





# Evolving Our Understanding of Technology-Integrated Assessment: A Review of the Literature and Development of a New Framework

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## Abstract

In this paper, we review the literature on technology in assessment in higher education and compare how the literature aligns with the assessment in a digital world framework (Bearman et al., 2022). We found themes in the literature that were not present in the framework (e.g., academic integrity and faculty workload) and constructs in the framework not evident in the literature (e.g., future self and future activities). Additionally, we consider other gaps in both the framework and the literature evident in day-to-day practices and government legislation or mandates, such as considering legal or ethical aspects of duty of care and the integration of Indigenous worldviews. We then developed the technology-integrated assessment framework to help instructors and administrators consider a broader range of constructs when planning assessment strategies in technology-integrated learning environments and to serve as a basis for further investigation into how the different constructs within the framework contribute to how we design, implement, and teach about assessment in digital learning environments today. We present an introduction of this technology-integrated assessment framework and discuss future research goals and opportunities.

**Keywords:** technology-integrated assessment, higher education, technology, assessment, duty of care



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## **Introduction**

There is a complex constellation of factors that influence technology-integrated assessment practice in higher education. Factors include ongoing calls for assessment reform (Boud, 2000; Felten & Meinking, 2024), implementations of technological tools with little regard to their potential for harm (Gilliard & Selwyn, 2023; Madland et al., 2022) or their ability to effect change (Selwyn, 2007, 2016), and the increasing influence of employers seeking technologically savvy employees (BC Ministry of Advanced Education and Skills Training [AEST], 2022; World Economic Forum, 2020). In addition, since 2020, multiple external realities have impacted technology-integrated assessment in higher education in British Columbia. First, the COVID-19 pandemic forced the closure of almost all higher education campuses worldwide, resulting in the large-scale shift to emergency remote teaching mediated by web-conferencing tools and other digital technologies (Bozkurt et al., 2020). Second, the public release and widespread availability of generative artificial intelligence (genAI) tools such as ChatGPT (OpenAI, 2022) has opened urgent conversations about how technology can both support and hinder learning. In the relative absence of frameworks that consider the breadth of factors influencing technology-integrated assessment, we identified Bearman et al.'s (2022) framework, *designing assessment in a digital world*, as being the most recent framework to have been developed by assessment researchers to date. Following careful analysis of the tenets of the Bearman et al. (2022) framework, we performed a literature review to discover how “on-the-ground” instructors who were not assessment experts approach technology-integrated assessment. Based on the gaps between the framework and our review of the literature, we proposed the *technology-integrated assessment framework* as a comprehensive framework for understanding the complexities of technology-integrated assessment. This report summarizes our approach, findings, and the development of the framework.

## **Assessment Design in a Digital World**

The Bearman et al. (2022) framework consists of three purposes for integrating technology into assessment practices. The first is to improve assessment practices using technological tools in alignment with the purposes of assessment (assessment of learning, assessment for learning, and assessment as learning), the levels of digital enhancement (substitution, augmentation, modification, and redefinition; the SAMR model as framed by Puentedura [2009]), and the potential for harm from using technology. The second purpose is to promote digital literacies involving mastery in the use of digital tools and the ability to evaluate the qualities of digital tools. The third purpose is to promote distinct human capabilities, including the ability of learners to imagine who they want to be and what types of activities they project they will engage in in the future.

## **Review of the Literature**

The next phase of our analysis involved reviewing the literature published by non-specialists in assessment. Our focus was to discover what was being published by instructors in various disciplines instead of publications by those who specialize in assessment as an academic discipline. We searched a variety of education-related databases and ended up with a corpus of 373 articles that met our inclusion criteria. We then analyzed the papers to extract information about key findings and topics, resulting in almost 600 unique codes. These codes were then consolidated into major themes. The seven most prominent themes are highlighted below.

