Trends in Physics Teacher Education from the Perspective of Research-Based Instruction

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Supported in part by DUE #1256333

Recommendations for Physics Teacher Education

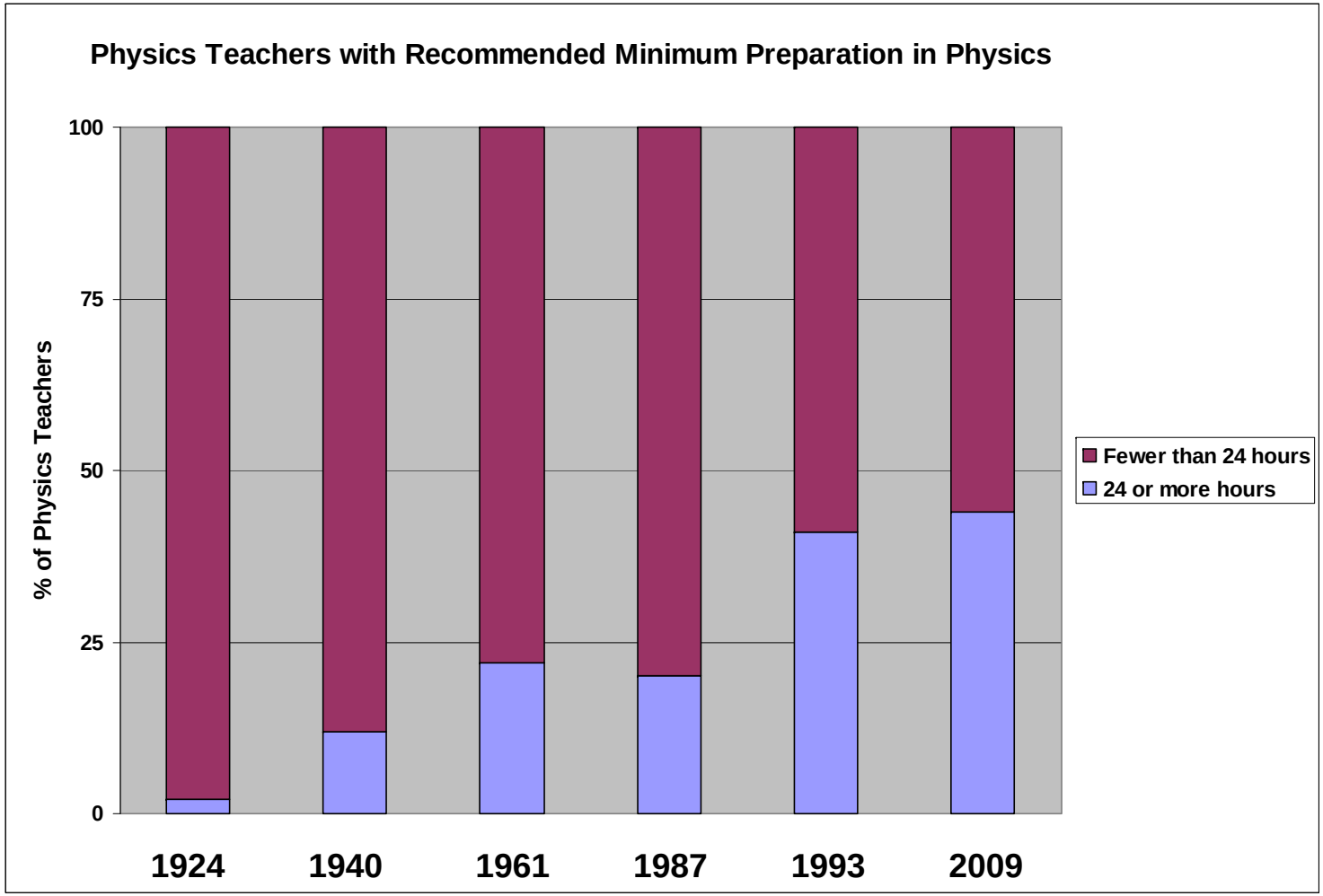
- **1960:** AAAS recommends 20-24 semester hours of physics, minimum
- **1968:** AAPT/AIP recommend minimum of 24 hours of physics, or 18 hours plus “in-service training”
- **1968:** AAPT/AIP committee advocates courses for teachers using “learning by discovery” method: “This type of course leads a student to puzzle things through for himself, offering both the experience of being a scientist and the satisfaction that accompanies success..”
- **1973:** Physics Survey Committee (NAS) says “successful use of inquiry-directed instruction requires teachers who have themselves learned to investigate in this manner.”

