

Table 2. Bloom's Revised Taxonomy and Assessment Methods

| Bloom's Revised Taxonomy | Assessment Method | When to Use | Evidence of Impact on Student Learning Outcomes | Key Recommendations on Planning/Using it Effectively |
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| <p>Remember</p> <p><i>Recognizing or recalling knowledge, facts or concepts</i></p> | <p>Multiple-choice Question (MCQ)</p> | <p>For objective testing so as to eliminate ambiguity in marking. A MCQ usually have one (or a few) definite answers that are given as choices for the students to select.</p> <p>For instructors looking for an efficient and time-saving way to assess large number of students.</p> <p>Suitable instructional strategies that prepare students for a MCQ assessment:</p> <ol style="list-style-type: none"> 1. Lecture 2. Spaced Practice 3. Self-Practice | <p>There are limited number of experimental studies on examining the use of MCQs for assessing students in higher education reported in the literature.</p> <p>There are several studies that report students' perceptions on being assessed using MCQs. For example, Donnelly (2014) examined the use of MCQs (<i>crafted based on or without case studies</i>) for assessing large group teaching of a first-year Marketing module. The majority (91%) of students (n=71) agreed that the MCQ format was favorable in assessing their recognition of the content.</p> | <p>When crafting MCQs:</p> <ul style="list-style-type: none"> ● Ensure that the question stem (1) is grammatically correct; (2) should not contain irrelevant material, making it ambiguous; and (3) avoid double negatives – For example, this may confuse students: <i>“Which of the following comments would NOT be unwelcome in a work situation?”</i> Instead, flip it around and write it in the positive form: <i>“Which of the following comments are acceptable in a work situation?”</i> ● Ensure that the options are (1) grammatically correct and (2) of similar lengths to prevent students “guessing” through choosing the longest option ● Seek critical comments from your colleagues, or with other instructors teaching the same course to examine the MCQs you have crafted on their suitability for assessing students' knowledge <p>When assessing using MCQs:</p> <ul style="list-style-type: none"> ● Use eLearn for MCQ assessments so that items can be randomised (reduced opportunity for students cheating) and grading automated, saving you time on manual marking; feedback can also be made immediately available to students ● Interspersed with other question types (e.g. fill-in-the-blanks, short-response, essay) so that students have different ways to demonstrate their understanding of the content such as through writing <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Osterlind, S., & SpringerLink. (1998). <i>Constructing Test Items Multiple-Choice, Constructed-Response, Performance, and Other Formats</i>, Dordrecht : Springer Netherlands (Second ed., Evaluation in Education and Human Services ; 47). <u>(See Chapter 5 on constructing MCQs p.161 - 202; available as an e-Book in the SMU Libraries)</u> 2. Shank, P., & American Society for Training Development. (2010). <i>Create Better Multiple-choice Questions</i>, Alexandria VA : American Society for Training & Development. (LKS Libraries Level 3: LB3060.32.M85 S42 2010) |
| <p>Understand</p> <p><i>Constructing meaning from instructional messages</i></p> | <p>Concept map</p> | <p>For assessing students' abilities to organise knowledge visually. Students construct concept maps by enclosing concepts related to a central topic in boxes and using connecting lines and linking phrases to depict relationships between</p> | <p>Concept maps have been found to have a significant impact on increasing student performance. For example, Ajayi, Achor and Agogo (2017) reported that 141 senior secondary students who collaboratively created concept maps on chemistry topics scored significantly higher mean achievement scores</p> | <p>When assessing using concept maps:</p> <ul style="list-style-type: none"> ● Use concept maps at the beginning of the course to characterise students' prior knowledge so as to adjust instructional strategies accordingly. It can also be used at various points during the course to prompt students to explicitly reveal both the content and structure of the knowledge ● Use traditional scoring when you have time constraints on assessing concepts maps; holistic scoring involving a rubric when there are more than 1 assessor |