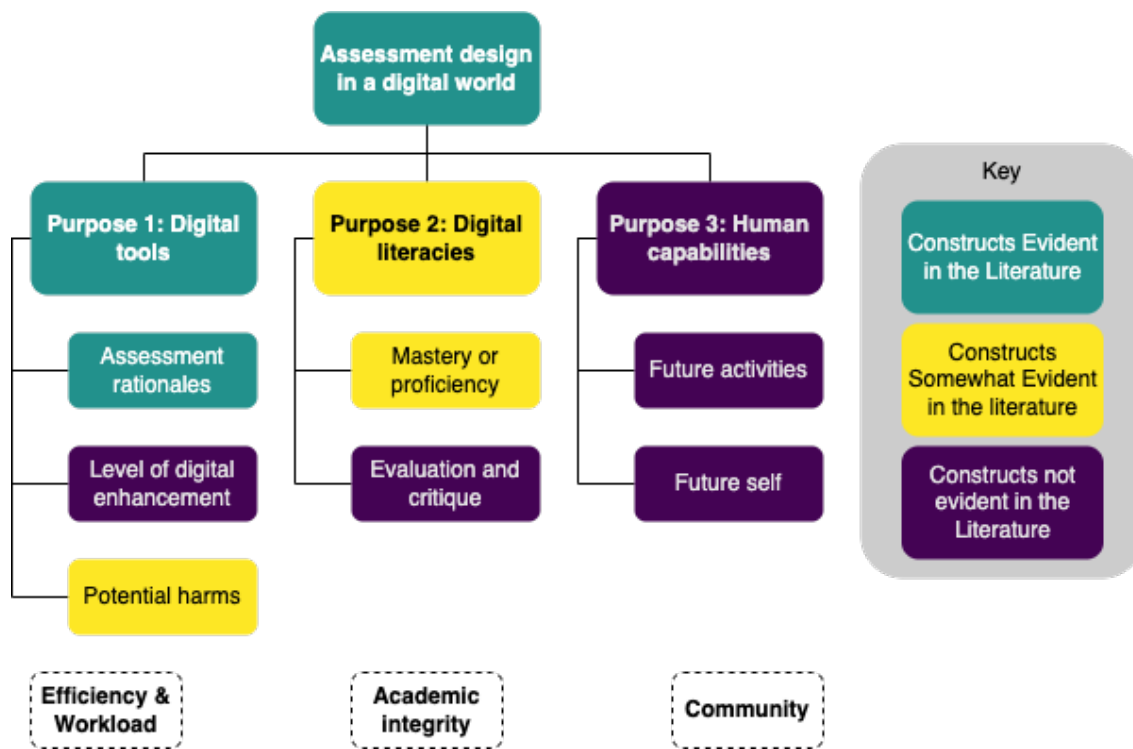
1. Focus on tools and tasks. Almost 250 of the 373 articles described investigations into a technological tool or task enabled by technology, with 75 mentioning a specific tool. This instrumental perspective on technology-integrated assessment is very prevalent in the literature, with a tendency to focus on efficiency (Brady et al., 2019), a construct that is often left undefined.
2. Efficiency and instructor workload. We took a general view that “efficiency” is often assumed to be related to minimizing instructors’ time and effort while maximizing impact, although this is rarely stated. Efficiency and workload are mentioned in 66 articles in our review.
3. Purposes of assessment. Formative (64 references) and summative (21 references) purposes of assessment were prominent themes in the literature. We note that this investigation did not support Boud and Soler’s (2016) claim that there is an overemphasis on summative assessment in technology-integrated assessment research relative to formative assessment.
4. Academic integrity and remote proctoring. The influence of the COVID-19 pandemic was apparent in the literature with 38 references to academic integrity and 17 references to remote exam proctoring. With most higher education systems around the world moving to emergency remote teaching in the spring of 2020, concerns about learners being able to access forbidden materials or resources during exams and assignments became much more pronounced.
5. Assessment design. 30 articles mentioned the need to be intentional about designing assessment tasks rather than simply substituting an analog technology (paper and pen selected-response exams) with a digital one (auto-graded selected-response exams in a learning management system).
6. Ethics and equity. This theme is notable for its absence in the literature. While there was a strong emphasis on academic integrity (38 references), there was a much lower emphasis on the ethics of using digital technologies (six references). Of the 14 references to equity, ten assumed that technology integration would lead to greater equity, an example of a positivity bias.
7. Systemic transformations of practice. COVID-19 was mentioned in 60 articles in our review; however, the impact of COVID-19 was not isolated to a discernible theme in itself. Instead, COVID-19 had a systemic impact on all the themes identified in the literature. Additionally, towards the end of our review, powerful genAI tools were released for free, public use, causing widespread consideration of how such tools would impact assessment. We considered both COVID-19 and genAI to be systemic transformations of practice due to their broad impact on all aspects of technology-integrated assessment. Due to the timing of our review and the release of genAI tools in late 2022, there were very few references to genAI in the peer-reviewed literature on technology-integrated assessment.
8. Finally, our review surfaced one article (Nieminen et al., 2022), published by the same group that published the assessment in a digital world framework, that recommended the theme of “fostering communality” (p. 10) be added to the original framework.

