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A Rather Different ‘Operating System’ for Courses, Learning and Assessments — a Formative, Objectives-Mastery, Modular System (FOMMS)

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A DIFFERENT EDUCATIONAL 'OPERATING SYSTEM' FOR COURSES, LEARNING AND ASSESSMENTS

— A Formative, Objectives-Mastery, Modular System

Aka FOMMS – 2019

SYSTEM SUMMARY

This project involves a rather different way of operating courses, learning and assessments, which we call a Formative, Objectives-Mastery Modular System (FOMMS). It is a whole **system**, not just a reform of one or other teaching aspect, so it involves several components working together.

Course topics are designed as a sequence of focused *learning units*, each a natural educational 'package' of learning objectives, teaching, activities, tasks, assessments, and credits.

In a *mastery-learning* approach the philosophy is that most students should be able to attain high-level 'mastery' of all objectives, given actionable feedback and second attempts. *Learning tasks* occur *during* learning, for learning credit L. *Mastery tasks* follow for mastery credit M.

Both types are formative in that students have the opportunity to learn from feedback and try again for full mastery. Quality also counts. The main goal is to maximize learning, rather than to grade and rank students.

Prompt feedback is given individually via elearning and/or by whole-class discussion. Guided self-assessment in class also works well for judging mastery or not.

The nature and quality of learning tasks and mastery assessments is crucial in such a system, and forms a creative part of instructional design.

Learning and mastery credits accumulate in ongoing fashion toward a student's accomplishment record, which lists all the specific objectives achieved, mastery awards, and overall course attainment grade.

It's not so much what you TELL students that counts, it's what you have them DO

INTRODUCTION AND MOTIVATION

After years of introducing various individual innovations in my teaching, I am now developing an alternative **educational operating system** in which all these ideas can function naturally.

So far it has the rather unwieldy name of *Formative, Objectives-Mastery, Modular System (FOMMS).*

The system is designed primarily around *educational* considerations, rather than fitting into the usual administrative expectations.

← *OVERVIEW:* See the SUMMARY sidebar at the left for an overview of the system

SYSTEM COMPONENTS AND FEATURES

The main components and features of the system are described below. They all work together.

Small-scale modularization and a typical learning unit

For teaching and learning purposes I modularize topics and concepts into fairly fine-grained 'learning units'. This is not just subject-matter sub-division, but reflects stages of concept learning. Topics are thus developed as a sequence of natural learning units.

Each unit is designed to be a focused educational 'package' containing various teaching, learning and assessment components.

A learning unit for a concept in an undergraduate science course might look something like this:

Learning Unit 'Package'

• Objectives • Teaching • Reading
• Activity • Example • Problem
• Learning task • Mastery task
• Actionable feedback

Learning and Mastery Credit

A "natural" learning unit clearly depends on the nature of the subject. Thus, my graduate course on the foundations of science education involves analytic writing and a project, and units reflect that.

Learning objectives

Each learning unit has detailed **learning objectives,** specifically for the concept at hand. Objectives are ideally explicit, but may also be implicit in instructional narrative and assignments. While a course may also have broad general goals, that is not what we mean here. Identifying objectives and desired outcomes aids instructional design and makes expectations clear to students.

Mastery learning

A "mastery-learning" educational approach is sometimes called "competency-based learning". The aim is for most students to achieve high-level mastery of specified learning objectives for each topic, rather than get satisfactory aggregate point scores on periodic exams.

Mastery requires full understanding, good explanations, and quality presentation. A student not achieving full mastery on a first attempt has the opportunity to learn from feedback and try again on a similar task. The idea is that given the chance, most students should eventually be able succeed at levels usually attained only by the best. Mastery of one unit also forms a good foundation or understanding the next.

Learning tasks, Mastery tasks and Credits

Learning tasks are designed **for** learning, and are thus assigned *during* a unit, and are usually done at home. A *serious thoughtful attempt* at a learning task, even if not yet correct or complete, will earn learning credit (L). This can be upgraded to mastery after feedback.

Mastery assessment tasks occur *after* concept learning, to demonstrate mastery. They may be done in class or at home depending on their nature, and carry mastery credit (M). Something not yet mastered earns Progress credit (P) and can be upgraded.

The nature and quality of tasks and assessments is obviously crucial in an objectives-mastery system like this. These are often formulated as structured multi-faceted questions and problems.

Formative feedback and upgrades

All tasks and assessments are treated *formatively* rather than summatively, since they are an integral ongoing part of teaching and learning. Broad feedback for everyone is given in class discussion, while individual feedback is provided separately on elearning, and guided self-assessment for mastery can work well in class. All feedback is *actionable*, in that students can relearn aspects they missed and try again for mastery.

Credit accumulation and record

Students *accumulate* learning and mastery credits on an ongoing basis, toward a final grade. Accumulating 90% of all available credits will earn an "A" grade, 80% a "B', and so on.

A student's course record will be very specific and informative. It lists all objectives attained at high level for each topic, plus mastery awards.

PILOTING AND OUTCOMES SO FAR

System aspects are being piloted in three courses:

- Phys 1020 – Energy, Environment & Climate
- Sci 6150 – Foundations of Science Education
- Phys 2500 – Waves and Optics

Thus far, I find that even where the big picture philosophy is clear, the devil is in the details! Operational aspects must run very smoothly, so elearning is essential for assignments, feedback, credit tracking and course management.

The method is coherent but not what students are used to. They need time to adapt their perspectives and learning behaviors.

Results so far are encouraging – even students who normally struggle in a conventional summative system of ***lectures/homework/ exam*** seem capable of attaining high level mastery if they take the system opportunities seriously and upgrade their work.

Success on a unit can boost student confidence and satisfaction. It also forms a better grounding for the next topic, so there may be a snowball effect.

ADOPTING THE SYSTEM

Adopting a FOMMS approach to your course can be 'straightforward', at least in principle – just take it one learning unit at a time! Plan teaching approach, devise learning and mastery tasks, give feedback and track mastery. The course can be developed this way topic by topic as you go. Use elearning to manage things. Credit accumulation replaces periodic quizzes and exams. A teaching assistant helps to run larger classes and will learn a lot by helping with feedback to students.

FORMATIVE FOR INSTRUCTORS TOO

We are surveying students to get formative feedback about the course and the new system, along the way, This is to help change and improve a course as it proceeds, rather than to 'evaluate' it at the end.