Guide for Institutional Assessment of Cognitive Skills

Queen’s University
2018

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Funded by the Higher Education Quality Council of Ontario
Preface

This guide was developed as part of the Cognitive Assessment Redesign Project (CAR), one of the Learning Outcomes Assessment Consortium (LOAC) projects funded by the Higher Education Quality Council of Ontario (HEQCO). The CAR project was built on the foundation of a four-year longitudinal project that investigated various methods for assessing learning outcomes (Simper, Frank, Scott, & Kaupp, 2018).

The CAR project is a network-based project, designed to build capacity in constructing assessment that aligns with dimensions of critical thinking, problem-solving or creative thinking. In the project support personnel (called Assessment Facilitators) enabled faculty members to develop their processes for assessment that aligned with overarching metrics. Consistent metrics allows aggregation of assessment data across the institution. The research team investigated the reliability of course-based outcomes with the external measures (the Valid Assessment of Learning in Undergraduate Education VALUE rubrics), and selective testing using the HEIghten critical thinking test, developed by the Educational Testing System (ETS). With the establishment of consistent metrics, the aggregated data provides a reliable estimate of the institutional value add between first and fourth-year cognitive skill achievement. The results of the research are published in a separate report, further details are available here: http://www.queensu.ca/qloa/home.

This guide was written as part of the sustainability plan for long-term institutional assessment of cognitive skills. It is written in three sections: Fundamentals of Assessment; the Guide itself; and Principles for Success. This document also provides Appendices, with resources necessary to implement the work. This document was written for the range of stakeholders necessary to sustain work of this nature: institutional leaders; assessment project management; and course instructors. The guide describes the processes to implement an institution-wide project for the assessment of cognitive skills, though sections of the guide may also be useful to design smaller-scale projects, or for a project aimed at the development and assessment of other skills.
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1. Fundamentals of Assessment

For people familiar with the fundamentals of assessment, please go directly to Section 2 where you will find details of the assessment design initiative undertaken at Queen’s University. Some details have been provided here to lay the foundation. Many other resources are available, for example, HEQCO Learning Outcomes Assessment: A Practitioner’s Handbook or you may choose to work through assessment principles, guidelines, and strategies, constructed as learning modules.

1.1 Purpose of Assessment

Boud & Dochy, (2010) outline seven propositions for assessment reform, recommending among other things that assessment for learning “is placed at the center of subject and program design, is a focus for staff and institutional development” (p.3). An embedded approach enables collection of learning evidence at the course assignment level such that outcomes are nested within the course objectives, building learning structures to meet the needs of the program, and considering the role of the collective assessment as it relates to the sector-based accountability, for example, the Degree Level Expectations in Ontario (“Guidelines for University Undergraduate Degree Level Expectations,” n.d.). Without a deliberate assessment plan, broad statements of outcomes are difficult to substantiate. An assessment plan needs to take many factors into account, and each of the learning contexts is different, posing difficulties for a unified approach. Many authors have articulated principles of effective assessment design (for example, Popham, 1999; Wiggins & McTighe, 2005), the synthesis of which formed the basis of the work undertaken at Queen’s University (Simper et al., 2018). Figure 1 provides a summary overview of considerations for assessment, and displays how the assignment level outcomes nest into the larger assessment goals. The rationale for assessment will be dependent on the perspective of the stakeholder. Just as contexts tie into one another, the rationale for assessment needs to be well aligned to the context in which it is to be used.

1.2 Goals for Learning and Assessment

Assessment for real or perceived punitive reasons, or for institutional ranking, can lead to groups trying to “game the system”, particularly when the approach uses metrics that have little relevance for course instructors. A course instructor can easily simplify the complexity of a task that will be used to gather data for institutional assessment, or passively undercut motivation for students to participate in low-stakes testing. Understanding and improving student learning is a common shared goal that can drive assessment, but other goals could include:

- Measuring student learning to present to students, parents, administration and government
- Providing data to instructors and departments about learning outcomes that are important to them
- Gathering data about the value of particular program elements (course sequences, experiential learning, teaming activities, etc.)
- Providing data to inform public and institutional policy

Strategic alignment of learning and assessment is Figure 2 displays the principles of backward design (Wiggins & McTighe, 2005).
Figure 1. Rationale and considerations for assessment

Learning by design

1. Identify desired results

2. Determine assessment evidence

3. Plan learning experiences and instruction

4. Evaluate effectiveness

Figure 2. Principles of backward design used to align teaching and assessment
1.3 Learning Outcomes

Desired results are articulated through learning outcome statements. These are measurable statements of student knowledge and abilities, described “as existing at the intersection of concepts (what students know and understand) and competencies (what students are able to do)” (Roksa, Arum, & Cook, 2016, p. 17). There are many resources available that go into more detail about learning outcomes, for example, see https://www.queensu.ca/ctl/teaching-support/learning-outcomes. Embedded in the outcome statements is a particular complexity of learning. For example, students will demonstrate the ability to integrate and apply appropriate information from various sources to create cohesive, persuasive arguments.

1.4 Learning Taxonomies

**Bloom’s Taxonomy**

Learning taxonomies are often hierarchical models that categorize the complexity of learning. Assessment frameworks such as the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics (see section 2.4 for details) utilize principles of the learning taxonomies below. Arguably the best known learning taxonomy is Bloom’s (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1965). Bloom’s taxonomy defines learning in three domains: cognitive; affective; and sensory. When considering assessment of cognitive skills, the examination of Bloom’s cognitive domain is useful (see Figure 3).

![Figure 3. Bloom’s cognitive domain](image)

**ICE Framework**

The Ideas, Connections, Extensions (ICE) model, based on the novice to expert literature and cognitive/transformative theories of learning, presents a developmental, growth orientation to learning. Ideas are the fundamental, discrete pieces of information, or steps in a process, that make up the building blocks of learning. Connections are the relationships that students form among discrete ideas, or in the way they relate new learning to prior knowledge. Extensions are made when students can articulate the implications of their learning and apply their learning to completely new and novel situations apart from the initial learning context (Fostaty Young & Wilson, 2000). The following diagram offers a list of verbs for the ICE model.
In a similar vein, the Structure of Observed Learning Outcome (SOLO) taxonomy (Biggs & Collis, 2014) classifies learning outcomes in terms of their complexity. The levels of complexity are described as unistructural [1], multistructural [2], relational [3], and extended abstract [4], these levels are referred to in Figure 5. When designing learning activities, the complexity of the question can suggest a particular hierarchical level of learning. For example, a question that asks students to identify a point of view is only prompting them provide one aspect, whereas questions asking students to connect or predict an effect requires them the integrate their knowledge.

Figure 5. SOLO taxonomy and example questions to elicit learning
1.5 Developing the assignment

Within a University, assessments are required as a means of evaluating academic work. An assignment is the particular task or activity that allows for students to develop and demonstrate their learning. Creating an assignment that aligns with the desired student outcomes, while taking all of the contextual considerations into account, can be challenging. While it may be time consuming to create an engaging assignment, the rewards in student learning can be profound.

If the students have the competence to handle them, open-ended complex problems can facilitate deep, meaningful learning. When dealing with novice learners however we need to consider the appropriate level of difficulty for the student’s prior knowledge. The zone of proximal development (Vygotsky, 1978) may be useful to consider. If the assignment is too difficult it can create anxiety for students. Similarly, a very easy assignment won’t challenge the students and motivational issues ensue.

**Real World Context**

*“In theory, there is no difference between theory and practice. In practice, there is”.*

–Richard P. Feynman

Assignments that have a real-world application have been demonstrated to be both meaningful and motivational (Frey, Schmitt, & Allen, 2012). There are several ways to include a real-world context into an assignment. By placing the learner in a real or simulated work place role provides context and purpose for the learner, and facilitates the connection and extension of ideas, concepts and understanding.

1.6 Criterion Assessment: Rubrics

There are various forms of assessment guides. A rubric is a scoring guide that indicate performance expectations and associated levels of attainment. Analytical rubrics differentiate evaluative criteria, and qualify definitions for those criteria at particular levels, with scoring strategy (Popham, 1997). The example rubric in Figure 6 labels the structural components of a rubric, and a range of rubric examples are provided in section 4.14.

<table>
<thead>
<tr>
<th>Assessment dimensions</th>
<th>Not demonstrated (0 point)</th>
<th>Developing (1 point)</th>
<th>Accomplished (2 points)</th>
<th>Advanced (3 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issues</td>
<td>Introduction of issues is unclear and/or not linked to the study topic.</td>
<td>Presents issues and omissions in related to the study topic.</td>
<td>Explains key issues impacting on the study topic.</td>
<td>Critiques key issues impacting on the study topic.</td>
</tr>
<tr>
<td>Context/Assumptions</td>
<td>Contextual factors are introduced, but do not relate to the study design.</td>
<td>Explains some contexts related to the study design, but awareness of assumptions is not apparent.</td>
<td>Demonstrates awareness of assumptions and analyses how different contexts impact on the study design.</td>
<td>Questions their own and others assumptions in the analyses of contextual factors related to the study design.</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>Hypothesis is unrelated to the topic.</td>
<td>Hypothesis is stated, but is not able to be tested under the proposed study design.</td>
<td>Hypothesis is stated, and may be able to be tested under the proposed study design.</td>
<td>The hypothesis is clear, testable and the study design allows for the full range of variables to be investigated.</td>
</tr>
<tr>
<td>Implications/recommendations</td>
<td>Conclusions are incorrect or incoherent</td>
<td>Explains Implications without making recommendations</td>
<td>Addresses Implications, making recommendations for corrections future work</td>
<td>Weighs impacts, accounting for implications when recommending future work.</td>
</tr>
</tbody>
</table>

*Figure 6. Rubric structure*
1.7 Facilitating consistent assessment using rubrics

If you are running a large course, it is likely that more than one person will be marking student work. It is recommended that training and calibration be conducted for the application of the course rubric. This may include the teaching assistants, or peers who are marking the same assignment. The benefits of this are marking consistency, achieving a more defensible justification for grades and as a reflective tool to ensure that the assignment guidelines were effective in eliciting the desired performance. The following steps are recommended for calibrating the use of a rubric for assessment:

1. Meet with the personnel who will be marking the student work.
2. Ask the group to read through the assignment instructions.
3. Ask the group to read through the assessment rubric and identify any unfamiliar terms.
4. Provide a sample student response for the group to read through.
5. Have the group members individually identify where they see the assignment dimensions demonstrated in the sample assignment.
6. For each of the dimensions, ask the group to refer to the quality indicators and make a judgement of performance level, making notations to justify their judgement.
7. As a group, compare judgements made and identify discrepancies.
8. Discuss differences in interpretation.
9. Agree on the level demonstrated in the sample (take notes for future reference and clarification).

1.8 Cognitive skills

The definitions of cognitive skills are diverse, and each are likely influenced by disciplinary contexts. Differences in opinion about assessment constructs can become a barrier to the work so it is advisable not to get bogged down in a battle of definitions. For example, much time could be spent debating how critical thinking in the humanities is different to critical thinking in the sciences, but this moves you no closer to your goal of assessing the construct. Cognitive skills are expressed differently depending on the norms, practices, contexts and common assumptions within a field. The constructs themselves are consistent however, it is the interpretations of the criteria that are illustrative of the differences between the disciplines.

In the Cognitive Assessment Redesign model, the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics (Rhodes & Finley, 2013) are adopted to operationalize the constructs. Figure 7 provides an overview of the Critical Thinking, Problem Solving and Creative Thinking outcomes, elaborated on in the VALUE rubrics.

