

Designing Intended Learning Outcomes

Enactivism: Knowledge is our capacity to act adaptively!



Enactive levels of learning

1: Classifying

- Students classify a situation correctly.
- Verbs: *Is familiar with; classify; identify; follow; list; accept.*
- ILO Example: Learners follow the logic of a medium-complexity computer program.

2: Describing

- Students describe a situation using appropriate rules and relations.
- Verbs: *Compare; define; report; interpret; estimate; investigate.*
- ILO: Learners describe the characteristics of reusable software design.

3: Applying

- Students apply rules effectively to achieve a familiar goal.
- Verbs: *express; calculate; substitute into; organise/solve familiar; complete, utilise.*
- ILO: Learners utilise data/control structures of the Julia language appropriately in familiar contexts.

4: Generalising

- Students transfer rules to novel categories and situations.
- Verbs: *explain; analyse; compare; translate; transfer; critically question.*
- ILO: Learners transfer solution algorithms in Julia to new, unfamiliar tasks.

5: *Anticipating*

- Students blend separate narratives to explore new, internally consistent hypotheses.
- Verbs: *coordinate; integrate; generate; synthesise; predict; hypothesise*.
- ILO: Learners generate algorithmic approaches for solving unfamiliar problems.

6: *Abstracting*

- Students abstract rules from reliably persistent aspects of a narrative.
- Verbs: *evaluate; develop; argue; plan; summarise; judge; reflect*.
- ILO: Learners develop reusable software solutions to unfamiliar problems.

Components of an ILO

An ILO (*Intended Learning Outcome*) is an intention to increase knowledge. Since learning is enactive, and enaction views knowledge as founded in competent (i.e., situated, adaptive) action, this means ILOs are an intention to increase *competence*. That is, we are intending to move learners (possibly students, but equally possibly myself, a project group or the readership of a research paper) from one specified state of competence to another.

An ILO describes a particular unit of learning – whether that unit is a 3-year undergraduate degree programme, a course module, seminar, research project or explanation. An ILO incorporates the following necessary aspects:

1. The lay *learners* whose level of competence we intend to increase.
2. A *narrative* purpose that motivates the need to learn.
3. A *model* that provides the content of what learners will learn.
4. The *enactivities* that specify the process of the new competence.
5. A *class* of contextual situations in which learners will enact the new competence.
6. *Clarity* of language for lay, second-language learners.

How to write an ILO

Who are the lay learners? What prior competences do they bring to learning?

Ask: Whose competence am I intending to change? Are students going to learn something that I know? Am I going to learn something somebody else knows? Am I going to learn something by investigating it? What competences do these learners already possess?

Seminar example: *My first-year students can perform straightforward algebraic manipulations, including the binomial multiplication and finding the gradient of a straight line.*

Research example: *The members of our research group can program significantly complex software in Julia, including agent-based modelling.*

What narratives drive the intention of learning?

Ask: Why am I offering this unit? How does it contribute to the ILOs of its overarching unit? What would you like successful learners to say they gained from this unit? Which intellectual and practical skills will every learner gain through having participated in the unit?

Seminar example: *On successfully completing this unit, learners will understand the role of derivatives in calculating the gradient of a curve, and their importance for explaining change in biological systems. They will be able to explain the concept of a limit, and understand the relationship between gradient and small increments of time and quantity.*

Research example: *At the end of our project, we will understand how exploratory processes augment structural (genetic) search to accelerate adaptive search.*

What structural model will learners acquire?

Ask: What is the content of the unit? What model structures are presupposed by the narratives? What are the reliably constant, or covariant, rules and classes of the narratives?

Seminar example: Definition of a derivative; its use in calculating gradients and predicting motion.

Research example: The relationship between exploration and structural search.

Which enactivities characterise the learning?

Once we have defined the structural content of the learning unit, we consider the quality of cognitive engagement that we expect learners to adopt with respect to that content. We call this quality of cognitive engagement an *enactivity* – that is, a relatively distinct aspect of the full enactive cycle – and typically express it in terms of a characteristic *verb* that specifies what we expect learners to do with the content.

Ask: What enactivities should learners be using to engage with the content? Which of the above list of verbs is most appropriate to this learning outcome?

Seminar example: Students can apply derivatives to calculate the gradient of a curve, explain the concept of a limit and generalise it to describe change in biological and general systems.

Research example: We will be able to explain the distinction between structural and exploratory search, integrate both kinds of search to improve optimisation performance, and abstract rules for such integration in novel situations.

What contextual constraints are there on the ILO?

Ask: In which context will learners perform the verb with the content? Does alignment with overarching ILOs or other learning units constrain this context? What limits are there on the competence learners will need to demonstrate?

Seminar example: There are no contextual constraints on this example.

Research example: Due to time constraints, we will focus our attention only on function optimisation, and ignore issues of competition for resources between individuals.

Is the language clear to second-language lay learners?

Ask: Does the complete ILO (content, verb and context) make sense, not to me as an expert, but to lay learners planning to engage with the learning unit? Does it contain discipline-specific jargon not available to the lay learners? Would second-language lay learners understand it? What is the verdict of readable.com? What do colleagues from other disciplines think?

Seminar example: On successfully completing this unit, learners can apply derivatives to calculate the gradient of a curve. They can explain the concept of a limit and generalise it to describe change in biological systems.

Research example: On completing this research project, we will be able to explain the distinction between structural and exploratory search. We will be able to integrate structural and exploratory search to improve the performance of structural search, and will have abstracted rules for applying exploration to novel problems in function optimisation.