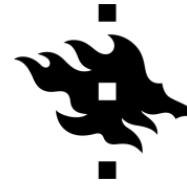




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ONLINE SEMINAR

“How to assess Learning Outcomes based on rubrics”

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How to assess Learning Outcomes based on rubrics

Constructive Alignment

There are four major steps:

1. Defining the intended learning outcomes (LOs);
2. Choosing teaching/learning activities to lead to the LOs;
3. Assessing students' learning outcomes to see how well they match what was intended;
4. Arriving at a final grade.

Constructive Alignment

Learning outcomes related to three organising categories:

- *intellectual and practical skills,*
- *personal and social responsibility, and*
- *integrative and applied learning.*

All are essential for students preparing to address today's global scientific challenges.

Rubrics for making meaning

Teacher perspective -> Objectives -> LO -> Teaching activities -> Assessment



Student perspective -> Assessment -> Learning Activities -> Outcomes

Rubrics orient us toward our goals as teachers.

What are Rubrics

“A rubric is an assessment tool that lists the criteria¹ for a piece of work or what counts and articulates gradations of quality for each criterion, from excellent to poor” (Goodrich 2005; Goodrich 1997; Popham 1997).

¹Criteria examples (what counts): purpose, organisation, details, voice, and mechanics often are what count in a written essay)

Rubrics versus Checklists

Checklist lists only the criteria.

Rubrics detail criteria and their levels/gradations of quality. Can also describe desirable qualities and common pitfalls in student work. Descriptions can be very informative for students, (and teachers) by helping them think, learn, and produce high quality work (Andrade 2000)



	1: Does not meet expectations	2: Approaches expectations	3: Meets expectations
Problem of Practice	The Problem of Practice is not identified or defined.	The Problem of Practice is not clearly defined or does not line up with the project scope.	The Problem of Practice is clearly defined and the project scope.
Project Overview	The Project Overview is missing or incomplete.	The Project Overview is broadly defined or is missing some necessary details.	The Project Overview gives a clear picture of how this Capstone will work.
Implementation Plan	The Implementation Plan is missing or incomplete.	The Implementation Plan is broadly defined, is missing some necessary details or is not feasible.	The Implementation Plan gives a clear path for the Capstone and is feasible.
Artifacts/Examples	There are no artifacts or examples of any components of the Capstone.	The provided artifacts/examples do not provide sufficient information to give an understanding of how the Capstone will work in practice.	The provided artifacts/examples provide sufficient information to give an understanding of how the Capstone will work in practice.
Reflection	The reflection plan is missing or incomplete.	The Reflection is broad, is missing some necessary details, or is not related to the Capstone.	The Reflection gives clear and useful feedback on the Capstone, including strengths and areas for growth.

Why use Rubrics

- Rubrics are a way to simplify, translate and construct a social representation of what concepts/skills look like in the teaching and learning process.
- Create a shared understanding of what concepts/skills means in the classroom, and share expectations among teachers, and among teachers and students.
- Allow teachers to monitor and formatively assess whether their students develop those skills.
- Rubrics are a metacognitive tool that helps make learning visible and tangible, and teaching intentional.

Why use Rubrics

- Formative assessment tool: they make the assessment criteria visible and explicit to both the teachers and the students.
 - describes varying levels of quality, from excellent to poor.
- The format of a rubric can vary, all rubrics have two features in common:
 - 1) a list of criteria, or “what counts” in a project
 - 2) gradations of quality, with descriptions

Rubrics purpose

- **Developmental** (Analytical/Instructional) – for learning (formative assessment), co-created with students; handed out; used to facilitate peer assessment, self-assessment, and teacher feedback; and only then used to assign grades.
- **Scoring** – for assessment (summative assessment), used exclusively by a teacher to assign grades.

Developmental rubric

A **developmental** (analytical / instructional) rubric:

- Useful when you want to help students see how they are moving on a path toward excellence.
- Communicates that you expect all students to achieve the highest level as they *move through the program*.
- Utilises clear level descriptions to convey the desired learning or performance objective (or competency).
- Delineates the criteria (aspects or dimensions of performance or competencies that will be assessed)

Developmental rubric - *example*

“what counts” or “what teachers and students should particularly keep in mind”.

Performance levels (a rating scale that identifies students' level of mastery)

	Beginning 1	Developing 2	Accomplished 3	Exemplary 4
Stated Objective or Performance	Description of identifiable performance characteristics reflecting a beginning level of performance.	Description of identifiable performance characteristics reflecting development and movement toward mastery of performance.	Description of identifiable performance characteristics reflecting competent performance.	Description of identifiable performance characteristics reflecting the highest level of performance.