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| | | <p>concepts in a hierarchical manner from the most inclusive concepts to more specific, least inclusive concepts.</p> <p>Can be used for assessing both the knowledge students have coming into a program or course (i.e. prior knowledge) and their developing knowledge of course material.</p> <p>Suitable instructional strategies that prepare students for a Concept Map assessment:</p> <ol style="list-style-type: none"> 1. Lecture 2. Guest/Invited Speaker 3. Games | <p>on their chemistry test than those (n= 141) who created concepts maps individually.</p> <p>The study by Watson and colleagues (2016) provides guidelines on scoring students' concept maps. They compared traditional with holistic concept map scoring methods. For traditional scoring, assessors counted the concept map components: knowledge breadth (number of concepts), depth (highest level of hierarchy) and connectedness (number of cross-links). Assessors graded the concept maps using a rubric for holistic scoring. They analysed the concept maps collected from 72 engineering undergraduate students using these 2 scoring methods. Their findings showed that traditional scoring allowed concept maps to be graded quickly on the knowledge breadth, depth and connectedness. Holistic scoring allowed assessors to judge changes in knowledge breadth, depth and connectedness and the structural complexity and connectedness.</p> | <ul style="list-style-type: none"> ● Create opportunities to develop students' critical thinking (analyse and synthesise ideas) and collaborative learning skills through collaborative concept mapping by having students work together to develop a shared understanding of concepts, or to critique each other's concept maps, in addition to or in place of the instructor ● Provide feedback on students' concept maps on knowledge breadth, depth and connectedness so as to help them improve on their comprehension <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Magna Publications Inc, Henry Stewart Talks Ltd, & Kanopy. (2014). <i>Concept mapping : How visual connections can improve learning : Higher ed and concept mapping.</i> , San Francisco, California, USA : Kanopy Streaming (Magna online seminar). Video link (login required) 2. Watson, M. K., Pelkey, J., Noyes, C. R., & Rodgers, M. O. (2016). Assessing conceptual knowledge using three concept map scoring methods. <i>Journal of engineering education</i>, 105(1), 118-146. |
| <p>Apply</p> <p><i>Using ideas and concepts to solve problems</i></p> | <p>Peer teaching</p> | <p>For assessing the peer teachers on their abilities to facilitate the learning of their peers, such as in demonstrating skills and explaining materials. Typically, students ("experts") teaching students ("novices") in situations that are planned and directed by the instructor.</p> <p>Suitable instructional strategies that prepare students for a Peer Teaching assessment:</p> <ol style="list-style-type: none"> 1. Socratic Questioning 2. Role play | <p>Academics identify pedagogical benefits of peer teaching such as improving students' (a) critical thinking, (b) learning autonomy, (c) motivation, (d) collaborative and (e) communicative skills. The skills highlighted in bold are part of the SMU's graduate learning outcomes.</p> <p>However, Stigmar's (2016) critical review of the literature of 30 studies (2010-2012) on peer-to-peer teaching in higher education revealed that its benefits did not necessarily lead to greater academic achievement gains or deep learning.</p> | <p>When assessing using peer teaching:</p> <ul style="list-style-type: none"> ● Introduce peer teaching when you are more familiar with your students so that you can do better matching (academically and socially) of "experts" to "novices" ● Provide clear instructions to "experts" on their roles in explaining directions on how to revise and organise information etc., watching for and correcting mistakes, providing positive feedback/encouragement (i.e. positively reinforcing statements and genuine praise) and corrective feedback (i.e. how to respond when an incorrect answer is given) ● Use group strategies (e.g. Buzz groups/Think-Share) to facilitate peer teaching <p>Recommended resource:</p> <ol style="list-style-type: none"> 1. Stigmar, M. (2016). Peer-to-peer teaching in higher education: A critical literature review. <i>Mentoring & Tutoring: Partnership in Learning</i>, 24(2), 124-136. |

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| | Quiz | <p>For assessing factual information and concepts. Typically contains content-focused questions which takes the form of selected response (e.g. MCQs, true-false) or short-answer formats (fill-in-the-blanks, short-response questions).</p> <p>Suitable instructional strategies that prepare students for a Quiz:</p> <ol style="list-style-type: none"> 1. Lecture 2. Guest/Invited Speaker 3. Spaced Practice 4. Self-Practice | <p>Brink (2013) examined the impact of pre- and post-lecture online quizzes on student performance in Intermediate Accounting course (n=666). He reported that students using both pre- and post-lecture quizzes led to significant improvement in students' performance on subsequent exams, relative to semesters using only post-lecture quizzes or semesters with no quizzes. Differences in the exam scores were statistically significant.</p> | <p>When assessing using quizzes:</p> <ul style="list-style-type: none"> ● Include questions that involve students in making comparisons can be used to assess analytical skills ● Introduce short quizzes at various points during the course duration to check on student understanding ● Review quiz answers so that students know where and how to correct their mistakes (i.e. provide feedback) <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Brink, A. G. (2013). The Impact of pre-and post-lecture quizzes on performance in intermediate accounting II. <i>Issues in accounting education</i>, 28(3), 461-485. 2. Osterlind, S., & SpringerLink. (1998). <i>Constructing Test Items Multiple-Choice, Constructed-Response, Performance, and Other Formats</i>, Dordrecht : Springer Netherlands (Second ed., Evaluation in Education and Human Services ; 47). <u>(See Chapter 5 on constructing MCQs p.161 - 202; available as an e-Book in the SMU Libraries)</u> 3. Reiner, C. M., Bothell, T. W., & Sudweeks, R. R. (2003). <i>Preparing effective essay questions: A self-directed workbook for educators</i>. New Forums Press. Link |