*Figure 7. Cognitive skill outcomes operationalized using the VALUE rubric criteria*
1.9 Continuous Improvement

The assessment strategies described below are intended to be conducted in an ongoing manner, as part of a continuous improvement plan. Figure 8 presents the model for continuous improvement that was developed and implemented as part of the Queen’s University assessment projects (B. Frank et al., 2018; Simper et al., 2018).

Figure 8. Model for continuous improvement

2. Guide for Cognitive Assessment Redesign

2.1 Design

The design of the project at Queen’s leveraged the Hannah & Lester, (2009) model of organizational leadership, a multi-level strategy for change management. It implemented strategies concurrently at the individual level (micro), building approach tendencies and capacities with networks (meso level), fostering and facilitating change, and, to a less extent, through systems of institutional sanctioning (macro level). It made use of reward incentives and embedded expertise, and replicated successful strategies in large-scale systemic initiatives (Chasteen & Code, 2018; Wieman, 2007). The design built upon successful VALUE rubric assessment programs that included professional development for faculty (Bernstein & Greenhoot, 2014). Research suggests that with the infusion of enough time and expertise, the necessary critical mass can be achieved to create a new norm (Corbo, Reinholtz, Dancy, Deetz, & Finkelstein, 2014).

Figure 9 displays the model adopted at Queen’s; it highlights the meso level network (Roxa & Martenson, 2009), and a research project manager who connects the members of the group. The next circle of the network is formed by the support personnel (called Assessment Facilitators). Each of the Assessment Facilitators worked with individual course instructors focusing on teaching and assessment. The instructors were grouped in disciplinary clusters, and the circles radiating from there, represent other instructors within the same disciplinary areas with whom conversations and informal peer-support occurred.
2.2 Team Roles

Project leader

The project leader role is critical to the success of the project. A description of the job requirements, necessary qualifications and experience is provided in 4.1. The person who anchors projects of this type needs to know how the institution runs so that they can anticipate and mitigate against potential obstacles and consistently impel the project forward. They also need to listen to the stakeholders and be sensitive to the diverse needs of participants. The project leader needs to be an advocate for the work, and look for every opportunity to connect the right people and build on one another’s strengths. Most importantly, the project leader is the person who manages all components, requiring keen organizational skills and the capacity to work through concerns in priority order.

Assessment Facilitators

Assessment Facilitator is a term used to describe the role supporting instructors across a learning area (for example, the Humanities). Facilitators must be familiar with the general operations of the institution, and if possible, know people in the Departments. Therefore, it is beneficial if these people are already on the ground. They may already be teaching, perhaps working as a sessional or adjunct instructor, or as a research associate, educational developer or instructional designer, but they need to hold disciplinary expertise in the field relevant to the course they are supporting. This is important because:

- It is key for building a relationship with the instructor,
- They use terminology that is familiar to the instructor,
- They will need to be able to assess the student work in a particular discipline.
What is the time commitment?

- In the model presented here, the Assessment Facilitators spent an average of one day per week, and worked with five instructors of different courses to achieve each individual instructor’s goals for the initiative.
- They met once a week from the beginning of September to the end of June. Meetings were 60–90 minutes in duration.

What skills do they need to have?

- Experience in working with people
- Background in principles of assessment
- Assessment Facilitators work closely with instructors involved in the project. They engage in the role of *critical friend* (Handal, 1999) and function as a sounding board for ideas and strategies. Depending on the instructor’s knowledge and experience, they develop materials, refine materials, or review to provide constructive feedback.
- They also fulfil the project goals by documenting processes, so written communication skills are an asset.
- Assessment Facilitator’s responsibilities are listed in the job role information sheet (see 4.2).

### 2.3 Project timeline

Table 1 lists the project phases, timeline for implementation, with the associated support documents. The dates correspond to a Canadian higher education calendar, and should be adjusted to suit the academic calendar in alternate settings.

**Table 1. Project implementation annual timeline**

<table>
<thead>
<tr>
<th>PHASE</th>
<th>SUPPORTING DOCUMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-implementation</strong></td>
<td></td>
</tr>
<tr>
<td>Stakeholder consultation – This is the stage for open conversations about institutional assessment goals with educational professionals in departments across the institution.</td>
<td>Team roles 2.2 Job role documents 4.1, 4.2</td>
</tr>
<tr>
<td><strong>Project Initiation</strong></td>
<td></td>
</tr>
<tr>
<td>Ethics application – To enable scholarly investigation and evaluation as the platform for the work. The blanket ethics application not only enables promotion and publication of the work in academic settings (conferences, journal publications), but also gives the course instructors an avenue to investigate their own practice. <em>It should be noted that the requirements for ethics applications vary depending on governance sector, and need to be amended to suit contexts.</em></td>
<td><em>Ethics text for the project is provided in 4.3</em></td>
</tr>
<tr>
<td>Construct a web page to overview the project and post the call for proposals (see <a href="http://www.queensu.ca/qloa/home">http://www.queensu.ca/qloa/home</a>). Call for proposals goes out, with two deadlines (one in September and another in November) to enable the submission of expressions of interest from Fall or Winter courses.</td>
<td>Expression of Interest template 4.5</td>
</tr>
<tr>
<td>Set up the instructor survey and letter of information/consent form in institutional survey platform.</td>
<td>Instructor survey 4.7 Consent form 4.9</td>
</tr>
</tbody>
</table>
### Launching the project

<table>
<thead>
<tr>
<th>Activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Following stakeholder consultations, promotion of the project is conducted by an appropriate administrator, e.g. Associate Dean or Undergraduate Chair through departmental meetings, curriculum committee meetings, personalized emails, and/or internal news/email blasts.</td>
<td>News article example 4.4</td>
</tr>
<tr>
<td>Induct Assessment Facilitators into their roles, orient them to the assessment instruments, processes and protocols. Individual outreach to potential project participants (course instructors).</td>
<td>Details available is sections 2.4, 0</td>
</tr>
<tr>
<td>Respond to proposals, notify successful applicants, and send a Letter of Agreement to formalize participation. Once these are completed, stipends are transferred to the Fall Term participating instructors.</td>
<td>Letter of Agreement 0</td>
</tr>
<tr>
<td>Assessment Facilitators are introduced to the recruitment procedures, and instructor consultations commence.</td>
<td>Recruitment script 4.10</td>
</tr>
</tbody>
</table>

### Implementation

<table>
<thead>
<tr>
<th>Activity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>The baseline teaching survey is sent to the participating instructors</td>
<td>Survey cover letter 4.8</td>
</tr>
<tr>
<td>If standardized testing is being conducted, the first–year students should test as early as possible in the academic year, and final-year students test in the first half of the final term (to avoid conflicts with course examination and workloads associated with large summative course-assessment).</td>
<td>An example of simplified test instructions 4.12</td>
</tr>
<tr>
<td>Assessment Facilitators recruit students in Fall courses (where possible, face-to-face). For online courses, recruitment is conducted by email. Although there is no deception involved, some departments require that students receive a debrief letter after they participate in research.</td>
<td>Email text 4.11 Debrief letter 4.13</td>
</tr>
<tr>
<td>Review of VALUE marking processes. Fall course work samples are collected.</td>
<td>See section 2.9</td>
</tr>
<tr>
<td>Network meeting arranged, 5-minute presentations from the Fall term course instructors. Potential Winter Term instructors are invited to attend this meeting.</td>
<td>See section 2.11</td>
</tr>
<tr>
<td>Fall term VALUE rubric marking is conducted.</td>
<td>See section 2.9</td>
</tr>
<tr>
<td>Reporting for the Fall term participants.</td>
<td>Narrative report template 4.15</td>
</tr>
<tr>
<td>Second round EOI’s are reviewed, Winter term instructors are sent letters of agreement, stipends are transferred and consultations begin.</td>
<td></td>
</tr>
<tr>
<td>Data is compiled, course reports produced and sent to Fall term instructors.</td>
<td></td>
</tr>
<tr>
<td>The student recruitment processes for the Winter term replicate those in the Fall; consenting students’ assignments are collected.</td>
<td></td>
</tr>
<tr>
<td>Network meeting arranged, 5-minute presentations from the Winter Term course instructors.</td>
<td></td>
</tr>
<tr>
<td>Winter term VALUE rubric marking is conducted.</td>
<td></td>
</tr>
<tr>
<td>Data is compiled, analyzed, and course reports produced and sent to Fall Term instructors.</td>
<td></td>
</tr>
</tbody>
</table>
2.4 Assessing student learning

The three assessment tools used to evaluate student learning in the project were:

- Standardized test (*HEIghten*- Educational Testing System)
- Standardized rubrics (*VALUE rubrics*- Association of American Colleges and Universities)
- Course-based assessment (rubrics and marking keys)

**HEIghten critical thinking test**

The HEIghten test was developed by Educational Testing Service (ETS). It is a 26-item online test of critical thinking with an exit survey with questions about demographics, engagement and effort. The assessment constructs are:

**Analytical skills:**
- analyzing argument structure;
- evaluating argument structure; and
- evaluating evidence and its use

**Synthetic skills:**
- developing valid (structurally strong) or sound (evidentially strong) arguments;
- selecting information that would constitute or contribute to such arguments for a given position; and
- drawing or recognizing conclusions, extrapolating implications, or recognizing or generating explanations for phenomena that are described.

It is administered in a one-hour test session, either proctored in-person through the test portal (https://www.programworkshop.com) or un-proctored through email invitation. The test currently costs USD $12 per test, so, to remain cost-effective, students need to log back into their existing test if they pause it for any reason. The results are available immediately and the test has an option to display the student’s result to them at the conclusion of the test. It displays their score for the assessment constructs, as they compare to the international average. The results are also available by course-report download or data file (.csv) as soon as the test session is closed.

**Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics**

The VALUE rubrics are intended to be used as an assessment tool along with feedback provided to support student learning. Rubrics help make expectations clear and promote the development of higher order cognitive skills. There are 16 VALUE rubrics in total (Rhodes & Finley, 2013). Three rubrics are described here, but the same process may be applicable for the other 13 rubrics.

The constructs of critical thinking, problem-solving and creative thinking are operationalized using the dimensions from the VALUE rubrics, as summarized Figure 7. The hierarchical levels in the rubrics are prioritized based on complexity, as described in learning taxonomies section 1.4. Procedures for using the VALUE rubrics are shown below in section 2.9.

**Course-based assessment**

There are a number of ways to evaluate student learning. While some argue that experts can make a judgement to determine the level at which a student is performing, we need explicit criteria to ensure the transparency of assessment in undergraduate education. For consistency purposes, there needs to be an
articulated standard of performance and guidance for the differentiation between levels of achievement. We refer to these as quality frameworks. Either an assessment rubric or marking key may be used for this purpose. Some characteristics of these are presented in Table 2.

Table 2. Characteristics of course-based assessment measures

<table>
<thead>
<tr>
<th>Assessment Rubric</th>
<th>Marking/ answer key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality indicators</td>
<td>Correct answer guide</td>
</tr>
<tr>
<td>Differing levels – require some interpretation of response</td>
<td>More prescribed, less scope for marker judgements</td>
</tr>
<tr>
<td>Effective for formative or summative assessment</td>
<td>Effective for summative assessment</td>
</tr>
<tr>
<td>Often shared with students before the submission of work and used as a feedback mechanism</td>
<td>Used to streamline marking timelines. Can be provided to students after submission for the justification of grading</td>
</tr>
</tbody>
</table>

Assessment measures

Multiple assessment measures are utilized as part of the validation process for the evaluation of student learning across the institution (see Figure 10). Course rubrics contain disciplinary-specific language to support learning in and assessment of student assignments.

Figure 10. Analytic design to support validation of course assessments
2.5 Instructor participation

The web page for calls for expressions of interest posed the following questions:
⇒ Is developing critical thinking, creative thinking or problem solving one of the goals for your course?
⇒ Would financial resources and a support network help you achieve this goal?
⇒ Would you like to know more about student learning in your class?
⇒ Do you want an opportunity to be part of assessment research?