Learning dimension
clearly stated

Descriptors provide clear **operational definitions** for the standards used to evaluate performance.

Case Study: Creativity and Critical thinking (OECD)

How do we assess creativity and critical thinking?

What counts? Need to know the aspects to be assessed -> skill / concept decomposed

Creativity macro-processes include: inquiring, imagining, doing and reflecting.

	CREATIVITY	CRITICAL THINKING
	Coming up with new ideas and solutions	Questioning and evaluating ideas and solutions
INQUIRING	<ul style="list-style-type: none"> • Feel, empathise, observe, describe relevant experience, knowledge and information • Make connections to other concepts and ideas, integrate other disciplinary perspectives 	<ul style="list-style-type: none"> • Understand context/frame and boundaries of the problem • Identify and question assumptions, check accuracy of facts and interpretations, analyse gaps in knowledge
IMAGINING	<ul style="list-style-type: none"> • Explore, seek and generate ideas • Stretch and play with unusual, risky or radical ideas 	<ul style="list-style-type: none"> • Identify and review alternative theories and opinions and compare or imagine different perspectives on the problem • Identify strengths and weaknesses of evidence, arguments, claims and beliefs
DOING	<ul style="list-style-type: none"> • Produce, perform, envision, prototype a product, a solution or a performance in a personally novel way 	<ul style="list-style-type: none"> • Justify a solution or reasoning on logical, ethical or aesthetic criteria/reasoning
REFLECTING	<ul style="list-style-type: none"> • Reflect and assess the novelty of the chosen solution and of its possible consequences • Reflect and assess the relevance of the chosen solution and of its possible consequences 	<ul style="list-style-type: none"> • Evaluate and acknowledge the uncertainty or limits of the endorsed solution or position • Reflect on the possible bias of one's own perspective compared to other perspectives

Note: This rubric is meant for teachers/faculty to identify the student skills related to creativity and to critical thinking that they have to foster in their teaching and learning, not for assessment.

	CREATIVITY	CRITICAL THINKING
	Coming up with new ideas and solutions	Questioning and evaluating ideas and solutions
INQUIRING	Make connections to other concepts and knowledge from the same or from other disciplines	Identify and question assumptions and generally accepted ideas or practices
IMAGINING	Generate and play with unusual and radical ideas	Consider several perspectives on a problem based on different assumptions
DOING	Produce, perform or envision a meaningful output that is personally novel	Explain both strengths and limitations of a product, a solution or a theory justified on logical, ethical or aesthetic criteria
REFLECTING	Reflect on the novelty of the solution and of its possible consequences	Reflect on the chosen solution/position relative to possible alternatives

Note: This rubric is meant for teachers/faculty to identify the student skills related to creativity and to critical thinking that they have to foster in their teaching and learning, not for assessment.

Scoring rubric

A **scoring** rubric:

- Identifies a number of possible performance levels (features of quality), and usually includes at least one level that is negative (i.e. needs improvement).
- Gives students diagnostic information. Though it is a *judgment* of performance, for better or worse.
- Designed so that criteria are weighted based on importance and so that the total point value is useful for grading purposes. Total scores of 10 or 100 make life easier for students and teachers!

Scoring rubric

Definition for “scoring rubric” from Carnegie Mellon University:

A rubric is a scoring tool that explicitly represents the performance expectations for an assignment or piece of work. A rubric divides the assigned work into component parts and provides clear descriptions of the characteristics of the work associated with each component, at varying levels of mastery. Rubrics can be used for a wide array of assignments: papers, projects, oral presentations, artistic performances, group projects, etc. Rubrics can be used as scoring or grading guides, to provide formative feedback to support and guide ongoing learning efforts, or both.

Features of Quality - SSI

Key Features of Quality in support of student and teacher judgement for the Science in Society Investigation are described here. The Features of Quality are the criteria used to assess the student work as best fitting one of the four Descriptors.