| <p>Analyze</p> <p><i>Breaking something down into components, seeing relationships and an overall structure</i></p> | Exam | <p>For assessing student learning at the conclusion of an instructional period, e.g. midterm or end of course. It is formally graded and contributes a certain weightage to the student course grade.</p> <p>Suitable instructional strategies that prepare students for an Exam:</p> <ol style="list-style-type: none"> 1. Lecture 2. Guest/Invited Speaker 3. Guided Inquiry 4. Problem Solving 5. Case 6. Student Presentation 7. Spaced Practice 8. Self-Practice | <p>Despite being commonly used to test students on content using different question formats, the number of experimental studies that examined the impact of exams on student learning is limited.</p> <p>The study by Glass and colleagues (2013) suggests that exams do improve student learning. For their research, 371 students from an upper level psychology course took a long-term retention exam, four to five months after the end of the course. Students scored 79% correct for the items on the long-term retention test when a related question had appeared on the final exam.</p> | <p>When assessing using exams:</p> <ul style="list-style-type: none"> ● Use a mix of question formats (e.g. MCQ, fill-in-the-blank, short-response, essay) to assess both lower and higher thinking levels ● Conduct your exams in eLearn so that the question order can be randomized and MCQs/True-False questions marking automated <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Glass, A., Ingate, M., & Sinha, N. (2013). The Effect of a Final Exam on Long-Term Retention. <i>The Journal of General Psychology</i>, 140(3), 224-241. 2. Osterlind, S., & SpringerLink. (1998). <i>Constructing Test Items Multiple-Choice, Constructed-Response, Performance, and Other Formats</i>, Dordrecht : Springer Netherlands (Second ed., Evaluation in Education and Human Services ; 47). <u>(See Chapter 5 on constructing MCQs p.161 - 202; available as an e-Book in the SMU Libraries)</u> 3. Reiner, C. M., Bothell, T. W., & Sudweeks, R. R. (2003). <i>Preparing effective essay questions: A self-directed workbook for educators</i>. New Forums Press. Link |

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| | Assignment/ Report | <p>For assessing students' abilities to organise their knowledge, opinions, and information into a coherent and clear form through their written submissions. Instructors assign tasks to students, typically to be completed outside of class. Common homework assignments may include students reading materials (e.g. cases), watching instructional videos, playing games prior to class in preparation for lectures, or have students writing reviews about them. Examples of reports include research reports and project reports.</p> <p>Suitable instructional strategies that prepare students for an Assignment/Report:</p> <ol style="list-style-type: none"> 1. Lecture 2. Guest/Invited Speaker 3. Game 4. Field Trip/Study Mission 5. Case Method 6. Project 7. Project with Client | <p>There is a lack of research that examined whether assignments/reports lead to improvements in student learning.</p> <p>Nonetheless, there are some studies which examined essay assignments for assessing students. One notable work by Scouller (1998) found that second-year undergraduate students (n=206) adopted surface approaches to learning when studying for MCQ assessments. On the other hand, they adopted deep approaches to learning when tackling their essay assignments.</p> | <p>When assessing using assignments/reports:</p> <ul style="list-style-type: none"> ● Explain to students the purpose, format, timeline, assessment criteria of the assignments/reports ● Provide format models for written assignments/reports whenever possible ● Share grading rubric with students ● Provide feedback (e.g. standard feedback grid that includes criteria, marks associated with and written comments to be returned to students together with reports) on students' work and get them to use the feedback to improve performance whenever possible <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Moss, A., & Holder, C. (1988). <i>Improving student writing: A guidebook for faculty in all disciplines</i>. Dubuque, IA: Kendall Hunt. (Link) 2. Monash University Libraries (n.d.). Writing a report: Quick study guide. |