Interested instructors developed a short expression of interest (EOI) to participate in the cognitive assessment redesign project. The EOI follows the template provided in 4.5. The three reflective question prompts that needed to be completed were:
• How do you currently encourage the development of cognitive skills in your course?
• How do you currently assess cognitive skills?
• How might you improve those assessments?

Contact details for the project manager are essential for potential participants with questions about the project. Responses for some of the common questions are listed below:

What do I need to do? What is the commitment?
Once your EOI has been accepted, you need to meet with members of the team to discuss your goals and develop a plan to achieve them. This process will vary, but it might mean meeting for an hour once a week for a month and reviewing some documentation in the interim such that an assignment and rubric format have been decided upon. There are only a few specific requirements, to complete a teaching practices survey, allowing project team members to come and speak with your students to seek consent (usually takes about 10 minutes, and attending a discussion group meeting once a term. See letter of agreement 0 for full details.

How does the VALUE marking work?
Following the course, the consenting student assignments are collected and assessed (double marked) using the VALUE rubrics. This does not affect the mark in the course in any way.

What's the purpose of using the VALUE rubrics?
The project team use the language in the VALUE rubrics to operationalize the constructs of critical thinking, creative thinking or problem-solving, and as a framework to align the course-based rubrics with. High correlations between the VALUE rubric scores and course-based scores support the validation argument for course-assessment.

If you want to match the course score with the VALUE scores, why don't I just use the VALUE rubrics for course marking?
Rubrics are generally designed to support student learning, as such, they need to be clear and succinct so that students can readily understand expectations for the assignment. The VALUE rubrics are very general, they require interpretation to use.

What about the content and conceptual knowledge, are they included in the rubric?
You may want to add additional assessment dimensions, things such as teamwork or communication to the course rubric, but cognitive skills showcase the application of knowledge. If the student has not acquired the base knowledge then they will not be able to apply it.
2.6 Educational Support

Backward design is an educational strategy that can be used to align assessments with intentions for learning. Using this strategy, Assessment Facilitators guided instructors to focus on the goal of learning rather than the process of teaching.

Working with instructors

Assessment Facilitators support instructors in meeting their redesign goals. Facilitators need to get to know the instructor as a person. Before they can help with anything to do with courses, Facilitators need to understand where the instructor is coming from and what their beliefs and opinions are about teaching the course in question. The theory of “Decoding the Disciplines” (Pace, 2017) provides helpful insight to promoting reflection of challenges to student learning in specific disciplines. The theory is centered around identification of bottlenecks to learning, and making tacit knowledge of experts explicit to the learner. Conversations in this regard often result in instructors’ heightened awareness of students’ learning needs and plans for instructional and assessment improvements are made. Once the Facilitator and course instructor have a shared understanding of the nature of the course, the focus of improvement, and the goals for the assessment redesign, the assignment, learning outcomes and assessment strategies can be (re)developed.

Instructors may or may not have a specific assignment in mind, the work may involve developing a new learning prompt or activity. The objective of the work is to align the course assessment criteria to the stated outcomes then to VALUE criteria. The VALUE rubrics are intended to be applied to a signature artifact. That is to say, an assignment that elicits demonstration of the best ability of the student in the assessment construct (critical thinking, creative thinking, or problem-solving). A signature artifact is usually a summative assignment that counts for a significant percentage of the course grade. We know that students are quite strategic and have many demands on their time. We also know that cognitive skills are as much about knowledge and ability as they are about their motivation to apply that ability. We probably aren’t going to see the best student’s outcomes in an assignment that’s worth 5% of the total course grade. There are some questions that often arise:

*Does the assignment have to assess all the dimensions in the VALUE rubric?*
Not necessarily, but the more holistic the assignment, the better the students tend to do overall. Assessing individual components of a skill is often an important step in student learning, but we are looking for the occasion when the students put the various components together and demonstrate the skill as a whole.

*What are student recruitment rates usually like?*
Consent rates for courses where instructors are actively involved have been demonstrated to be 80% or above (B. M. Frank, Simper, & Kaupp, 2016).

Developing an assignment

The role of the Assessment Facilitator is to support the purposeful alignment of cognitive skills (see Figure 11) through the development of authentic tasks. In developing the assignment, consider the following:

- Assignment brief/ description
- Guiding questions/ scenario/ support materials
- Strategies for engaging in the task i.e. working through problems as a group
- Assessment rubric
- Work examples
- Written/ verbal discussion
2.7 Creating a course rubric aligned to desired assessment constructs

A rubric authoring tool, called ‘BASICS’ (Building Assessment Scaffolds for Intellectual Cognitive Skills) was built to support the alignment of course assessment with cognitive skill assessment. It provides a workflow for assessment choices and generates an assessment rubric based on user input that can be tailored to individual needs. The dimensions and criteria in BASICS were adapted from the Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics. The development of the tool is outlined in (Simper, 2018), with moderate intraclass correlation coefficients between the BASICS rubric and corresponding VALUE rubric dimensions suggesting that the BASICS rubric aligned with the VALUE criteria.

Figure 12. displays the 5-step process which is intended as a reflective device for discussions about intentions for learning as per the backward design process (see Figure 2). There is an editing function in the BASICS tool to enable the rubric to be re-worded to suit the needs of the instructor. Once a final draft has been developed, consideration should be given to the way the rubric will be used.
Figure 12. Guidelines for using the BASICS rubric builder
Table 3 lists rubric design elements suggested for consideration in the construction of a course rubric. Some of the elements may not apply, but the table can be used as a checklist, part of a validation of the rubric. Mapping process of rubric construction can be aided by the use of a web authoring tool.

Table 3. Considerations for rubric development and design (Dawson, 2017).

<table>
<thead>
<tr>
<th>Design element</th>
<th>Considerations</th>
<th>E.g.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specificity</td>
<td>The particular object of assessment</td>
<td>Assignment specific</td>
</tr>
<tr>
<td>Secrecy</td>
<td>Who the rubric is shared with, and when it is shared</td>
<td>Given to students with the assignment brief</td>
</tr>
<tr>
<td>Exemplars</td>
<td>Work samples provided to illustrate quality</td>
<td>Students go through a quality work sample and with annotations showing how performance criteria has been met</td>
</tr>
<tr>
<td>Scoring strategy</td>
<td>Procedures used to arrive at marks and grades</td>
<td>Each achievement column has a corresponding numeric value</td>
</tr>
<tr>
<td>Evaluative criteria</td>
<td>Overall attributes required of the student</td>
<td>General descriptions of the performance dimension are provided in the left-hand column of the rubric</td>
</tr>
<tr>
<td>Quality levels</td>
<td>The number and type of levels of quality</td>
<td>Four qualities of level are provided, the minimum required achievement is labeled <em>meets expectations</em></td>
</tr>
<tr>
<td>Quality definitions</td>
<td>Explanations of attributes of different levels of quality</td>
<td>Insufficient, Developing; Meets expectations; Exceeds expectations</td>
</tr>
<tr>
<td>Judgement complexity</td>
<td>Evaluative expertise required of users of the rubric</td>
<td>Clear differences are evident in work sample to differentiate between levels</td>
</tr>
<tr>
<td>Users and uses</td>
<td>Who makes use of the rubric, and to what end</td>
<td>Students use the rubric to self-assess prior to submission and instructor uses the rubric to assign performance levels</td>
</tr>
<tr>
<td>Creators</td>
<td>The designers of the rubric</td>
<td>Instructor developed the rubric</td>
</tr>
<tr>
<td>Quality processes</td>
<td>Approaches to ensure the reliability and validity of the rubric</td>
<td>A sub-set of student assignments are cross-marked by another instructor</td>
</tr>
<tr>
<td>Accompanying feedback</td>
<td>Comments, annotation, or other notes on student performance</td>
<td>Assignment performance levels are highlighted and a written comment is provided</td>
</tr>
<tr>
<td>Presentation</td>
<td>How the information in the rubric is displayed</td>
<td>Rubrics are available electronically, through the learning management system</td>
</tr>
<tr>
<td>Explanation</td>
<td>Instructions or other additional information provided to users</td>
<td>The rubric accompanies the course assignment description.</td>
</tr>
</tbody>
</table>
2.8 Recruitment: Letter of Information and Consent

Recruiting students to consent to participate is important for multiple reasons. Firstly, to meet ethical guidelines for informed consent to participate in research, and equally importantly so that they are aware that the institution is actively working to improve teaching, learning and assessment. The timing of recruitment will depend on what is happening in the course, but should be conducted as soon as practically possible. During the recruitment session, you should:

- Introduce yourself
- Explain the main points of the project (recruitment script in 4.10 should be used as a guide)
- Direct students to the letter of information and consent form (survey link). The URL should be shortened to make it easier for students on portable devices. For example, http://tinyurl.com/queensu-CAR.
- If the students are completing the HEIghten test, then it is convenient to recruit immediately before the test. If that is the case, the instructions for the test are given the test link included at the end of the consent survey.

Collecting work samples

Where possible, pull the consenting student’s assignments from the learning management system. For the courses where assignments are submitted in hard copy, or for exams, the documents will need to be collected and scanned. Collect course assignment grades at the rubric-level, if possible. Touch base with your instructors in a timely manner in case there are hard copies of their marking sheets that need to be collected.

2.9 VALUE Marking Protocols

The assignment will have been targeted at critical thinking, problem solving, or creative thinking (or a combination thereof). Identify which of the rubrics is intended to be applied to the work sample, then follow the protocol below.

Structure of rubrics

Although it is tempting to read the rubric first, it is important to review the front-page overview in order to familiarize yourselves with the framing language and the purpose of the rubric. The glossary of the rubric offers the best opportunity for modification, for adding or modifying terms to clarify the performance descriptors on the back page. The left-most column of the back page lists the criteria for the learning outcome and stresses the multidimensionality of what it takes to demonstrate any of these outcomes; essentially, it is a breakdown of the components of the skills. The performance benchmarks are listed along the top, and are intended not to be time-specific but developmental and ongoing. The capstone benchmark is intentionally placed on the left, so that it is read first. If the marker reads the benchmark first, it may artificially constrain the assessment of the student; the rubric is not meant to be read based on what is expected of students in a particular year, but the level of skill they demonstrate.

Using rubrics to assess student work

It is suggested that the best way to understand the rubric is to practice using it through calibration sessions: working through a sample of student work using a rubric. Participants can discuss the language and expectations utilized in the rubric. In our experience, this process is best started by understanding the
artefact, without consideration of the rubric, to familiarize ourselves with the content and the purpose of the assignment. Then we reviewed the framing language and the performance descriptors. Finally, we systematically worked our way through the criteria and assigned a performance level, based on evidence in the artefact. Discussing with other markers the levels assigned, the evidence used, and interpretation of language in the performance descriptors is key to gaining proficiency with using the rubrics.

**The VALUE rubric assessment protocol**

A. Building a common understanding:
   - Read through the assignment instructions and example responses to build an understanding of the nature and context of the course assignment,
   - Identify what the students were directed to demonstrate (this might, for example, require reading a research paper to which the students were responding), and
   - Operationalize the “issues”, “contextual factors”, and “assumptions” relevant to the student responses.

B. Rating work sample:
   - Collectively work through a single student response (not one included in the research sample) to identify evidence for each of the dimensions to be rated. Research Assistants (RAs) then discuss the evidence found that suggests the level of the demonstrated response,
   - Individually rate 5-10 work samples at a time, compiling an annotated list to back up the decision for each of the criteria, and
   - Assign and record a performance level (for each dimension) for the work samples.

