

LEARNING OUTCOMES AND GRADE SPECIFICATIONS IN A FORMAL LOGIC COURSE

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Challenges

Logic I is a large (200 student) course in formal logic. It has typically been taught in a standard lecture format, 4–6 problem sets and 2–4 closed book exams. Grade distributions are lower than average for philosophy courses, and the D/F/Withdraw rate is high. The abstract nature of the material prompts math anxiety in many students. Some interventions (open textbook, partially flipped course, collaborative learning) were already implemented prior to 2020.

The Covid-19 pandemic required the course to be delivered online in Fall 2020 and Winter 2021. Many students had unreliable access to the internet, were located in different time zones, had no access to distraction-free environments, or faced pressures such as additional child- or elder-care commitments. This prompted a redesign of course and assessments to ensure maximal flexibility for students and minimal exam pressure.

Course delivery

The course material was divided into 12 modules. One week was devoted to each module. The modules corresponded to 12 learning outcomes. Each module involved (a) assigned readings from the textbook; (b) pre-recorded lectures (approx. 45 minutes); (c) two 50-minute Zoom sessions (explanations, examples, group work); (d) tutorial sessions (students worked through additional exercises or participated in problem set workshops with other students).

Assignments

Each unit was paired with three assessment activities: (a) a problem set; (b) a 10-question multiple choice quiz; (c) a timed “challenge problem”. The 12 problem sets replaced the usual bi-weekly problem sets in the traditional course, the quizzes and challenge problems together replaced the usual three exams. The quizzes mainly tested understanding and applications of concepts. On problem sets, students practiced logical methods (e.g., making truth tables, symbolizing sentences, constructing proofs). Challenge problems were questions like on the problem set, of medium difficulty, designed to be completed in about 10–15 minutes, with a 30 minute time limit. Collaboration was allowed on problem sets but not on quizzes and challenge problems.

Learning goals

Each assessment was designed to allow students to show proficiency in the learning goal for the module. For instance, the learning goal for week 4 was: “I can construct the complete truth table for a sentence or sentences of truth-functional logic and use it to determine entailment, satisfiability, equivalence, and tautologies, and to find satisfying valuations.” On problem sets, students were asked to construct truth tables and answer questions on their basis, e.g., “is this sentence a tautology?” On quizzes, they were asked to relate the concepts covered that week, e.g., whether an argument with a contradictory premise is valid.

Proficiency

Each problem set and quiz had a number of questions ranging from easy to medium which I would expect a student earning a B to easily do. Students had access to all course materials; so nothing required memorization. If these problems were correctly answered, students earned a “complete” for the assignment.

A few questions were pitched at an advanced level; if they also answered those, they earned a “complete+.” Challenge problems were only scored complete or incomplete, and were the only timed assessment. Proficiency in a learning goal was shown by earning “complete” or better in each of the three activities.

Grades

Grades were assigned on the basis of the number of learning goals completed. To earn a B, students had to earn completes in 10/12 learning goals, 8/12 for a C, and 6/12 for a D. Complete+ grades were used to assign A-range grades: for an A, students had to complete all learning goals, and earn complete+’s on at least 10/12. (For simplicity and flexibility, a B actually required 10/12 in each assessment category; it was not required that 10 modules had to be completed.) Intermediate grades were awarded on the basis of completed assessments over and above the required number.

Time allowed and Tokens

Students had an initial period of 7 days to complete the activities for a given module. Problem sets and challenge problems were completed online using carnap.io, and provided instant feedback (students could only submit correct solutions). Quizzes were done on the LMS (D2L/Brightspace), with feedback provided after the quiz was submitted, but students had 3 initial attempts.

To ensure students had opportunities to show proficiency after a module was completed, and to catch up, they could buy another attempt at a problem set, quiz, or challenge problem for a “token.” Each student had six tokens to use, and could request a do-over of any activity up to two weeks after it was first due; the do-over would be due three weeks after it was first due. Tokens could also be used to buy extensions on weekly activities.

Outcomes

Average DFW rates for “traditional” sections of Logic I (10 sections throughout 2014/15 and 2015/16) averaged 23.4%, and the typical mean grade was B. The DFW rate was 19% in F2020 and 15% in W2021, with a mean grade of B+.

Links

- Course outline with learning goals.
- [Carnap.io](https://carnap.io) online service for teaching logic
- Textbook used: P. D. Magnus et al. (2017). *forall x: Calgary*. forallx.openlogicproject.org



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