Upgrading the Learning for Teachers in Real Analysis; A Curriculum Project

Tim Fukawa-Connelly	Nicholas Wasserman
Temple University	Teachers College
Keith Weber	Pablo Mejia-Ramos
Rutgers University	Rutgers University

Upgrading Learning for Teachers in Real Analysis is a project in which we designed and implemented an innovative real analysis course for pre-service and in-service mathematics teachers (PISTs). More generally, this project provides an alternative model to teaching advanced mathematics to PISTs, a model that more meaningfully connects the teaching of secondary mathematics to the advanced mathematics content. This poster describes the theoretical model, the means of developing connections between real analysis and secondary mathematics content, the 12 modules we designed and how they fit in a standard real analysis curriculum, and presents evidence for their efficacy. The instruction is built from and returns to authentic secondary mathematics classroom situations.

Keywords: Real Analysis, Teacher Education, Mathematical Knowledge for Teaching

We describe an innovative real analysis course that developed for pre-service and in-service secondary mathematics teachers. The course had a multitude of goals: (i) PISTs would learn the real analysis; (ii) PISTs would understand secondary mathematics better; (iii) PISTs would have the pedagogical content knowledge to respond more effectively to pedagogical situations; (iv) PISTs would see the relevance of real analysis to secondary mathematics teaching; and (v) there would be genuine positive changes in PISTs' instructional practice. We developed an instructional model that grounds the study of advanced mathematics in pedagogical situations and asks teachers to revisit those same situations and apply their new knowledge. To accomplish our goals, we developed 12 modules that connect the content and practices of real analysis to the teaching of secondary mathematics. In each module, PISTs are first presented with an authentic classroom situation from high school mathematics in which a teacher needs a deep understanding of mathematics to respond appropriately. From the discussion that ensues, PISTs build up from teaching practice to tackle the underlying mathematical issues at play in a real analysis context. After the work in real analysis resolves these mathematical issues, PISTs step down to practice and are asked to revisit the original and analogous classroom situations. As such, each module has both mathematical goals (what mathematics are PISTs learning?) and pedagogical goals (what pedagogical practices are PISTs going over in the module?). To design a module we generated pedagogical situations that had three characteristics: (i) the pedagogical situations were authentic (i.e., not contrived but true to situations that arise in teaching), (ii) the prospective teachers were asked to engage in a High Leverage Practices (TeachingWorks, 2013) that are central to the work of a secondary mathematics teacher, and (iii) successfully engaging in these High Leverage Practices required mathematical knowledge that could be informed by or reinforced via real analysis. This poster will show the theoretical model, the means of developing connections between real analysis and secondary mathematics content, illustrate how the 12 modules fit in a standard real analysis curriculum, and present evidence for their efficacy. We will include a QR code that navigates to all of the modules as well as provide printed examples. We argue that the course was effective in many ways, and describe ongoing challenges.

References

TeachingWorks (2013). High-leverage practices. http://www.teachingworks.org/work-ofteaching/high-leverage-practices. Accessed March 2016.