C. Calibration:
   - The two markers use their annotations to discuss any differences between levels assigned,
   - In some cases, this process results in one or the other of the markers adjusting their level on a dimension. The rating process is based on individual interpretation, so differences in level determinations are occasionally observed. These changes are recoded and reported as post-calibration agreement.
   - Repeat for the remainder of the work samples. Generally, the greater the number of assignments that are rated, the fewer differences there are in ratings.

2.10 Student sample

The population of students will vary depending on the size of the project and the number of students enrolled in the participating courses. A sample of approximately 30 course assignments is desirable to be externally scored using the VALUE rubrics. Where possible, the sample drawn for marking using the VALUE rubrics will be taken from those who have tested on HEIghten. Occasionally there are upper year students enrolled in first-year courses, so the sample might need to be grouped by the student’s year of study to ensure that the work is derived from the appropriate year group. If it is a large class, there may be a process of stratifying that is necessary to ensure representativeness.

2.11 Creating a Community

The purposes of the meeting are for participating instructors to share experiences and build community. There is an expectation that each of the participating instructors will prepare a 5-minute presentation, and lead a 5-minute discussion about their experiences in the project. The guiding questions for instructors are:
   - What were you looking to improve [what challenges did you identify]?
   - What were the indicators that there was an issue
   - What methods are you employing to make a change?
With a large group of instructors, adequate lead time needs to be provided. Instructors can be polled to determine the most mutually beneficial time for the meeting. The duration of the meeting will depend on how many presentations there will be. The presentations themselves provide an opportunity for reflection and discussion. This sharing of ideas and experience is the primary goal of the meeting.

2.12 Post Implementation

Documenting processes

Record keeping facilitates the demonstration of the effectiveness of the project. The narrative form template (see 4.15) provides a framework for documenting the process undertaken in each of the courses. These forms are completed by the Assessment Facilitators. An additional method of tracking the impact of the work is the teaching and assessment survey (see 4.7). The surveys are to be completed prior to and after redesign implementation. Attitudes change slowly over time, so the surveys should be implemented in a longitudinal manner to track long-term shifts.

Analysis and reporting

The project team conducts analysis of the assessment data. Results, together with the comments from the Narrative forms are compiled into a course report. A reporting template is provided [add when available]. These reports provide an opportunity for debrief and form the basis for a cycle of continuous improvement (see 1.9).

2.13 Sharing experience

The following recommendations were offered by participating instructors who had been through the Cognitive Assessment Redesign process.

“Think first about what you intend for the students to be able to demonstrate at the end of the course, and then build strategies for teaching those cognitive skills. Don't assume the way you've done things in the past is accurately assessing what you intend to assess in your course.”

“I would say to try to gain before and after snapshots of skills, to give students plenty of feedback, and to listen to students' own language and reflections and goals, to have a thoughtful rubric, and to ask for advice!”

“Become familiar with the VALUE rubric in advance of designing the assessment to get a sense of how cognitive skills can be evaluated, then work backwards when designing the assessment ("backward design")”

“I would recommend spending time with the VALUE rubrics first to break down those broad cognitive skills into component parts and then try to notice how/when students are”

“Based on my experience I'd have to encourage them to first take the time to observe how the students work through the existing assessment, gathering feedback along the way, in order to determine what THEY feel needs to be changed in order for them to get the most out of the experience.”
“Start by brainstorming (with trusted colleague, education developer etc.) what the overall critical thinking goals are for the course, and how they can be met with specific skills development (again, which skills, at what level, in what order). And some of this ideally should require attention to where the course fits in the student’s program of study (where this is relevant). And encourage looking at the educational literature on critical thinking in their particular discipline as well as find out what colleagues are doing.”

“Clarify which cognitive skill they would like their students to further develop and create/adopt a frame of thinking for that particular skill to help guide rubrics, purpose of the assignment, instructions to students, marking and feedback.”

3. Principles for Success

**Sustainability of the project**

The term ‘propagation’ refers to the action of widely spreading and promoting an idea or theory. Many initiatives run for a short time and then practices revert to previous habits. Khatri et al., (2016) suggested that working toward a propagation plan is an effective way to support the sustainability of an initiative. Table 4 provides an example of a propagation plan for the Assessment Redesign project.

**Table 4. Propagation plan, goals, strategies and indicators**

<table>
<thead>
<tr>
<th>Targets</th>
<th>Goals</th>
<th>Strategies</th>
<th>Indicators of success</th>
</tr>
</thead>
</table>
| Make success of the project visible to senior leadership | Build ownership of the initiative into the departmental and university leadership structure | • Stakeholder consultation; briefing and de-brief meetings  
• Internal news articles  
• Work with University Relations group to develop a communication plan | • Senior leaders speak about successes in public forum  
• Public statements articulate the institutional commitment to assessment of cognitive skills |
| Recognize individuals as champions of assessment practices | Leverage capacities developed during the initial implementation | • Support nominations for teaching awards  
• Instructor presentations E.g. Webinars; Institutional Teaching Showcase)  
• Co-authored journal publications | • The number and type of awards attained by project participants  
• The number of presentations given (and number of participants)  
• Research paper citations |
| Wider adoption of new/ revised assessment practices | Extension phase beyond the project timeline to expand the network (targeting instructors of core courses within disciplines) | • Website to facilitate access to resources and for ongoing recognition of courses targeting assessment of cognitive skills  
• Incorporation of assessment into quality assurance processes  
• Visiting speakers to reinforce effective practices | • Website analytics  
• The number of instructors involved in directly assessing cognitive skills  
• The number of students impacted  
• Statistics from Centre for Teaching and Learning annual report (detailing pedagogical and assessment support and attendees at special events) |
3.1 Institutional leadership

Imagine that you have just been asked by the President, what evidence do we have that our students are learning? – what data would you call upon to answer that question? Perhaps you’d refer to student surveys like NSSE or course grades, but do either of these provide direct data on learning? To answer that question, you’d need evidence about exactly what each individual student was capable of at the beginning of their education, and then demonstrate what they are able to do now. Canadian institutions are facing increasing pressure to assess learning outcomes using reliable measures to meet accreditation requirements, and for demonstration of continuous improvement.

Unless an institution already has a culture that values assessment, building an institutional assessment process will involve motivating change, which includes a collaborative exercise of establishing the vision, analyzing the existing landscape on the campus, and identifying challenges (see Elrod & Kezar, 2016). In addition, the research methodology needs to consider the messiness of real-world learning, and also embrace disciplinary cultures of teaching. The US Department of Education’s report on transformative leadership, identifying specific roles for leaders in driving change (Astin, Alexander W. & Astin, Helen S., 2000), was published nearly two decades ago, with little impact. A model of organizational leadership proposed by Hannah & Lester, (2009) outlines a multi-level strategy for change management. Their model proposes that strategies be implemented concurrently at the individual level (micro), building approach tendencies and capacities, while networks (meso level) are fostered and facilitated, and additionally through systems of institutional sanctioning (macro level). In short, consistent assessment undertaken at the institutional level requires support from leaders at different levels, including the central administration, deans, heads, undergraduate chairs, instructors, staff and students. Who are the key leaders at your institution?

3.2 Fiscal and Logistical Needs

Assessment is a core business of a university, or at least it should be. Given current funding levels, there are considerable pressures on university budgets. This is especially so in some provinces, “Ontario received less than 70 per cent of provincial operating grant revenue per student in comparison to the average for the rest of Canada” (“Funding by Province,” n.d.). Competing priorities mean that the argument for the benefit of every initiative needs to be supported with evidence of impact. So, how much does it cost to implement an assessment project? Of course, it depends on scale, but the project undertaken with reach across Queen’s, a medium-sized institution, was undertaken for approximately $250,000, annually. In-kind commitments were undertaken in addition to core costs, and expenditures for such a program may vary. Table 5 reports the financial aspects of the institution-wide, network-based assessment re-design project as undertaken by Queen’s and described in Chapters 2 and 3. An additional budget has been included that outlines potential costs for a smaller scale project (see Table 6).
### Table 5. Indicative cost breakdown for an institution-wide assessment project

<table>
<thead>
<tr>
<th>Personnel Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Manager: annual salary including benefits</td>
<td>$90,000</td>
</tr>
<tr>
<td>Humanities Assessment Facilitator</td>
<td>$15,000</td>
</tr>
<tr>
<td>Social Science Assessment Facilitator</td>
<td>$15,000</td>
</tr>
<tr>
<td>Science Assessment Facilitator</td>
<td>One day per week for 10 months @ $350 p/d</td>
</tr>
<tr>
<td>Engineering Assessment Facilitator</td>
<td>$15,000</td>
</tr>
<tr>
<td>Health Sciences Assessment Facilitator</td>
<td>$15,000</td>
</tr>
<tr>
<td>Graduate student markers: 130 hours @ $24/hr.</td>
<td>$3,120</td>
</tr>
<tr>
<td><strong>Subtotal Personnel Expenses</strong></td>
<td><strong>$168,120</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardized testing fee (HEighten) sample of 1000 first year, 300 fourth year @ CAD$16 per test</td>
<td>$20,800</td>
</tr>
<tr>
<td>Instructor stipends @ $2,000 per instructor (up to a maximum of 25 instructors)</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>Subtotal Additional Expenses</strong></td>
<td><strong>$81,880</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$250,000</strong></td>
</tr>
</tbody>
</table>

### Table 6. Indicative cost breakdown for small-scale assessment project

<table>
<thead>
<tr>
<th>Personnel Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project director/ Assessment Facilitator</td>
<td>Two days per week for 10 months @ $350 p/d</td>
</tr>
<tr>
<td>Graduate student markers: 30 hours @ $24/hr.</td>
<td>$720</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Expenses</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor stipends @ $2,000 per instructor (perhaps 5 instructors)</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional Development and Dissemination</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel and conferences/ registration</td>
<td>$2,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$42,720</strong></td>
</tr>
</tbody>
</table>
References


Pace, D. (2017). *The Decoding the Disciplines paradigm: Seven steps to increased student learning*. Indiana University Press.


4. Forms
4.1 Position Summary: Project Manager; Queen’s University

Reporting to the Vice-Provost (Teaching and Learning), the Project Manager is responsible for organizing and coordinating all aspects of the research and ensuring a smooth and effective implementation of the institutional assessment and evaluation projects. The Project Manager will plan, manage and implement research methodologies, oversee data analysis, the development of research tools and reports, and the creation of web interfaces. The incumbent will be responsible for training and supervising graduate and undergraduate research assistants, pursuing opportunities for scholarly publication, procuring additional research grants, and liaising with research partners. In collaboration with the research team, the Project Manager will also assist in the development of new funding proposals and interactions with faculty, instructors and staff in the adoption of evidence-based practice in assessment of student learning.

PRIMARY DUTIES AND RESPONSIBILITIES:

- Develop research processes i.e. ethics and consent, logistics, instrumentation, data collection and debriefing
- Liaise with existing research partners and develop new research partnerships
- Oversee research budgets and account management and contribute to financial planning by maintaining financial records.
- Establish schedules for research including data collection, analysis, and dissemination, and train, monitor and evaluate graduate research assistants accordingly
- Create and/or manage the design, development, testing, and implementing of experimental protocol
- Prepare applications for ethics approval for research projects
- Develop surveys and facilitate focus groups
- Interpret, modify and implement changes in research and operations procedures, policies or standards as required
- Perform analysis of qualitative and quantitative data sets and interpret results
- Prepare results for presentation, usually in form of written report or proposal
- Work with departments and faculty, facilitating the assessment of learning outcomes in undergraduate courses
- Design and facilitate faculty and staff workshops in assessment and evaluation practices
- Work with faculty and graduate students to develop, write and publish research findings, media releases, briefing notes, and web content for identified communication vehicles and/or distribution, as required.
- Present findings at scholarly conferences and to a variety of internal and external stakeholders
- Support marketing and promotion
- Plan, prioritizes and manages the work of employees, providing strategic and tactical advice, guidance and coaching. Identifies the need for staff resources, participates on staffing committees, and makes effective recommendations regarding employee selection.
- Manage performance by establishing performance standards, reviewing and evaluating performance and conducting formal performance reviews on an ongoing basis.
- Staff training and development needs, and ensures that employees receive training required to improve and sustain successful performance.
• Investigate, address and resolve employee/ labour relations issues, including disciplinary matters. Makes decisions or effective recommendations on matters involving possible discipline, discharge or probationary termination.