| <p>Evaluate</p> <p><i>Making judgments based on criteria and standards</i></p> | Case | <p>For assessing students' discussions of possible solutions and analyses of the pros and cons of various approaches to the problem. A case analysis with recommendations is useful for assessing students' evaluation skills.</p> <p>A case describes specific activities, events, or problems that are drawn from the real-world of professional practice and include contingencies, complexities, and dilemmas to evoke integrative analysis, critical thinking and problem-solving.</p> <p>Suitable instructional strategies that prepare students for a Case:</p> | <p>There are 2 studies in the literature that reported the use of cases led to increased exam performance:</p> <ol style="list-style-type: none"> I. Bonney (2015) reported that cases were statistically more effective than classroom discussions and textbook reading at promoting learning of key biological concepts, leading to increased exam performance for 56 biology undergraduate students. II. Chaplin (2009), he compared student performance in lecture-based versus case study-based instruction. Case-based teaching that emphasized problem solving (SMU's graduate learning | <p>When assessing using cases:</p> <ul style="list-style-type: none"> ● Base judgment on the quality of students' discussion, student presentations and/or reports ● Ask students open-ended questions and assess them based on the quality of their responses ● Set tasks that require teamwork and sharing resources ● Assess students' demonstration of deeper understanding and cognitive skills through the process of analysis of the case: quality of research, structural issues in written material, organisation of arguments, feasibility of solutions presented, intra-group dynamics, evidence of consideration of all case factors, multiple resolutions (recommendations) of the same scenario issue <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Bean, John C., & Peterson, Dean. (1998). Grading Classroom Participation. <i>New Directions for Teaching and Learning</i>, (74), 33-40. 2. Christensen Centre for Teaching and Learning, Harvard Business School (n.d.). <i>Teaching by the Case Method: Student Performance</i>. (Link) |

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| | | <ol style="list-style-type: none"> 1. Problem Solving 2. Socratic Questioning 3. Case Method 4. Discussion | <p>outcome) and discussion significantly improved student performance on exams throughout the semester and enhanced students' abilities to correctly answer application- and analysis-type questions.</p> | <ol style="list-style-type: none"> 3. Pepper, Molly B., & Pathak, Seemantini. (2008). Classroom Contribution: What Do Students Perceive as Fair Assessment? <i>Journal of Education for Business</i>, 83(6), 360-368. |
| | <p>Debate</p> | <p>For assessing students' abilities to discuss, organise and put forth their points of view for one side of an argument on a topic.</p> <p>Typically, students are split into two teams to defend either the affirmative or negative side. The instructor assesses students' critical thinking and oral communication skills. The critical thinking skills used in a debate include defining the problem, assessing the credibility of sources, identifying and challenging assumptions, recognising inconsistencies, and prioritizing the relevance and salience of various points within the overall argument.</p> <p>Suitable instructional strategy that prepare students for a Debate:</p> <ol style="list-style-type: none"> 1. Debate 2. Socratic Questioning | <p>The papers published on debates are mainly in disciplines of law, ethics and political sciences. Two examples are shown here:</p> <ol style="list-style-type: none"> I. Jagger (2013) reported that the use of class debate in a first-year undergraduate professional ethics course led to the development of critical thinking and oral communication skills in students. II. Omelicheva and Avdeyeva (2008) reported that undergraduate political science students in the experimental group acquired better comprehension, application and critical evaluation skills based on their test scores when a controversial topic was taught via debates, as compared to it being taught using lectures. Their study suggested that it is important to teaching using suitable methods in order to prepare students for the assessment. | <p>When assessing using debates:</p> <ul style="list-style-type: none"> ● Select appropriate topic for the debate: centred around a topical or current issue and should be one in which both sides of the "argument" have a realistic basis ● Provide clear guidelines on the structure of the debate so that students are clear of timings and roles. For roles, consider: <ul style="list-style-type: none"> ○ Proposers who gives a verbal presentation (prepared by the team) for 15 minutes in support of their position ○ Questioners who ask questions of the opposing team after the opponent's case has been presented, and answer the questions asked by the opposing team and the audience ○ Summarisers who present the summary of the case (prepared by the team) for 10 minutes and try to incorporate the answers to the most important questions