Recommendations by Physics Community for Teacher Education: Summary

- Preparation equivalent to a major or minor in physics (20-24 semester hours, minimum)
- Experience in, and ability to teach physics as hands-on, inductive “inquiry-based’ course

Actual Outcome: Most Physics Teachers Have Less Than Recommended Preparation

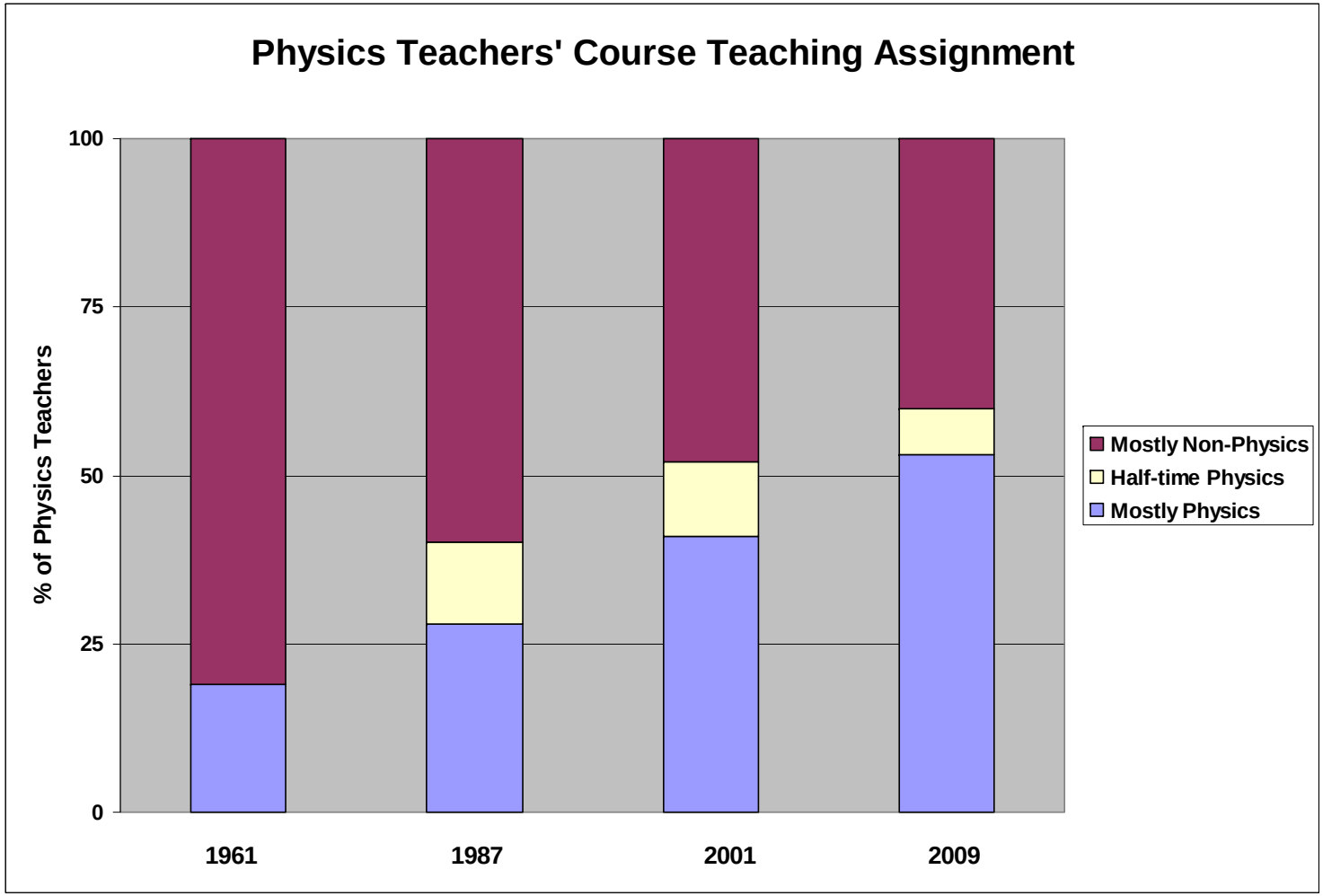
- Most U.S. physics teachers have now—and have always had—less than the recommended physics preparation, equivalent to a major or minor in physics (~24 semester hours)
- Average preparation has increased substantially over the years, but more than 50% of teachers still fall short