REQUIRED QUALIFICATIONS

• A graduate degree in education, preferably with a specialization in post-secondary assessment combined with a minimum of 5 years of experience
• Experience in supervision and decision–making in professional educational contexts
• Experience conducting educational research in assessment and evaluation
• Advanced skills in quantitative and qualitative research methods
• Advanced knowledge of assessment tools and the capacity to adapt and develop tools
• Consideration will be given to an equivalent combination of education and experience.

SPECIAL SKILLS

• Proficiency in education research methods, e.g. assessment and evaluation, and psychometrics
• Ability to create protocol for and facilitate interviews and focus groups in a research project
• Ability to use sound judgement and personal initiative to adapt procedures as required to meet the needs of the project and to conduct independent research
• Ability to choose best protocol or adapt procedures to meet changing needs of the research
• Organizational, problem-solving, and analytical skills
• Advanced technical writing skills, and ability to coordinate the development of scholarly publications
• Advanced oral communication skills to facilitate dissemination to internal and external stakeholders
• Proficiency in statistical analysis of large data sets, including some data visualization
• Excellent interpersonal skills both verbal and written to present information, advice and guidance; to supervise research assistants and undertake consultations with faculty
• Capacity to adapt quickly to changing circumstances and make accommodations on an independent basis, while respecting the guidelines and goals of the research

DECISION MAKING

• Expected to work independently, be self-directed and able to prioritize work with minimal supervision
• Contribute to decision-making regarding experimental approach, adapting protocols and procedures
• Make budgetary decisions and appropriately allocate resources
• Assess progress and determine alternative methods
• Plan, prioritize, and oversee the work of research assistants based on research activity schedule
• Determine what changes should be made to ensure that the goals of the project are met according to the established schedule
• Identity appropriate method to present information and draft reports or publications
• Determine whether a particular procedure falls within ethics guidelines, and where to seek an amendment to the ethics guidelines
• Decide when and how to answer questions from internal and external research stakeholders or outside agencies and when to involve the Principal Investigators
• Evaluate job candidates and makes effective recommendations on suitable hires.
• Make decisions and/or effective recommendations regarding transfers and promotions.
4.2 Assessment Facilitator job role information sheet

Cognitive Assessment Redesign (CAR) Assessment Facilitator

Queen’s University is initiated an institution-wide, network-based approach to the development and assessment of cognitive skills (critical thinking, creative thinking, and problem solving) in undergraduate education. The project involves incentivized recruitment of first and fourth-year course instructors interested in purposefully aligning skill development through the design of course assessments tailored to cognitive skill acquisition. The validation of course-based marks will be undertaken using a standardized measure. Producing change in teaching and learning practices within an institution requires sustained participation, collaboration and support for participating faculty members. A network approach will be used (see figure below), financially supporting instructors and encouraging interaction between members aimed at building capacity toward long-term sustainability. Further details are available on the project website (http://www.queensu.ca/qloa/home). This document describes the goals of the project and the role and expectations of the Assessment Facilitators.

The network comprises the CAR members (course instructors), their Assessment Facilitators, and network support personnel (Centre for Teaching and Learning). The research manager will coordinate logistics, implementation timelines and reporting.
There are six specific goals for the project. We aim to:

- Build departmental capacity; recognize and reward faculty leaders within departments who will be creating or redesigning assessments that align with cognitive skills
- Support faculty to develop course-based assessments (in first- and fourth-year courses), using rubrics for the assessment of cognitive skills
- Investigate the reliability of course-based assessments
- Validate the course-based outcomes with a selective sample tested using a standardized critical thinking test
- Report the value-add between first and fourth-year cognitive skills achievement across the institution

**Expectations for the Assessment Facilitators**

The role of Assessment Facilitator begins in [start date] and continues until the [end date]. The expected time commitment to not exceed one day per week (on average).

1) **Meetings:** Weekly (90 min) to facilitate the following
   - a) Training in authentic task development
   - b) Training for assessment processes and protocols
   - c) Discussion of progress with their group of instructors

2) **Duties**
   - a) Provide pedagogical and instructional design support and assessment advice to the course CAR instructors for redesigning course assessment(s)
   - b) Assist with the development of course tasks, tailored to critical thinking, creative thinking, and/or problem solving
   - c) Undertake student participant recruitment
   - d) Coordinate scheduling and assist with in-course standardized testing (where applicable)
   - e) Undertake the use of VALUE rubric marking of course-based assignments (including calibration to ensure consistency of marking)
   - f) Provide feedback to CAR instructors

3) **Deliverables**
   - a) VALUE rubric assessment data
   - b) Course narrative: reviewing the successes, challenges and achievements of their group as reported by their instructors and as experienced through their work

**Remuneration** will be paid on a contract basis (for the ten months) to total sum (including all benefits and associated taxes) of $15,000 per Assessment Facilitator.
The Cognitive Assessment Redesign (CAR) project is an institution-wide, network-based approach to the development of cognitive skills in undergraduate education. This project aims to incentivize first- and fourth-year instructors to align skill development through the design of course assessments, tailored to cognitive skill acquisition. A network will be initiated to support instructors, encourage sustained participation and collaboration, and to build progression in teaching and learning throughout the institution.

The CAR-network is a group of instructors and educational support personnel, aimed at capacity-building for long-term sustainability of cognitive assessment strategies. The research utilizes specific measures for assessment of student learning, pre-and post, instructor survey (see survey items in 0) to gauge the impact of the project on teaching attitudes and assessment practices, as well as course-level documentation of the assessment redesign effort (see 4.15 Narrative report). The role of the assessment Facilitator (outlined in 4) is to provide support and feedback to the instructors about effective assessment practices.

**Research Questions**

1. What instructional processes and in-class assessment practices are effective for assessment of cognitive skills?

2. In what ways does the CAR network support the development and assessment of cognitive skills in undergraduate education?

3. What is the correlation between course assessments, VALUE ratings and HElghten test scores?

4. What is the “Value-add” in a Queen’s University undergraduate degree (the difference between the demonstration of cognitive skills between first and fourth year)?

5. How effective is the CAR model at propagating change in assessment practices at Queen’s University?

The Principal investigators will liaise with Associate Deans and Department Heads and engage their support in recruiting instructors in the project. Initiation of the network will begin in August by linking faculty and educational professionals. Interested instructors will submit an expression of interest and a selection committee comprising two faculty members, a representative from the Office of the Provost and a representative from the Centre for Teaching and Learning will evaluate the proposals to select successful applicants for the project.

The selection criteria will be posted with the call for proposals, namely:
(1) Suitability and feasibility of the proposed assessment/ task,
(2) Commitment of the instructor and academic unit to the project,
(3) Sustainability of the intervention for ongoing implementation.

Instructors will sign a letter of agreement (see Letter of Agreement) prior to distribution of grant funds and the implementation of courses.

The data collection phase of the project involves recruitment of student participants. Assessment Facilitators will speak to students toward the beginning of the semester, explain the project and seek participation (add reference). Letter on Information and Consent Form. Student enrolled in (participating) online courses will be sent an email (add reference).

Data analysis will be operationalized as follows:

• Assessment Facilitators, together with members of the research team will use VALUE rubrics to mark a sample of students’ course assignments
• Correlations will be analyzed and used to support validation of the course marks based on the VALUE rubric scores
• The correlational and regression analysis will be investigated to determine the relationship between the in-course assessment and the HEIghten test scores, and
• Results from the comparative first and fourth-year rubric and test scores will be reported to demonstrate the “value-added” for the institution.

**Instrumentation**

VALUE rubrics were developed by teams of faculty experts representing colleges and universities across the United States through a process that examined many existing campus rubrics and related documents for each learning outcome and incorporated additional feedback from faculty. The rubrics articulate fundamental criteria for each learning outcome, with performance descriptors demonstrating progressively more sophisticated levels of attainment. The rubrics are intended for institutional campuses, disciplines, and then courses. The utility of the VALUE rubrics is to position learning at all undergraduate levels within a basic framework of expectations such that evidence of learning can by shared nationally through a common dialog and understanding of student success.

HEIghten™ is a 45-minute online critical thinking test developed by the Educational Testing Service (ETS) designed for institutional assessment of critical thinking. Students are asked to respond to series of questions based on a shared multi-part stimulus that reflects real-world issues. Students are expected to analyze and evaluate an argument structure, and evaluate evidence and its use to develop a valid or sound argument. Students are expected to demonstrate understanding of the implications of information and argumentation by drawing or recognizing conclusions, extrapolating implications, or recognizing or generating explanations for phenomena that are described.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Up to 5,000 first year students and 2,000 fourth year students.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of data</td>
<td>Queen's undergraduate or graduate students from departments within the Faculty of Engineering and Applied Science, departments within the Faculty of Arts and Science and departments within the School of Health Sciences.</td>
</tr>
</tbody>
</table>
Documentation will be collected from instructors. As the instructors will be co-investigators in the research, documentation of their "participation" will be in the form of a letter of agreement (see 0).

<table>
<thead>
<tr>
<th>Secondary data</th>
<th>Secondary data from the Office of Institutional Research and Planning (OIRP), will provide information as described in the letter of information and consent form:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Program, Plan, year of study International/ domestic (described as enrolment status)</td>
</tr>
<tr>
<td></td>
<td>• Sex, language (individually listed of the consent form)</td>
</tr>
<tr>
<td></td>
<td>• Course grade, course numerical percentage (described as course outcomes)</td>
</tr>
<tr>
<td></td>
<td>• Sessional grade point average, cumulative grade point average, first year grade point average (grouped as grade point average on the consent form)</td>
</tr>
</tbody>
</table>

| Recruitment    | Students will be recruited during class time by the Assessment Facilitator; a printed, or survey version of the LOI and consent form will be provided. The instructor and teaching assistants will not be present at this time. |

| Withdrawal procedures | Participants will be free to withdraw from the study, without explanation, without penalty or reprisal, for a period of three months following consent by contacting the relevant Assessment Facilitator by email, at which time they will be offered the option of having their data removed from the results of the study. |

| Compensation     | No student compensation. No direct remuneration to instructors. The project however does involve funds to support the implementation or investigation of the assessment. As outlined in the call for expressions of interest, research funds may use for: |
|                  | • Teaching Assistants or facilitators                                                                                                                                                                                                                     |
|                  | • Costs related to student learning activities, e.g. materials, equipment, field trips, guest speakers                                                                                                                                                        |
|                  | • Development of teaching assessment materials (RA/ TA)                                                                                                                                                                                                   |
|                  | • Travel for activities related to the project Specific use of funds will be itemized in the instructor expression of interest                                                                                                                           |

| Risks            | Students may feel that they have to consent because their instructor is a co-investigator in the research. Potential for power imbalance will be mitigated through research personnel recruiting student to consent (the instructor or teaching assistants will not be in the room). It will be made clear that there is no obligation for students to consent. If students feel uncomfortable about participation for any reason, it will be suggested that they do not participate. |

| Benefits         | The study provides benefit to the instructors and departments involved by providing support for assessment redesign and feedback on student learning. It will benefit the research community by contributing to research on critical thinking assessment, and will provide insight into assessment at the institutional level. This project also will serve to demonstrate that a network model is feasible and provides a financial and administrative support to benefit faculty in the following measures: |
|                 | • Capacity building; growing the ability for faculty to redesign course assessments                                                                                                                                                                          |
|                 | • Produce change through sustained participation and collaboration                                                                                                                                                                                        |
• Allow a vessel for cross-departmental communication allowing for cross-departmental sharing of effective practices

• A strong support base for feedback and problem solving

• Promotion of faculty network approach to future University projects This project will further serve to promote and implement cognitive learning assessment in Queen’s curriculum to enhance the student learning experience as per the Queen’s University Strategic Plan. This project will serve to build the learning capacity at Queen’s, promoting both course innovation and cognitive assessment in a variety of Queen’s courses and disciplines.

| Participant confidentiality | Students will not be directly identified in any research documentation, reports or publications. Knowledge of the identity of participants will be restricted to project researchers (excluding the course instructor and Teaching Assistants). Instructors survey data will be aggregated to demonstrate the overall impact of the changes to teaching and assessment. Instructors responses will not be individually identifiable. |
| Data security | Research data will be stored on an encrypted, password protected computer system with access restricted to the hub leaders and project researchers. Any hard copy will be stored in a locked filing cabinet in the Centre for Teaching and Learning. |
4.4 Promoting the project

Learning Outcomes Assessment project into new phase

Wednesday February 28, 2018
By Peter Jeffrey, Associate Director, News and Publications

New focus on embedding and assessing student critical thinking skills in course work.