### Adjusting the Framework

There were notable overlaps and differences between the Bearman et al. (2022) model and the findings of our review. There are areas of overlap (e.g., assessment design, purposes of assessment), themes from the framework minimally evident (e.g., digital literacies, potential harms) or not evident in the literature (e.g., level of digital enhancement, human capabilities), and themes in the literature not evident in the framework (e.g., academic integrity and efficiency and instructor workload). These gaps offer an opportunity to refine the framework to capture more fully what it means to integrate technology and assessment. Figure 1 highlights these differences.

**Figure 1**

*Comparing the Bearman et al. Framework with the Literature*



### Developing the Technology-Integrated Assessment Framework

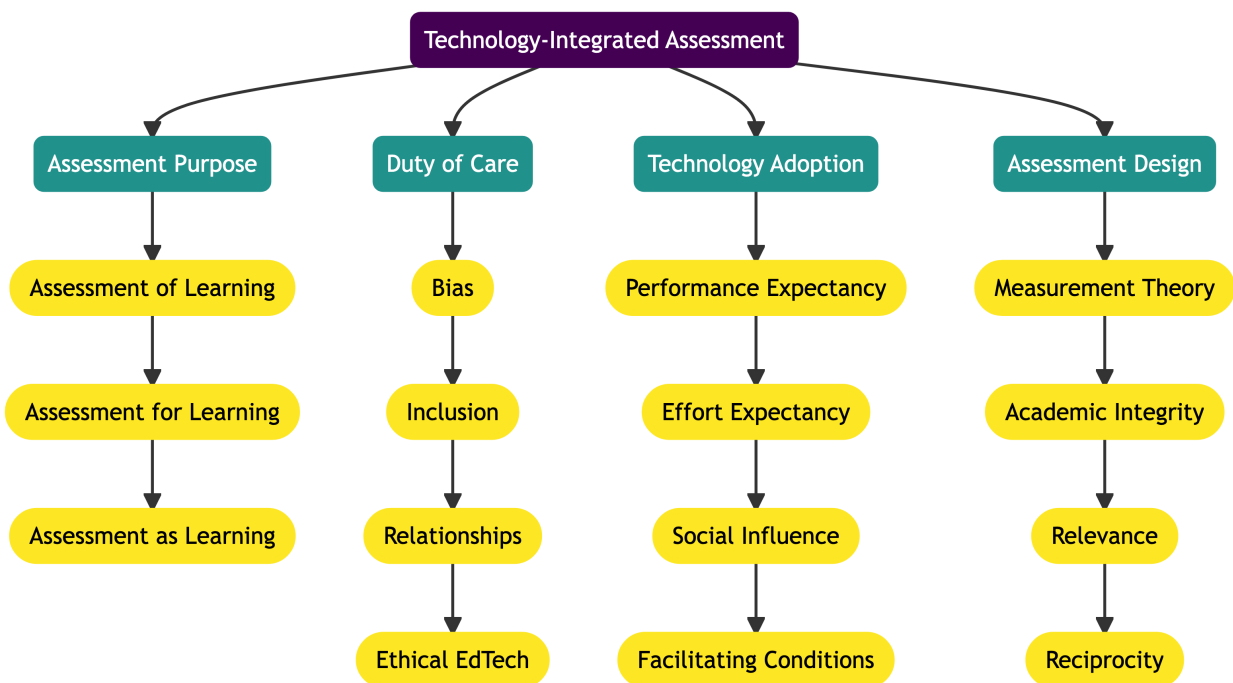
Following the identification of the gaps mentioned in the previous section, we undertook a process of revising the framework to address these gaps. Also, based on our professional expertise and scholarly engagement with the literature in technology integration, classroom assessment, and psychometrics, we suggest additional constructs that should be considered in conceptualizing technology-integrated assessment. Adjusting the Bearman et al. (2022) model involved retaining items where there was overlap between the model and the literature, dropping items not found in the literature, revising some items to fit themes identified in the