posed during the debate. ○ Audience generally consists of everyone involved in the other debates, plus the instructor. Before the debate, the audience casts their votes for the case that they agree with, and will cast their vote again after the debate. Members of the audience are also allowed to ask questions ○ Chairperson needs to give a short introduction to the debate, ensure fair debating and keep the debate on track and within time ● Allow students to have a mark-free rehearsal; constructive feedback is critical so that students can learn from the experience ● Share assessment criteria (rubric) with students ● Judge students' ability to discuss, evaluate and quantify issues related to the topic to be debated, and to communicate in a professional manner ● Avoid having teams of more than five students "per side" as it becomes difficult to ensure that each student contributes <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Jagger, S. (2013). Affective learning and the classroom debate. <i>Innovations in Education and Teaching International</i>, 50(1), 38-50. 2. Omelicheva, M. Y., & Avdeyeva, O. (2008). Teaching with lecture or debate? Testing the effectiveness of traditional versus active learning methods of instruction. <i>PS: Political Science & Politics</i>, 41(3), 603-607. 3. Reli Handayani. (2017). Students' Critical Thinking Skills in a Classroom Debate. <i>LLT Journal: A Journal on Language and Language Teaching</i>, 19(2), 132-140. |

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| | <p>Student presentation</p> | <p>For assessing students' abilities to reason critically in areas that cannot be assessed by written exam, e.g. oral communication skills, conciseness, persuasiveness, quality and clarity of responses to questions, body language and professional manner.</p> <p>A student presentation involves a student, or groups of students, working together to share verbally on a topic to an audience.</p> <p>Suitable instructional strategies that prepare students for a Presentation:</p> <ol style="list-style-type: none"> 1. Guided Inquiry 2. Case Method 3. Student Presentation 4. Project with a Client 5. Project | <p>There are some studies that compared the reliability of peer and teacher assessments of oral presentation. However, the evidence on whether student presentation led to improvements in student performance is limited.</p> <p>The study by DeGrez and colleagues (2014) did find positive results. They showed students short video clips illustrating behaviors (i.e. do's and don'ts of oral presentation) in relation to the assessment criteria. They also provided students with opportunities to practice the application of the assessment criteria to their own presentations. The researchers found that their research design actually led to a statistically significant increase in scores from the first to the third presentation.</p> | <p>When assessing using student presentation:</p> <ul style="list-style-type: none"> ● Provide clear instructions on the purpose and format ● Allow students to have a mark-free rehearsal; constructive feedback is critical so that students can learn from the experience ● Develop a list of assessment criteria (rubric) and convey to students in advance, so that they are enabled to shape their skills in a manner that they know is appropriate ● Ask students open-ended questions and assess them based on the quality of their responses ● Involve students in peer assessment by getting them to evaluate each other's presentations based on a given criteria and give their feedback for improvement ● Provide feedback on students' work based on the criteria and get them to use the feedback to improve performance whenever possible ● Get students to reflect on their performance and write an account of the manner by which they will modify their performance on the next occasion ● Consider recording student presentations to allow presents to review their performances and to allow you to assess presentations at a time most suitable to you <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. De Grez, L., Valcke, M., & Roozen, I. (2014). The differential impact of observational learning and practice-based learning on the development of oral presentation skills in higher education. <i>Higher Education Research & Development</i>, 33(2), 256-271. 2. Kerby, D., & Romine, J. (2009). Develop Oral Presentation Skills Through Accounting Curriculum Design and Course-Embedded Assessment. <i>Journal of Education for Business</i>, 85(3), 172-179. 3. McCarthy, P., & Hatcher, Caroline. (2002). <i>Presentation Skills: The Essential Guide for Students</i>. London: SAGE Publications. |