	Exceptional	Above Expectations	In Line with Expectations	Yet to Meet Expectations
Investigating	<ul style="list-style-type: none"> • Chooses an interesting or novel topic and research question • Finds information about the topic from a large number of varied and balanced sources, and gives a complete reference list • Evaluates the reliability (relevance, accuracy and bias) of the sources 	<ul style="list-style-type: none"> • Chooses an interesting or novel topic and research question • Finds information about the topic from a number of balanced sources, and gives a complete reference list • Considers the reliability and quality (relevance, accuracy and bias) of the sources 	<ul style="list-style-type: none"> • Chooses a topic and research question with some teacher guidance • Finds some useful sources of information about the topic and gives some references • Gives some consideration to the reliability or quality (relevance, accuracy and bias) of the sources 	<ul style="list-style-type: none"> • Chooses a topic but is given the research question • Is directed to sources of information about the topic • Uses very few sources with little evidence of what the sources are
Communicating	<ul style="list-style-type: none"> • Clearly positions the topic as science in society; explains the relevant science and the impact of the topic on society and/or the environment • Presents the investigation in a very well-structured way (that is clear and easy to read) using relevant scientific terminology and informative representations; uses an innovative approach that truly enhances the work • Explains different sides of the argument in detail 	<ul style="list-style-type: none"> • Positions the topic as science in society; explains the relevant science and the impact of the topic on society and/or the environment • Presents the investigation in a well-structured way (that is clear and easy to read), using relevant scientific terminology and informative representations • Considers information from different sides of the argument 	<ul style="list-style-type: none"> • Mentions in passing the impact of the topic on society and/or the environment. • Presents the investigation in a structured way using relevant scientific terminology • Provides information on different sides of the argument 	<ul style="list-style-type: none"> • Presents the investigation using some scientific terminology • Presents the investigation in a way that is somewhat structured
Knowledge & Understanding	<ul style="list-style-type: none"> • Views on the chosen topic are considered and discussed in depth • Gives a justified personal opinion informed by research, linking the information to the argument and using science explanations 	<ul style="list-style-type: none"> • Gives a personal opinion informed by research linking the information to the argument and using science explanations 	<ul style="list-style-type: none"> • Gives a personal opinion informed by research with some explanation 	<ul style="list-style-type: none"> • Gives a personal opinion without explanation or a link to the original question

APPENDIX 8 -

Assessment Criteria	1 Honours A1	1 Honours A2	2.1 Honours B1
Integration of Literacy and Numeracy	<p>The following key aspects must be outstanding: Literacy / Numeracy Levels Integration of literacy and numeracy Responsiveness to literacy/numeracy issues</p>	<p>The following key aspects are excellent: Integration of literacy and numeracy Responsiveness to literacy/ numeracy issues. Literacy / Numeracy Levels</p>	<p>The following aspects are very good: Literacy / Numeracy Levels Integration of literacy and numeracy Responsiveness to literacy/numeracy issues</p>
Quality Assessment of/for Learning	<p>The following key aspects must be outstanding: Assessment of learning in relation to a wide range of outcomes Assessment for learning in relation to a wide range of outcomes The following aspect is excellent: Variety of assessment instruments</p>	<p>The following key aspects are excellent: Assessment of learning in relation to a wide range of outcomes Assessment for learning in relation to a wide range of outcomes Variety of assessment instruments</p>	<p>The following key aspects must be excellent: Assessment of learning in relation to a wide range of outcomes Assessment for learning in relation to a wide range of outcomes The following aspect is very good: Variety of assessment instruments</p>

Table 2.3. OECD assessment rubric: Creativity

	Level 4: Outstanding	Level 3: Excellent	Level 2: Emergent	Level 1: Dormant
PRODUCT	<p>The student work:</p> <ul style="list-style-type: none"> • is highly imaginative, showing many instances of personal features and risk taking (formulation, technique, composition or content) • fully meets the requirements of the task • goes beyond the knowledge and rules expected to be mastered by the student in more than one aspect. 	<p>The student work:</p> <ul style="list-style-type: none"> • is imaginative, showing some examples of personal features (formulation, technique, composition or content) • meets the requirements of the task • goes beyond the knowledge and rules expected to be mastered by the student in one aspect. 	<p>The student work:</p> <ul style="list-style-type: none"> • is personal in some of its features (formulation, technique, composition or content) • meets some but possibly not all the requirements of the task • is in line with the knowledge and rules expected to be mastered by the student. 	<p>The student work:</p> <ul style="list-style-type: none"> • meets the requirement of the task but • reproduces existing examples, with little personal perspective on formulation, content, technique or composition.

Table 2.3. OECD assessment rubric: Creativity

	Level 4: Outstanding	Level 3: Excellent	Level 2: Emergent	Level 1: Dormant
PROCESS	<p>The work process:</p> <ul style="list-style-type: none"> • shows a willingness to examine carefully a variety of ideas as well the ability to make meaningful connections with other ideas or domains. • generated several unusual or radical ideas and pushed some to their limits before making the final choices. • shows a clear awareness of the areas of personal novelty and risk that were pursued, and of why the final choices were made. 	<p>The work process:</p> <ul style="list-style-type: none"> • shows a willingness to brainstorm ideas and examines carefully the chosen idea. • generated one unusual or radical idea and pushed it to its limit before making the final choices. • shows a clear awareness of the areas of personal novelty or risk that were pursued. 	<p>The work process:</p> <ul style="list-style-type: none"> • shows a willingness to think or act beyond one's first idea, but connections made between ideas or domains lack consistency or remain superficial. • fails to explore selected ideas with depth. • shows little awareness of the areas of personal novelty or risk that were pursued. 	<p>The work process:</p> <ul style="list-style-type: none"> • is limited to the exploration of imitative patterns or to the examples presented by the teacher or expected to be familiar.