literature (e.g., human capabilities and potential harms from the original were merged into duty of care in the TIAF), and adding items that appeared in our literature review. Following the process of revising the Bearman framework based on the literature review, we mapped the items in the TIAF against the 5Rs of Indigenous education, relationship, respect, relevance, responsibility, and reciprocity (Tessaro et al., 2018) to ensure the framework would be inclusive of Indigenous worldviews. The Indigenous values of responsibility and respect were already covered by the duty of care category of the TIAF, and we added relationships as a standalone item under duty of care. Responsibility and reciprocity were added as items under assessment design in the TIAF.

Our technology-integrated assessment framework (TIAF) consists of four categories of influences on technology-integrated assessment: assessment purposes, duty of care, technology adoption, and assessment design. We propose that each of these categories of influence contains 3–4 subcategories, as outlined in Figure 2.

**Figure 2**

*The Technology-Integrated Assessment Framework*



The following sections provide overviews of the main components of the TIAF.

**Assessment Purposes**

The Bearman et al. (2022) model included the purposes of assessment as a sub-item under the tools purpose, but we elevate it to a top-level item as we believe that technology-integrated assessment should prioritize assessment before tools. Also, the language used by Bearman et

al., assessment of/for/as learning, is used here rather than what was used in the literature review, relating to the formative/summative binary.

### **Duty of Care**

Bearman et al. (2022) report, and we corroborate, that assessment as a human-centred process is not prominent in the literature. We attempt to remedy this by highlighting the importance of human relationships in the assessment process. In agreement with Bearman et al., we argue that the assessment process carries the risk of harm and, by extension, that instructors should consider that they have an ethical duty to protect learners from that harm even though a legal duty of care may not exist in Canada. We believe instructors have a duty to:

- avoid bias in grading practices (Woo et al., 2023);
- practice inclusivity (Fawns & Nieminen, 2023; Tai et al., 2022);
- honour relationships inside and outside the classroom (Tessaro et al., 2018); and
- use tools that support ethical technology practices (AEST, 2022).