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| Reflection journal/log/paper | <p>For assessing students' abilities to create written records of their insights gained over a period of time on various concepts learnt, about critical incidents involving their learning, or instructor-student interactions.</p> <p>Suitable instructional strategies that prepare students for Reflection journal/log/paper:</p> <ol style="list-style-type: none"> 1. Field Trip/Study Mission 2. Role Play | <p>Existing studies on journal writing focused mainly on describing its value as promoting reflection and learning from practice in disciplines involving making clinical judgments (e.g. nursing). There are also a few studies by David Kember that looked at assessing reflection.</p> <p>There is however, an old experimental study by McCrindle and Christensen (1995) that reported that journal writing led to undergraduate biology students performing significantly better on their final exams, and demonstrated better construction of more complex and related knowledge structures.</p> | <p>When assessing using reflection journals/logs/papers:</p> <ul style="list-style-type: none"> ● Provide prompts[^] to guide students' reflections. Prompts can: ask students to describe their experience/action, evaluate their actions (or the actions of others) against agreed-upon standards, compare their choices (or the choices of those they are observing) to alternatives approaches, identify the motivations, values, or assumptions that drove their own action or the action of others; conceive how their judgment in the future might be affected by this experience and reflection ● Develop a rubric to assess students' ability to reflect (e.g. description of the experience, description of one's intellectual and emotional response to the experience, evaluation of their prior perceptions, actions, or beliefs, connections of reflections to readings/research/people plans for future action, quality of writing) ● Provide positive feedback/encouragement (i.e. positively reinforcing statements and genuine praise); if reflection appear shallow or insincere, include additional questions as part of the feedback to prompt more thoughtful responses in future reflection <p><i>^Many students may be unfamiliar with reflection, confusing "reflection" with "reporting" and missing the critical step of self-assessment that is at the core of reflection. Providing prompts can guide students to reflect.</i></p> <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Varner, D., & Peck, S. R. (2003). Learning from learning journals: The benefits and challenges of using learning journal assignments. <i>Journal of Management Education</i>, 27(1), 52. Retrieved from http://libproxy.smu.edu.sg/login?url=https://search-proquest-com.libproxy.smu.edu.sg/docview/195719977?accountid=28662 2. McCrindle, A. R., & Christensen, C. A. (1995). The impact of learning journals on metacognitive and cognitive processes and learning performance. <i>Learning and instruction</i>, 5(2), 167-185. |
| Self-assessment /evaluation | <p>For assessing students' abilities in identifying discrepancies between current and desired performance using a predetermined list of criteria, using in the form of ratings. <i>Often used in combination with peer assessment/evaluation.</i></p> <p>Suitable instructional strategies that prepare students for Self-assessment/evaluation:</p> <ol style="list-style-type: none"> 1. Role play | <p>Several published studies compared the reliability and validity (accuracy) of students' self-assessments against those of teachers and peers.</p> <p>There is one experimental study by McDonald and Boud (2003), where high school teachers formally trained 256 students in self-assessment. End of the year exams showed that this group of outperformed the control group of 259 students in all areas of academic studies.</p> | <p>When assessing using self-assessments/evaluations:</p> <ul style="list-style-type: none"> ● Establish clear learning targets and evaluation criteria (rubric) ● Provide models and anonymous exemplars, because they are concrete examples that allow students to understand, visualize, and internalize the evaluation criteria ● Engage the students in practice opportunities (formative assessment) before employing self-assessment/evaluation as an assessment ● Provide students with feedback about students' understanding of the criteria (as demonstrated by their application), and finally, ● Get students to identify subsequent learning goals and strategies to attain each goal |

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| | | <ol style="list-style-type: none"> 2. Student presentation 3. Project 4. Project with a client | | <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Harris, & Brown. (2013). Opportunities and obstacles to consider when using peer- and self-assessment to improve student learning: Case studies into teachers' implementation. <i>Teaching and Teacher Education</i>, 36, 101-111. 2. McDonald, B., & Boud, D. (2003). The impact of self-assessment on achievement: The effects of self-assessment training on performance in external examinations. <i>Assessment in Education: Principles, Policy & Practice</i>, 10(2), 209-220. |