Designing one's own rubric and tools

*“Studies of the validity of rubrics have shown that **clarity and appropriateness of language** is a central concern”.*

(Reddy, Y.M. and H. Andrade (2010))

*“An instructional rubric must be **aligned with reasonable and respectable standards and with the curriculum being taught** in order to be valid”.* (Andrade, 2005)

1) list the criteria, or “what counts”

2) gradations of quality, with descriptions, and/or scores

1) List the criteria, or “what counts”

Determine the objective of the assignment.

What is the main purpose of the assignment you're grading?

What are the students supposed to have learned by completing the assignment?

How will you recognize a successful assignment?

What makes a project stand out?

What's "good enough"?

List all the components (content and process) of the project to be graded.

Keep it simple.

Focus the rubric during your teaching/instruction.

2) gradations of quality (descriptions, and/or scores)

Use round numbers to make it easy on yourself.

Assign point values according to the importance of individual tasks.

Assign letter grades according to levels of achievement.

Define and describe your letter grades.

Detailed descriptions of each level, articulating what a particular grade "means"

Organise the grading criteria and point values into a table.

When using a rubric

Co-create the rubric with students / other teachers

Consider allowing students to have input on the rubric.

Share the rubric with your students before they complete the assessment

Use the rubric during teaching (feedback) and learning (self/peer-assessment)

Grade assessments using the rubric

In conclusion...

Rubrics appear to be a strong tool to influence teaching and learning in real-life settings and make abstract concepts / skills tangible and visible to teachers.

While they do not work as stand-alone scaffolding tools for teachers, they clarify and simplify the meaning of concepts / skills and help teachers to become more intentional, systematic and consistent in the development and assessment of these key skills in their teaching.

Giving focused feedback is time consuming. A good rubric allows one to provide individualised, constructive critique in a manageable timeframe.

Reading material:

Andrade, H.G. (2000), "Using rubrics to promote thinking and learning", *Educational Leadership*, Vol. 57/5, pp. 13-18.

Arter, J. and J. McTighe (2001), *Scoring Rubrics in the Classroom*, Corwin Press Inc., Thousand Oaks.

Brookhart, S.M. and F. Chen (2015), "The quality and effectiveness of descriptive rubrics", *Educational Review*, Vol. 67/3, pp. 343-368, <https://doi.org/10.1080/00131911.2014.929565>

Busching, B. (1998), "Grading inquiry projects", *New Directions for Teaching and Learning*, Vol. 74, pp. 89-96, <https://doi.org/10.1002/tl.7409>

EEF (2018a), Teaching and Learning Toolkit, Education Endowment Foundation, London, <https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit>

EEF (2018b), Metacognition and Self-regulated Learning: Guidance Report, Education Endowment Foundation, London, <https://educationendowmentfoundation.org.uk/tools/guidance-reports/metacognition-and-self-regulated-learning>

Jonsson, A. and G. Svingby (2007), "The use of scoring rubrics: Reliability, validity and educational consequences", *Educational Research Review*, Vol. 2/2, pp. 130-144, <https://doi.org/10.1016/j.edurev.2007.05.002>

Panadero, E. and A. Jonsson (2013), "The use of scoring rubrics for formative assessment purposes revisited: A review", *Educational Research Review*, Vol. 9, pp. 129-144, <http://dx.doi.org/10.1016/j.edurev.2013.01.002>

Perlman, C.C. (2003), "Performance assessment: Designing appropriate performance tasks and scoring rubrics", in: Wall, J.E. and G.R. Walz, *Measuring Up: Assessment Issue for Teachers, Counselors, and Administrators*, Pro-Ed Inc., North Carolina.

Reddy, Y.M. and H. Andrade (2010), "A review of rubric use in higher education", *Assessment & Evaluation in Higher Education*, Vol. 35/4, pp. 435-448, <http://dx.doi.org/10.1080/02602930902862859>

Andrade, Goodrich H. (2005) Teaching With Rubrics: The Good, the Bad, and the Ugly, *College Teaching*, 53:1, 27-31, DOI: [10.3200/CTCH.53.1.27-31](https://doi.org/10.3200/CTCH.53.1.27-31)

Thank you

Questions?