### **Technology Acceptance**

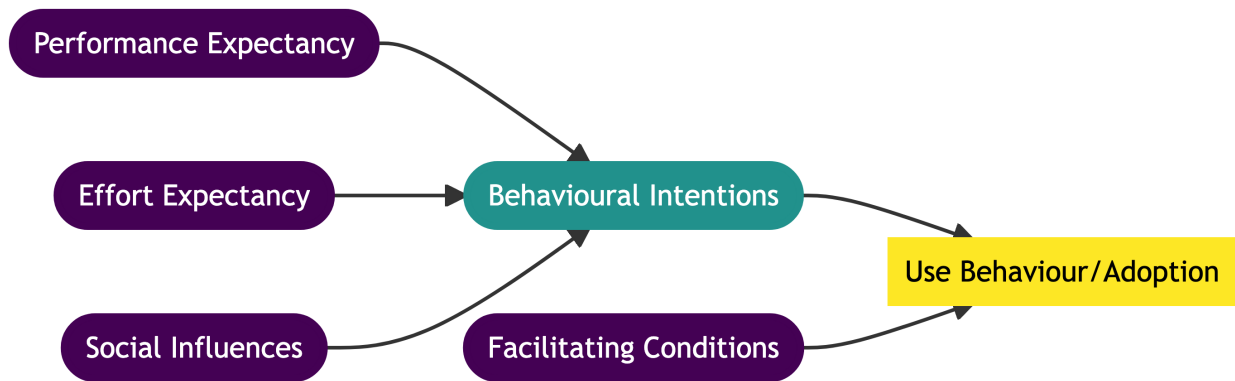
We posit that Bearman et al.'s (2022) framework could be enhanced by considering the well-established unified theory of acceptance and use of technology (UTAUT; Venkatesh et al., 2003). Although UTAUT is typically applied in the information technology literature, there are examples of its application in higher education (Almaiah et al., 2019; Birch & Irvine, 2009; Or & Chapman, 2022). UTAUT could help explain behaviours related to technology use in assessment contexts, including the common observation that instructor workload is a factor in how instructors decide whether to use technology. The UTAUT, partially shown below in Figure 3, shows four exogenous factors (performance expectancy, effort expectancy, social influences, and facilitating conditions), and one endogenous factor (behavioural intentions, which moderates the first three exogenous factors) that influence technology acceptance.

### **Assessment Design**

The final component of the TIAF is assessment design aligns with both Bearman et al. (2022) and the literature. This component includes measurement theory (relating to the validity and reliability of inferences drawn from assessment data), academic integrity (assessment tasks should reduce the need for learners to engage in academic dishonesty), relevance (assessment tasks should connect to learners lives in meaningful ways), and reciprocity (assessment should allow for two-way interactions between instructors and learners). The design of assessment tasks should be prioritized to ensure purposeful alignment of all components of the TIAF with the objectives of the course.

**Figure 3**

Partial diagram of the UTAUT Model



Note. From Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425–478. JSTOR. <https://doi.org/10/gc8zn2>. Copyright 2003 by the authors and used under the terms of the fair dealing exception of the Copyright Act in Canada.

### Conclusion

The technology-integrated assessment framework represents an initial foray into conceptualizing the complex factors influencing instructors in technology-integrated assessment environments. We have built a framework that can be used as a workflow guide for instructors as they design or redesign assessment tasks. It can also be used as a self-reflective tool for instructors who respond to the pressures of genAI and whatever future event causes a university campus to close (e.g., weather, disease, climate change, natural disaster). The model centres and prioritizes assessment theory, ethical human connections, and relationships, the complex factors influencing decisions to use technology, and the importance of intentional assessment design. Future research may include a comprehensive analysis of the TIAF for additional validity evidence or to determine its applicability to broader contexts such as program assessment.

### Author's Contributions

- All authors (CM, VI, CD, OB) contributed to the conception and design of the paper.
- CM conducted the formal analysis and interpretation of the data, acquired funding, created all visualizations, and wrote the original draft.
- VI supervised the project and was the primary reviewer and editor.
- CM and VI conceptualized and created the technology-integrated assessment framework and its associated visualizations.
- OB and CD contributed to substantive review and editing.
- All authors (CM, VI, CD, OB) have approved the final submitted manuscript.

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### Ethics Statement

Ethical approval was not required for this literature review and theory-generating paper.

### Conflict of Interest

The authors do not declare any conflict of interest.

### Data Availability Statement

As this is a conceptual paper, there are no data to store.

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