During their undergraduate years, students are busy mastering their course curriculums. But there is a growing focus across the university on ensuring their critical thinking, creative thinking, and problem solving skills are also being put to the test at every opportunity. These transferable skills are what employers are interested in, and can really help when students get out into the job market.

This is where the ongoing Learning Outcomes Assessment project at Queen's comes in. It's funded by the Higher Education Quality Council of Ontario (HEQCO) and has now entered a new phase with the launch of the Cognitive Assessment Redesign (CAR) initiative.

*This initiative is aimed at taking into account everything we have learned so far about
4.5 Expression of interest (EOI) template

Cognitive Assessment Redesign (CAR) Expression of Interest Submission Form

Section I

<table>
<thead>
<tr>
<th>Applicants Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment</td>
<td></td>
</tr>
<tr>
<td>Department</td>
<td></td>
</tr>
<tr>
<td>Course Name and Course Code</td>
<td></td>
</tr>
<tr>
<td>Contact e-mail Address</td>
<td></td>
</tr>
<tr>
<td>Learning Outcomes to be assessed (including at least one of the critical thinking, creating thinking, problem solving)</td>
<td></td>
</tr>
</tbody>
</table>

Section II

In no more than one page per question, please describe:

1. How do you currently encourage the development of cognitive skills in your course?

2. How do you currently assess student skill development?

3. How might you improve cognitive skill development and assessment in your course?
   Please consider how the approach or strategy may be ongoing beyond the funded year of implementation.

Section III
Please provide a detailed budget outline in the table below. If necessary please add more rows to the table provided:

<table>
<thead>
<tr>
<th>Budget Item</th>
<th>Item Description</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total:

Section IV
Please provide a co-signature from your Head/Director, Dean or Associate Dean:

Name __________________ Signature __________________
Position __________________ Date __________________

Cognitive Assessment Redesign (CAR) EOI rubric

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Developing (1)</th>
<th>Meets Expectation (2)</th>
<th>Above Expectation (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitability and feasibility of the proposed assessment/ task</td>
<td>Includes a brief description of instructional strategies that focus on cognitive skills, but proposed assessment(s) are vague and may not be feasible for implementation.</td>
<td>Describes instructional strategies that focus on cognitive skills and suggests teaching and assessment practices that are feasible and show potential for cognitive skill development and assessment.</td>
<td>Explains instructional strategies that are tailored to cognitive skills and proposes teaching and assessment strategies that are highly suitable for cognitive skill development and assessment.</td>
</tr>
<tr>
<td>Commitment of the instructor and academic unit to the project</td>
<td>EOI demonstrates basic understanding of the project. Expression of interest is signed by Head/Director, Dean or Associate Dean</td>
<td>Ideas are communicated clearly. Demonstrates adequate knowledge of the project. Expression of interest is signed by Head/Director, Dean or Associate Dean</td>
<td></td>
</tr>
<tr>
<td>Sustainability of the intervention for ongoing implementation</td>
<td>Identifies possible improvement strategy but there is no reference to how the strategies may be implemented beyond the semester or the course.</td>
<td>Describes an improvement strategy for the assessment of cognitive skills that has potential for future application.</td>
<td>Proposed intervention is a robust and sustainable solution for the assessment of cognitive skills.</td>
</tr>
</tbody>
</table>

Total /8

Comments:
4.6 Letter of agreement

Cognitive Assessment Redesign (CAR) Instructor Letter of Agreement

Date:

To the CAR Project Management Team,

I, [instructor name] understand that we will be joining the project team as co-investigators, for the purpose of investigating the implementation of cognitive assessment in [course name and number]. I understand the intended outcomes and purposes of this project, and commit to:

a) Participating in the project from [start date] to [end date]

b) Completing a teaching practices survey approximately September, and again approximately April.

c) Designing a course assignment (with support from your assessment facilitator to align with the cognitive assessment criteria.

d) Spending grant money as specified in the attached expression of interest document (any variation from the outlined expenses must be approved by the project manager).

e) Allowing project team members access to my students to seek consent for use of data.

f) Allowing project team members access to (consenting student) course assessments.

g) For instructors who “opt-in”, allow project team members to administer the HEighten standardized test as part of the course.

h) Attending network meetings for briefing and to share experiences with peers.

i) Sharing experiences in formal and/or non-formal settings, (at least two of the following):

   a. Present at a Queen’s University assessment event
   b. Present at an external conference
   c. Provide advice to peers in one-to-one or small group setting

Furthermore, I understand that in agreeing to this participating in this project that we will receive funding of up to $2,000 to be provided by the Vice Provost (Teaching and Learning).

☐ I am aware that my Department Office will manage the funds

Chart field: ___________ - __________ - __________ - __________ - __________

Participant Agreement

By signing below, I hereby agree to participate in the Cognitive Assessment Redesign (CAR) project as per its full terms:

Name: ___________________________ Department: ___________________________

Signature: ___________________________ Date: ___________________________
4.7 Teaching and assessment survey

**Teaching Attitudes - Section A**

1. Please rate the following statements related to undergraduate teaching by their level of importance to being an effective teacher of undergraduate students.

<table>
<thead>
<tr>
<th>Not at all Important (1)</th>
<th>Somewhat Important (2)</th>
<th>Neutral (3)</th>
<th>Important (4)</th>
<th>Very Important (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding how students learn a particular subject</td>
<td>Promoting interest in the subject matter</td>
<td>Understanding what motivates students to learn the course material</td>
<td>Conveying enthusiasm for the subject</td>
<td>Providing relevant, real life examples of the concept you are teaching</td>
</tr>
</tbody>
</table>

2. The following are some statements about your attitudes, beliefs and approaches towards undergraduate teaching. Please rate your level of agreement with each of the statements based on your own attitudes and opinions.

<table>
<thead>
<tr>
<th>Strongly disagree (1)</th>
<th>Disagree (2)</th>
<th>Neutral (3)</th>
<th>Agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To teach effectively requires knowing how students learn a subject and not just knowing the subject</td>
<td>Learning is a social activity</td>
<td>Learning can be facilitated through the use of social interaction among students</td>
<td>It is important for instructors to explicitly address any preconceptions of students (cultural biases, past learning experiences, etc.) in their learning</td>
<td>An instructor is responsible for engaging students in a subject</td>
</tr>
<tr>
<td>Strongly disagree (1)</td>
<td>Disagree (2)</td>
<td>Neutral (3)</td>
<td>Agree (4)</td>
<td>Strongly agree (5)</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------</td>
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<td>-------------------</td>
</tr>
</tbody>
</table>

- I encourage interaction/interactive learning during my class time (10)
- I regularly review and change, as needed, my teaching techniques to match the needs of the students (11)
- My student’s success is my success (12)
- An instructor is responsible for preparing students for their future career (14)
- An instructor has been successful if students retain the important concepts of the class for the long term (16)
- An instructor is responsible for providing students with useful feedback (17)

3. General Assessment of Teaching

We would now like you to think of your general perception and opinion of the undergraduate teaching environment at Queen's University.

Please indicate on the below scale your perceptions of the importance placed on teaching and research.

<table>
<thead>
<tr>
<th>much more importance on research than teaching (1)</th>
<th>a little more importance on research than teaching (2)</th>
<th>the same amount of importance on teaching and research (3)</th>
<th>a little more importance on teaching than research (4)</th>
<th>much more importance on teaching than research (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The administration at Queens puts... (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My Academic Unit puts... (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I put... (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teaching Practice - Section B

3. A Have you been actively involved in transforming* a course recently?
*A transformed course incorporates at least two major principles of backward design (generated learning goals, evidence-based teaching practices, assessing student achievement of learning goals).
- Yes (1)
- No (2)

3. B Please indicate the course you are reporting on:
________________________________________________________________________

3. C Please indicate the last year you last implemented it:
________________________________________________________________________

3. D Would you consider elements of the course you are reporting on to be *transformed?
*A transformed course incorporates at least two major principles of backward design: generated learning goals, evidence-based teaching practices, assessing student achievement of learning goals.
- Yes (1)
- No (2)

If 3.D = Yes

3. E Please describe the way the course was transformed ______________________________________

3. F Estimate the number of students in the course

4. The format of my course ${3.B/ChoiceTextEntryValue}, implemented in ${3.C/ChoiceTextEntryValue} included:
You may select multiple
- Traditional face-to-face (1)
- Discussion section/ Reading group (2)
- Scheduled drop-in sessions or group collaboration sessions or tutorial (3)
- Lab/ Studio/ Fieldwork (4)
- Fully online (5)
- Hybrid (i.e. partly online, partly face-to-face) (6)
- Other format (please specify) or additional information regarding your selection | static | other (7)

________
5. Please identify the supporting materials and sources provided for students in $\text{3.B/ChoiceTextEntryValue}$, implemented in $\text{3.C/ChoiceTextEntryValue}$:
   - Goals or learning objectives articulated to students (1)
   - Readings from texts written for university students (2)
   - Articles or chapters from scholarly literature (3)
   - Readings from popular press or journalist accounts (4)
   - Lecture notes (5)
   - Worked examples or other sample assignments/papers/exams given as models (6)
   - Animations or simulations; film, video, or audio materials; websites or internet sources (7)
   - Other supporting materials (please specify) or additional information regarding your selection (8)

6. Feedback to students, including grading policies in $\text{3.B/ChoiceTextEntryValue}$, implemented in $\text{3.C/ChoiceTextEntryValue}$ (check all that occurred):
   - Students saw assignments with feedback before grading or with opportunity to redo to improve mark (1)
   - Students saw marked assignments or exams (2)
   - Students saw answer key or rubric for scoring open ended answers (3)
   - Students explicitly encouraged to meet individually with you (4)
   - Other feedback to students (please explain) (5)

7. Other (check all that occurred either in class or outside of class time in $\text{3.B/ChoiceTextEntryValue}$, implemented in $\text{3.C/ChoiceTextEntryValue}$):
   - Assessment given at beginning of class to assess background knowledge (1)
   - Pre-Post assessment instrument (i.e. knowledge measure before and after class) (2)
   - Opportunities for students' self-evaluation of learning (3)
   - Students provided with opportunities to have some control over their learning, such as choice of topics for course, paper, projects, assessment methods, etc. (4)
   - Instructor-TA meetings to get feedback on student learning and provide guidance for instruction (5)
   - None of these occurred during the course. (6)

8. The marking was undertaken by: (select all that apply)
   - The course instructor(s) (1)
   - Graduate teaching fellow (2)
   - Teaching assistant(s) (3)
   - Other (4)

9. Was there discussion between markers about criteria? (select all that apply)
   - The criteria were discussed informally, but markers scored assignments by themselves (2)
   - Markers met to formally discuss differences between a selection of student work (to agree on the level that should be awarded) (3)
   - There was a formal process of cross-marking/ follow-up calibration (multiple markers assessing a range of work samples, comparing their grade/ levels assigned to ensure consistency of marking) (5)
   - There was no discussion of criteria either before or after the marking was completed (1)
   - Other (0)
4.8 Survey: instructor email

Dear [name],

We are delighted that you are part of the cognitive assessment redesign project. Part of the research includes tracking the changes to teaching and assessment as a result of the project. We are investigating these changes through studying changes in course materials and assessment documents, and through the attached survey.