| Peer assessment/evaluation | <p>For students individually assessing each other's contribution using a predetermined list of criteria, using in the form of ratings. Students are given feedback on the quality of their work, often with ideas and strategies for improvement. The instructor may use peer assessments/evaluations in assigning individual grades for team assignments/projects/presentations. <i>Often used in combination with self-assessment/evaluation.</i></p> <p>Suitable instructional strategies that prepare students for Self-assessment/evaluation:</p> <ol style="list-style-type: none"> 1. Role play 2. Student presentation 3. Project 4. Project with a client | <p>Several published studies compared the reliability and validity (accuracy) of students' peer assessments against those of teachers.</p> <p>There is one published study in which Xiao and Lucking (2008) reported that 114 students in the experimental group of using a rating-plus-qualitative-feedback method received statistically higher instructor's mean writing assignment scores than those in the control group (n = 118), who received peer score feedback only.</p> | <p>When assessing using peer assessments/evaluations:</p> <ul style="list-style-type: none"> ● Construct a clear and accurate rubric to establish proper criteria and standards ● Emphasize to students to be sensitive when giving feedback to their peers illustrating good practice examples of what constitutes a negative peer assessment/evaluation and a positive one ● Engage the students in practice opportunities (formative assessment) before employing peer-assessment/evaluation as an assessment ● Before students are ready to give feedback to others, their assessments should be compared to instructor grading of the same examples to ensure their reliability <p>Recommended resource:</p> <ol style="list-style-type: none"> 1. Xiao, Y., & Lucking, R. (2008). The impact of two types of peer assessment on students' performance and satisfaction within a Wiki environment. <i>The Internet and Higher Education</i>, 11(3-4), 186-193. | |

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| | Two-Tier Multiple-Choice Question (TTMCQ) | <p>For assessing students' higher-order thinking skills in a quick and efficient manner. A TTMCQ is similar in format to a traditional MCQ but contains a second-tier of question associated with the main question.</p> <p>The first tier in the MCQ is testing the content knowledge of the students, i.e. recall of knowledge, facts or concepts (<i>Remember /Understand</i>).</p> <p>The second tier asks the reason for the response given in the first tier and goes beyond recall and facilitates HOT (<i>Apply/Analyse/Evaluate</i>).</p> <p>Suitable instructional strategies that prepare students for TTMCQ assessment:</p> <ol style="list-style-type: none"> 1. Lecture 2. Spaced practice 3. Self-practice | <p>TTMCQs have been used mainly in the healthcare and sciences disciplines.</p> <p>There is one study published in the Physics discipline where Çil (2015) engaged preservice science teachers (n = 97) in three different learning activities: TTMCQs, MCQs, or studying a lecture summary.</p> <p>The narratives of the participants before and after the learning activities were transcribed into a format of <i>flow maps</i> to assess their conceptual understanding of variables. They found that the mean scores of the post flow maps (on inferring and or explaining which showed thinking at the evaluation level) for the participants in the TTMCQ group were statistically higher as compared to the mean scores of the other two groups.</p> | <p>When crafting TTMCQs:</p> <ul style="list-style-type: none"> ● Include visual representations such as charts, figures and tables which require students' analysis skills to interpret the data ● Allow for problem/evaluation: a problem and its solution are usually presented. Students use their own judgement (based on given criteria in the question) and critical thinking to find the appropriate solution. Students can be asked to criticise, prove, defend or recommend ● Guidelines on crafting MCQs also applies <p>When assessing using TTMCQs:</p> <ul style="list-style-type: none"> ● Conduct TTMCQ assessments in eLearn so that grading can be automated, saving you time on manual marking; feedback can be made immediately available to students, facilitating their process of self-learning ● Interspersed with other question types (e.g. fill-in-the-blanks, short-response, essay) so that students have different ways to demonstrate their understanding of the content such as through writing <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Çil, E. (2015). Effect of Two-tier Diagnostic Tests on Promoting Learners' Conceptual Understanding of Variables in Conducting Scientific Experiments. <i>Applied Measurement in Education</i>, 28(4), 253-273. 2. Boston University School of Public Health (n.d.). Writing Multiple-Choice Questions that Demand Critical Thinking. Retrieved from http://sphweb.bumc.bu.edu/otlt/teachingLibraries/Assessment/WritingMultiple.pdf. |
