assessment. *Journal of Research on Technology in Education*, *43*(2), 119–134. <https://doi.org/ggfh8z>

Popham, W. J. (2011). Assessment Literacy Overlooked: A Teacher Educator’s Confession. *The Teacher Educator*, *46*(4), 265–273. <https://doi.org/dctz5h>

Scriven, M. (1967). The methodology of evaluation. In B. O. Smith (Ed.), *Perspectives of curriculum evaluation*. Rand McNally.

Selwyn, N., O’Neill, C., Smith, G., Andrejevic, M., & Gu, X. (2021). A necessary evil? The rise of online exam proctoring in Australian universities. *Media International Australia*, 1329878X2110058. <https://doi.org/gj6tzt>

Shepard, L. A. (2000). The Role of Assessment in a Learning Culture. *Educational Researcher*, *29*(7), 4–14. <https://doi.org/cw9jwc>

Shute, V. J., Dennen, V. P., Kim, Y., Donmez, O., & Wang, C. (2010). *21st century assessment to promote 21st century learning: The benefits of blinking*.

Shute, V. J., & Rahimi, S. (2021). Stealth assessment of creativity in a physics video game. *Computers in Human Behavior*, *116*, 106647. <https://doi.org/10.1016/j.chb.2020.106647>

Skinner, B. (1938). *The behaviour of organisms*. Appleton-Century-Crofts.

Smith Glasgow, M. E., Dreher, H. M., & Schreiber, J. (2019). Standardized testing in nursing education: Preparing students for NCLEX-RN and practice. *Journal of Professional Nursing*, *35*(6), 440–446. <https://doi.org/ggqh9p>

Stadler, M., Hofer, S., & Greiff, S. (2020). First among equals: Log data indicates ability differences despite equal scores. *Computers in Human Behavior*, *111*, 106442. <https://doi.org/10.1016/j.chb.2020.106442>

Stiggins, R. J. (1991). Assessment Literacy. *The Phi Delta Kappan*, *72*(7), 534–539.

Stiggins, R. J. (1995). Assessment Literacy for the 21st Century. *The Phi Delta Kappan*, *77*(3), 238–245.

Thorndike, E. L. (1905). *The Elements of psychology*. A.G. Seiler.

Timmis, S., Broadfoot, P., Sutherland, R., & Oldfield, A. (2016). Rethinking assessment in a digital age: Opportunities, challenges and risks. *British Educational Research Journal*, *42*(3), 454–476. <https://doi.org/gftz95>

Vygotsky, L. S. (1978). *Mind in society* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.; A. R. Luria, Trans.). Harvard University Press.

Watson, C., Wilson, A., Drew, V., & Thompson, T. L. (2017). Small data, online learning and assessment practices in higher education: A case study of failure? *Assessment & Evaluation in Higher Education*, *42*(7), 1030–1045. <https://doi.org/ggrgxn>

Willis, J., Adie, L., & Klenowski, V. (2013). Conceptualising teachers’ assessment literacies in an era of curriculum and assessment reform. *The Australian Educational Researcher*, *40*(2), 241–256. <https://doi.org/gh5k7d>

Woldeab, D., & Brothen, T. (2019). 21st Century assessment: Online proctoring, test anxiety, and student performance. *International Journal of E-Learning & Distance Education*, *34*(1).

Xu, Y., & Brown, G. T. L. (2016). Teacher assessment literacy in practice: A reconceptualization. *Teaching and Teacher Education*, *58*, 149–162. <https://doi.org/f8txgm>