This is the “pre” survey, prompting you to respond about the last time you ran the course. We will ask you to complete it again at the conclusion of the project. The survey has 15 questions (some multi-part), and takes approximately 10 minutes to complete.

Thank you in advance for taking the time to complete the survey, to support the evaluation of the effectiveness of the project.

Cognitive Assessment Redesign team
CAR-Network@queensu.ca
4.9 Letter of Information and consent form

Cognitive Assessment Redesign at Queen’s University

Letter of Information and Consent for Student Course-based Learning

Dear student:

You are invited to participate in a research study being conducted by researchers at Queen’s University, investigating methods for improving cognitive assessment (critical thinking, creative thinking and problem solving) in first and fourth year courses. Researchers will be using course assessment rubrics, standardized rubrics and in some cases a standardized test, to investigate the effectiveness of learning and assessment at Queen’s. We intend to use this information gathered from the study for the following purposes:

a) To provide feedback to your instructor about the course assessment
b) To investigate the course assessment to see how it compares to other measures.
c) To help evaluate cognitive skill development at Queen’s (the improvement between first and fourth year).
d) To provide evidence for administrators and instructors about effective assessment practices.
e) For research publication and dissemination to the wider community.

PROCEDURES
Researchers seek consent to access your course work and outcomes (for example, assignments, projects, reports, lab reports, results from tests or course surveys), and registrar data, such as enrollment status, language status, sex, and grade point average.

BENEFITS
By enabling researchers to evaluate the effectiveness of teaching and learning you will be helping research personnel to provide feedback to course instructors for the purpose of improving course activities and student learning.

PARTICIPANT CONFIDENTIALITY/ RISKS
You will not be individually identifiable in any course-based data. The project coordinator will replace your name with an identification number that associates your grades with a specific course. Only the members of the research team from Queen’s University will have access to the master file linking your name with your identification number. Your instructor and teaching assistants will not know if you participated. The researchers will not share any directly identifying information about you. There are no known risks, but if you are not comfortable with participating, your data will not be included in the study.

CONSENT
You can indicate your consent on the page below. Declining to consent will not affect your status at Queen’s University in any way. If you do consent, you may withdraw your consent to participate at any time by notifying the project manager [name and email address]. Any ethical concerns about the study
may be directed to the Chair of the General Research Ethics Board at 1-844-535-2988 (Toll free in North America) or 1-844-535-2988 (if outside North America). If you have any further questions about this study, please contact [name and email].

Sincerely,
[Principal Investigators name, contact details and signature]

PARTICIPANT CONSENT:
Please check the appropriate box or boxes to indicate your participation choices as described in the attached letter:

☐ A. I do not wish to participate in the study.

☐ B. I consent to allow the use of:
   • course work and outcomes (for example, assignments, projects, reports, lab reports, results from tests or course surveys).
   • registrar data, such as enrolment status, language status, sex, and grade point average.

Name: ________________________________ Course: ______________
Student number: ____________________________
Signature: ____________________________ Date: ______________
4.10 Student recruitment script

Hello, my name is (insert name) and I am (position and or rank) in the (department or office).

Today (I / we) am (are) here to talk to you about an exciting research project at Queen’s that we would like for all of you to be a part of! Queen’s is investigating methods for improving cognitive skill development and assessment, so critical thinking, creative thinking and problem solving, across a range of disciplines and faculties. There are some elements of your course that have been redesigned to support your learning. Your course instructor has opted to be part of this project to improve your learning experience, but your confidential participation in the research is your individual decision,

- participating won’t affect your grade in any way
- [instructor name] won’t know what your choice is
- and there’s nothing extra required of you

We are asking for your consent so that we can evaluate the effectiveness of the project. We are specifically asking for is permission to externally mark your course assessments using standardized measure so that we can evaluate the development of cognitive skills across Queen’s, and permission to access some demographic information so that we can investigate the fairness of the assessment for our diverse groups at Queen’s. [If applicable] (Instructor name) has also opted to include a standardized test as part of your course. And we request access to the result of that test.

Through this project, Queen’s is working towards building a greater capacity for school departments to build better courses that enhance your learning experience. We want to engage more instructors in the learning experience by getting faculty and departments to be active in improving teaching to provide the best education possible. This project is designed to support long-term improvements at Queen’s, so your participation may help students for years to come. Information gathered from this project provide basis for our informed conversations with other higher education institutions that are also interested in cognitive assessment across their institution.

The information gathered from this study will be used for the following purposes:

a) To provide feedback to your instructor about the course assessment
b) To investigate the course assessment to see how it compares to other measures of assessment
c) To help evaluate cognitive skill development, focusing on the improvement between first and fourth year
d) To provide evidence for administrators and instructors about effective assessment practises
e) For research publication and dissemination to the wider community

As a participant, you will not be required to participate in non-course academic assessments outside of your graded assessments, however we request access to your course-based assessments and grades along with your registrar data, that being your enrolment status, language status, sex and grade point average. We will not use your data if you choose not to participate.

Your course instructors and teaching assistants will not know if you have participated. To protect your identities we, the project team, will give each participant an identification number that only members of the research team will be aware of the link between your ID number and your identity. The researchers will not share or disseminate any information that can directly identify you. You will not be disadvantaged in any way should you choose not to participate. If at any point during this study you no longer feel comfortable in participating or do not want your data included from the study, you are entitled to withdraw from the study at which point the researchers will destroy all data related to your identification number. Withdrawal from the study is done by contacting the project manager. Any questions about the project can be directed to the project manager [name and email] who is available to answer questions at any time during the study.
4.11 Student recruitment email

Dear [name],

Your [course] instructor is currently redesigning assessment in support of cognitive skill development. This redesign is happening in many courses at Queen’s as part of a research project focusing on critical thinking, creative thinking and problem solving, across a range of disciplines and faculties. [Instructor name] has opted to be part of this project to improve your learning experience, but your confidential participation in the research is your individual decision.

We are asking for your consent so that we can evaluate the effectiveness of the project. We are specifically asking for is permission to externally mark you course assignment(s) so that we can see how cognitive skills develop across Queen’s University. (Only for relevant courses) [Instructor] has also opted to include a critical thinking test as part of your course, we request access to the result of that test. We also seek permission to access some demographic information so that we can investigate the fairness of the assessment for our diverse groups at Queen’s.

There is no additional requirement for participating beyond indicating you consent preference and participants will not be identifiable. You will not be disadvantaged in any way if you choose not to participate and your course instructors and teaching assistants will not know your consent choice.

Through this project, Queen’s is working towards building a greater capacity for school departments to build better courses that enhance your learning experience. We want to engage more instructors in the learning experience by getting faculty and departments to be active in improving teaching to provide the best education possible. This project is designed to support long-term improvements at Queen’s, so your participation may help students for years to come. Information gathered from this project provide basis for our informed conversations with other higher education institutions that are also interested in cognitive assessment across their institution. The information gathered from this study will be used for the following purposes:

a) To provide feedback to your instructor about the course assessment
b) To investigate the course assessment to see how it compares to other measures of assessment
c) To help evaluate cognitive skill development, focusing on the improvement between first and fourth year
d) To provide evidence for administrators and instructors about effective assessment practises
e) For research publication and dissemination to the wider community

If you have any questions about the project please email [name and email].

Please use the following ling to view the letter of information and select you consent option:
[ survey link ]
4.12 Simplified HEighten test instructions

1. Read the letter of information and select you consent choice:
   [consent survey URL here]
2. Select “Download the ETS Online Testing Browser”
3. Download the Browser and follow the steps to launch
4. Enter the session number:
   [session number here]

(please include the dash)

Structure:
- Demographic survey
- Tutorial (select “next” to continue)
- Practice test (close out “x” as soon as you are comfortable with the test)
- Test
- Closing survey
4.13 Debrief Letter

Dear participant,

On behalf of the research team and Queen’s University, we would like to thank you for taking your time to participate in our study of cognitive skills assessment at Queen’s. The purpose of this research is to assess how we as an institution assess cognitive skill development and provide an educational experience that teaches added development of these skills through the four years. By working with instructors to redesign course assignments to better assess cognitive skills, we will be able to determine where we exceed expectations and where we need to focus our efforts. It is our intention to make Queen’s a leader in cognitive skills assessment while also demonstrating to courses across the institution that cognitive skill assessment is possible in their disciplines.

If you are interested in this area of research, you may wish to read the following references:

If you have any concerns or would like to know more about this study and how your data is being used, please do not hesitate to contact the research team at nls3@queensu.ca. We also invite you to check out our website at http://www.queensu.ca/qloa/home. Any ethical concerns may be directed to the Chair of the General Research Board at chair.GREB@queensu.ca.

Finally, thank you again for your participation. With your help, we continue to make Queen’s University better!
4.14 Assignment and rubric examples

**Population Genetics: Lake Trout - Research report (Critical thinking)**

Background: There are a number of lake trout lakes north of Kingston. Two of these are Devil Lake (see lower left image) and Knowlton Lake (see lower right image). Lake trout lakes are also called cold water lakes, because these fish cannot survive when water heats up to a certain temperature in summer. Warm water lakes are more common in the Kingston region.

For this assignment, we will be comparing the observed heterozygosity in lake trout from the two lakes, by assessing their DNA microsatellite diversity. Our results will show that the lake trout in Devil Lake have a higher observed heterozygosity than those in Knowlton Lake. It will be your task during the lab to find the actual observed heterozygosity values and to determine if Devil Lake has a significantly greater observed heterozygosity. The focus of your discussion will be on possible factors that contribute to the higher observed heterozygosity of the Devil Lake trout. To help with this assessment, you should become familiar with population genetics (e.g., start with Ch.23 of the textbook) and lake trout ecology (e.g., what makes good lake trout habitat, what do lake trout need to complete their life cycle).

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Excellent</th>
<th>Adequate</th>
<th>Weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanation of Content Issue</td>
<td>Explanations of issue are compelling and have depth and breadth</td>
<td>An explanation is provided for the issue, but details are missing, vague, or incorrect</td>
<td>Minimal explanation is provided, many details are missing, and some (or all) information is incorrect</td>
</tr>
<tr>
<td>Explanation of Content Issue</td>
<td>Indicates a thorough understanding of the problem</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence</td>
<td>Position is effectively argued through the use of relevant, accurately represented empirical evidence</td>
<td>Evidence is used to support the argument and position</td>
<td>The evidence used is ineffective in supporting the discussion or argument</td>
</tr>
<tr>
<td>Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence</td>
<td>Evidence is taken from sources with enough interpretation to develop a comprehensive argument</td>
<td>Evidence use is persuasive and grounded in scientific thought</td>
<td></td>
</tr>
<tr>
<td>Evidence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Position and Outcomes</td>
<td>Discussion is logically and effectively explained and demonstrates substantial depth of thinking</td>
<td>Coherent discussion demonstrating depth of thinking</td>
<td>Discussion is largely simplistic and does not demonstrate depth of thinking</td>
</tr>
<tr>
<td>Writing Style and Format</td>
<td>Very few writing and stylistic mistakes (see writing guide)</td>
<td>Some writing and stylistic mistakes</td>
<td>Many writing and stylistic mistakes</td>
</tr>
<tr>
<td>Adherence to scientific format,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grammar, sentence/paragraph structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adherence to page limit</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Analysis of a Short Play: Critical thinking essay

**Topic:** Choose ONE of the following plays as the subject of your essay: Francine Dick, "Summer's End" OR Linda McCready "The Living Library."