| <p>Create</p> <p><i>Reorganise diverse elements to form a new pattern or structure</i></p> | Project with a client | <p>For the instructor and client to assess students on their abilities to apply inter-disciplinary knowledge and skills to find practical and implementable solutions to the client's real-world problems, and the ability to adapt thinking, behavior, or strategy based on changing circumstances during the course of the project.</p> <p>A project with client involves a group of students working under the guidance and direction of the instructor and client.</p> <p>Suitable instructional strategies that</p> | <p>There is limited published evidence which shows that projects with clients lead to significant improvements in academic performance.</p> <p>Nonetheless, a recent study by Akpan (2016) showed that undergraduate students who undertook consulting projects with clients developed essential career-related competencies (e.g. problem-solving, communication, leadership) at the end of the projects.</p> | <p>When assessing using projects with clients:</p> <ul style="list-style-type: none"> ● Judge both the: <ul style="list-style-type: none"> ○ process (e.g. collaboration, research, ability to apply multidisciplinary knowledge and skills to solve the client's problem, resilience and adaptability of students in navigating ambiguity and situations of changing priorities and circumstances), AND ○ product (e.g. student group presentation, group report, individual project log, extent of practicality and implementability of solutions to client's problem) of student learning ● Get students to keep individual project logs and get them to articulate their own efforts, commitment and contributions towards teamwork and solutions to the client's problem ● Construct clear and accurate rubrics to establish proper criteria and standards for assessing process and product of student learning to be used by instructor and industry mentor ● Assess the projects in stages since this gives students an indication on their progress ● Constantly positive and corrective feedback; also seek feedback from industry mentors on how students are progressing |

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| | | <p>prepare students for assessment using Projects with Clients:</p> <ol style="list-style-type: none"> 1. Guided inquiry 2. Problem solving 3. Discussion 4. Project with a client | | <ul style="list-style-type: none"> ● Include self- and/or peer assessments/evaluations to allow students to reflect on their own and their peers' project work <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Davier, A., Zhu, M., & Kyllonen, P. (2017). <i>Innovative assessment of collaboration, Cham, Switzerland : Springer</i>(Methodology of educational measurement and assessment). <u>(Available as an eBook in SMU Libraries)</u> 2. Akpan, I. J. (2016). The efficacy of consulting practicum in enhancing students' readiness for professional career in management information systems: An empirical analysis. <i>Decision Sciences Journal of Innovative Education, 14</i>(4), 412-440. |
| Project | | <p>For the instructor to assess the process and output of student projects.</p> <p>A project involves a student, or group of students, working under the guidance and direction of the instructor. It involves planning and developing a schedule of study and outcomes to be achieved over a period of time usually longer than that of an individual assignment. The students are not required to only produce a single outcome, but are required to link multiple, and often distantly related disciplinary and interdisciplinary concepts.</p> <p>Suitable instructional strategies that prepare students for assessment using Projects with Clients:</p> <ol style="list-style-type: none"> 1. Guided inquiry 2. Problem solving 3. Discussion 4. Project | <p>There is evidence to show that projects has an impact on exam performance, such as the study by Iwamoto and colleagues (2016) who reported that first-year undergraduate psychology students in the experimental group scored significantly higher on the MCQ exam as compared to the control group.</p> | <p>When assessing using projects:</p> <ul style="list-style-type: none"> ● Judge both the: <ul style="list-style-type: none"> ○ process (e.g. collaboration, research, ability to link multiple, and often distantly related disciplinary and interdisciplinary concepts), AND ○ product (e.g. student group presentation, group report, individual project log) of student learning ● Get students to keep individual project logs and get them to articulate their own efforts, commitment and contributions towards teamwork and solutions to the client's problem ● Construct clear and accurate rubrics to establish proper criteria and standards for assessing process and product of student learning ● Assess the projects in stages since this gives students an indication on their progress ● Constantly positive and corrective feedback ● Include self- and/or peer assessments/evaluations to allow students to reflect on their own and their peers' project work <p>Recommended resources:</p> <ol style="list-style-type: none"> 1. Davier, A., Zhu, M., & Kyllonen, P. (2017). <i>Innovative assessment of collaboration, Cham, Switzerland : Springer</i>(Methodology of educational measurement and assessment). <u>(Available as an eBook in SMU Libraries)</u> 2. Iwamoto, D. H., Hargis, J., & Vuong, K. (2016). The effect of project-based learning on student performance: An action research study. <i>International Journal for Scholarship of Technology Enhanced Learning, 1</i>(1), 24-42. |