The topic of your essay should be based on ONE of the following areas of discussion:

- Discuss the way stage actions reveal aspects of character in one play.
- Identify the central conflict in one play. How is the major conflict developed in the play? Is it resolved and if so how?
- Discuss one character in one play as static or dynamic, flat or round.
- Analyze the importance of staging and stage actions generally in one play.
- Analyze the significance of imagery or figurative language in one play.

<table>
<thead>
<tr>
<th>CONTEXT (Staging/ actions; central conflict and character; imagery or language)</th>
<th>INSUFFICIENT</th>
<th>DEVELOPING</th>
<th>ACCOMPLISHED</th>
<th>ADVANCED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Makes vague reference to contexts</td>
<td>Explains contexts, and character traits inferred</td>
<td>Analyzes the relationship between contexts and character</td>
<td>Makes insightful inferences based on the relationship between character and contexts</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>POSITION (Narrative- setting, character, conflict, resolution)</th>
<th>RECOURTS PARTS OF THE NARRATIVE WITHOUT EXPLAINING THE INFERRED MEANING</th>
<th>DESCRIBES AN ELEMENT OF NARRATIVE AND THE MEANING INFERRED</th>
<th>EXPLAINS HOW MEANING IS CONSTRUCTED THROUGH NARRATIVE DEVICES</th>
<th>ANALYZES THE COMPLEXITIES OF NARRATIVE ELEMENTS TO CONSTRUCT A PREFERRED MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>The examples selected are ineffective in supporting the argument</td>
<td>Selects and explains relevant examples to support some of the arguments made</td>
<td>Selects and interprets relevant examples to develop and support the argument</td>
<td>Comprehensively analyses examples, to construct and support the argument</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EVIDENCE (Selects and uses examples to investigate a point of view)</th>
<th>The examples selected are ineffective in supporting the argument</th>
<th>Selects and explains relevant examples to support some of the arguments made</th>
<th>Selects and interprets relevant examples to develop and support the argument</th>
<th>Analyzes the complexities of narrative elements to construct a preferred meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has no overall organizational structure; the main ideas are difficult to interpret</td>
<td>Is poorly organized; some of the ideas are ambiguous, or difficult for the reader to follow</td>
<td>Follows a logical organizational structure, but sometimes drifts from the point being made</td>
<td>Is clear and organized around the development of the main ideas</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORGANIZATION &amp; STRUCTURE</th>
<th>Writing is unintelligible due to grammatical and, typographic errors</th>
<th>Language usage is inconsistent; meaning is sometimes impeded because of errors</th>
<th>Language is compelling; contains few errors</th>
<th>Elegant use of language to create dramatic interest; few or no errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>The essay...</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SYNTAX &amp; MECHANICS</th>
<th>---</th>
<th>---</th>
<th>---</th>
<th>---</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing is unintelligible due to grammatical and, typographic errors</td>
<td>Language usage is inconsistent; meaning is sometimes impeded because of errors</td>
<td>Language is compelling; contains few errors</td>
<td>Elegant use of language to create dramatic interest; few or no errors</td>
<td></td>
</tr>
</tbody>
</table>
Anatomy Case study: Problem Solving

Description:
In this assignment students will review a case study and will be required to think critically about the information presented, and develop a thorough assessment of the situation. The case study is a clinical scenario integrating anatomical knowledge from various modules thus giving you an opportunity to practice and apply several new concepts. These problem-solving questions will actively engage and encourage you to think about the course content in a real-life situation. You are expected to use a variety of resources for your inquiry into this case study.

Read the case study below:

Case study description: “A 65-year-old is experiencing chronic pain and weakness in his dominant arm and shoulder for the previous two months with no previous trauma. He has minor pain on palpitation of the right shoulder. His pain is increased with arm abduction of more than 300 and has weakness with external rotation of the arm. He cannot maintain his arm in an elevated position for more than a few seconds. An injection of local anesthetic relieves the pain but does not help with the weakness.

In a report, answer the following case study questions. Please note that you are asked to respond in a paragraph format and justify your answers (a single word or sentence is not sufficient). You need to provide a rationale for coming to that conclusion and connect it to material you have learned in this course. Furthermore, you are expected to draw from sources beyond the course content and reference consistently. This assignment is to be completed on your own, and you are responsible for ensuring that your answers conform to the principles of academic integrity.

Case Study Questions:

Explain the possible anatomical causes of these symptoms.
- Identify multiple differential diagnoses with appropriate justifications. Provide the most likely diagnosis based on this analysis.
- From an anatomy point of view:
- Explain the various treatment options for the presenting symptoms.
- Propose a management plan for the most likely diagnosis.
- Explain the effects of the management plan for this condition.
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Developing</th>
<th>Accomplished</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define Problem</td>
<td>Repeats the symptoms identified in the case and does not discuss the anatomical relevance of these facts to the problem; presents a superficial and incomplete analysis of some of the identified problems.</td>
<td>Explains the symptoms and provides an analysis of most of the anatomical causes of the problem identified, but does not engage with those in substantial depth.</td>
<td>Analyzes symptoms presented in the clinical case study and demonstrates a sophisticated, insightful, and critical analysis of the anatomical causes of the problem.</td>
</tr>
<tr>
<td>Differential Diagnoses</td>
<td>Includes unlikely differential diagnoses for the presenting symptoms with little to no justification.</td>
<td>Identifies a single appropriate diagnosis with limited justification or support. Does not include unlikely differential diagnoses.</td>
<td>Identifies multiple differential diagnoses relevant to the symptoms presented and makes appropriate justification for the most likely diagnosis.</td>
</tr>
<tr>
<td>Analyzing and Evaluating the Treatment Options</td>
<td>Presents a simplistic analysis of the connection between the anatomical causes of the problem and treatment options. The analysis of the plans lack in detail and depth.</td>
<td>Makes appropriate but somewhat vague connections between the anatomical cause of the problem and their treatment options. Does not in engage in substantial depth in assessing a variety of plans.</td>
<td>Effectively weighs and assesses a variety of treatment options that address the anatomical cause of the problem.</td>
</tr>
<tr>
<td>Management Plan</td>
<td>Proposed management plan is poorly justified with incomplete research and documentation.</td>
<td>Proposed management plan is lacking in justification with limited research and documentation.</td>
<td>Proposed management plan is detailed and contains thorough and well-reasoned justifications based on thoughtful research which is well documented.</td>
</tr>
<tr>
<td>Treatment Effects on Anatomical Causes</td>
<td>Provides inappropriate connections between the management plan and anatomical causes of the problem; does not relate the case study to the broader field.</td>
<td>Provides simplistic description of how the management plan may alleviate some or all of the anatomical causes of the problem; somewhat relates the case study to the broader field.</td>
<td>Provides in depth description of how the management plan may alleviate the anatomical causes of the problem by situating and relating the case study to the broader field.</td>
</tr>
</tbody>
</table>
4.15 Course narrative report template

Cognitive Assessment Redesign Course Narrative Form

<table>
<thead>
<tr>
<th>Course Name and Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Facilitator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Implementation timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**Background** – Describe (Summarize/ update from the EOI):

<table>
<thead>
<tr>
<th>The course description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>The students who take the course</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The key learning goals/outcomes of the assignment intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>What motivated the redesign work, and the goals of the redesign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Implementation** – Describe the process for consultation and development:

<table>
<thead>
<tr>
<th>Were meetings face-to-face, virtual, through email communication?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>The frequency of interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>The nature of the interactions e.g. who brought up issues, who made suggestions?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Thinking about the strategies implemented (learning activities, assignments, etc.) to try to achieve the goals described in section one, emphasizing the major components changed in the assessment redesign. Consider:

<table>
<thead>
<tr>
<th>In what way (if at all) have the teaching methods, course materials or learning activities been changed and why?</th>
</tr>
</thead>
</table>
**Assessment metrics – Describe:**

<table>
<thead>
<tr>
<th>The student assignment that has been collected for external evaluation on the VALUE rubrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>The course assessment methods that were employed (e.g. rubrics, grading criteria, marking scheme)</td>
</tr>
<tr>
<td>The transparency for students (i.e. were they active in development, given the rubric with the assignment, provided feedback based on assessment criteria)</td>
</tr>
</tbody>
</table>

If HEIghten was included as part of the course, if so:

<table>
<thead>
<tr>
<th>In what context? (i.e. in-class/ out of class, proctored/un-proctored)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was there an incentive (did the score count/ was there a percentage attached)</td>
</tr>
</tbody>
</table>

**The alignment and reflection:**

<table>
<thead>
<tr>
<th>Which rubric(s) was applied to the assignment, and why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment on student achievement on the VALUE rubric dimensions</td>
</tr>
<tr>
<td>Where there any challenges or obstacles, if so, what strategies did you employ to get past them?</td>
</tr>
<tr>
<td>Were there any unexpected outcomes for you as the facilitator, arising from your work with the instructor? If so, explain.</td>
</tr>
</tbody>
</table>
### Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical thinking</td>
<td>To avoid ongoing contention as to what exactly constitutes critical thinking, early in the project, the VALUE rubric definition was adopted, “critical thinking is a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion” (AAC&amp;U, 2014), operationalized using the following five dimensions, explanation of issues, evidence, influence of context and assumptions, student’s position, conclusions and related outcomes.</td>
</tr>
<tr>
<td>Cognitive skills</td>
<td>Is a term borrowed from the study of cognition and working memory, the acquisition, retention and application of complex knowledge, and skills “such as those involved in both moment to moment decisions and in more long-term strategies” (Logie, Baddeley, Mané, Donchin, &amp; Sheptak, 1989, p. 54). Complex cognitive skills (CCS) comprise a number of interrelated constituent skills, and require considerable time and effort to acquire mastery in (Van Merriënboer, 1997).</td>
</tr>
<tr>
<td>Learning outcomes</td>
<td>Are measurable statements of student knowledge and abilities, described “as existing at the intersection of concepts (what students know and understand) and competencies (what students are able to do)” (Roksa et al., 2016, p. 17)</td>
</tr>
<tr>
<td>Problem solving</td>
<td>The term problem solving has been used here to describe resolution of “messy”, complex problems, dealing with “a large number of barriers the coexist simultaneously (and the desire to) overcome barriers between a given state and a desired goal” (Sternberg &amp; Frensch, 2014, p. xi). The project adopted the VALUE rubrics for assessing student assignments, where problem solving was operationalized using the following six dimensions, define the problem, identify strategies, propose solutions, evaluate potential solutions, implement solution, evaluate outcomes.</td>
</tr>
<tr>
<td>Value-add</td>
<td>The difference between performance in first and final-year, used to estimate the contribution of an educational institution toward student outcomes.</td>
</tr>
<tr>
<td>VALUE rubrics</td>
<td>Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics, developed by the Association of American Colleges and Universities (AAC&amp;U).</td>
</tr>
</tbody>
</table>
For further information available at http://www.queensu.ca/qloa/home
or in person at The Centre for Teaching and Learning F200 Mackintosh Corry Hall.
Queen’s University, Ontario, Canada.