Estimated, from various sources

Physics Teachers Spend Most of Their Time Teaching Other Subjects

- In the 1920s, the average physics teacher taught two, three, or more *other* subjects.
- In 1961, more than 80% of U.S. physics teachers spent the *majority* of their time teaching other subjects.
- Most physics teachers taught a predominantly non-physics program until *2009*.

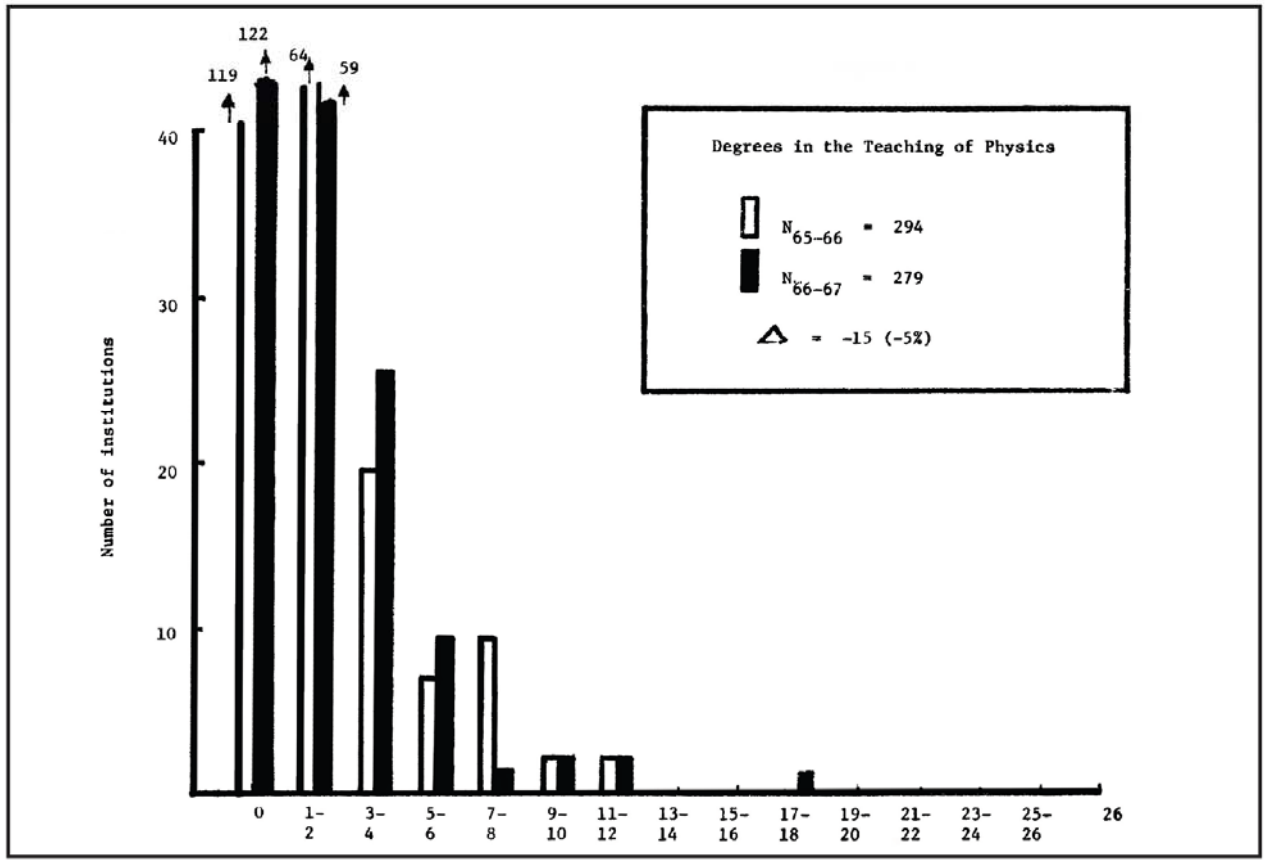


Source: AIP and NSF

Physics Teacher Education Programs Are Scarce and Produce Very Few Graduates

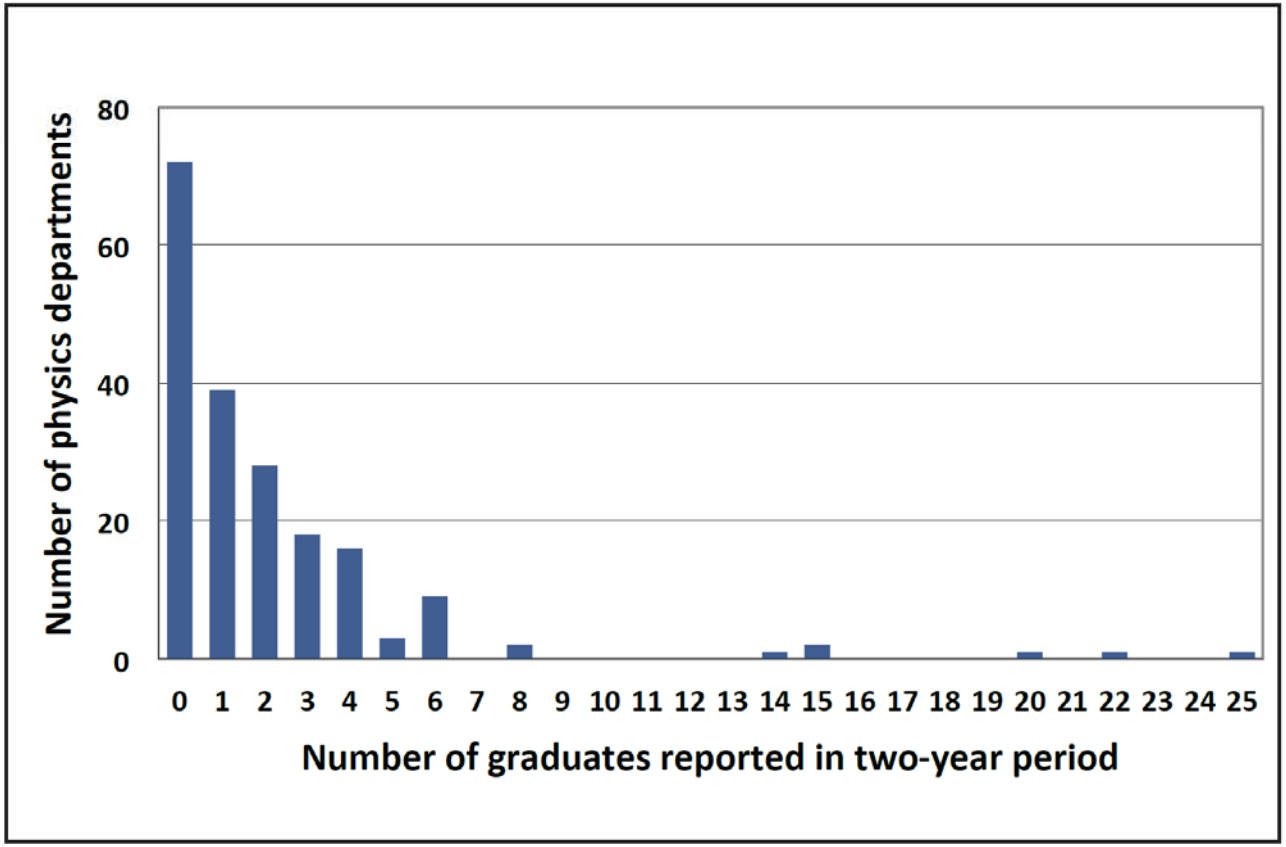
- **1881:** "…the difficulty of finding trained teachers or teachers with whom science was not subordinate to other things…is real enough…. *[Report on the Teaching of Physics and Chemistry]*
- **1946:** "[There is] a deficiency in the number of well-trained science teachers in the secondary schools." *[AAPT]*
- **1966:** "…there is a short supply of physics teachers at every educational level…[there is a] shortage, or even absence, of competent physics teachers in many secondary-school systems." *[National Academy of Sciences]*
- **2013:** "…the physics community is not producing enough highly qualified physics teachers to meet the growing need at the high school level." *[National Research Council of the National Academies]*

Distribution of Physics Teacher Graduates from U.S. Institutions, 1965-1967



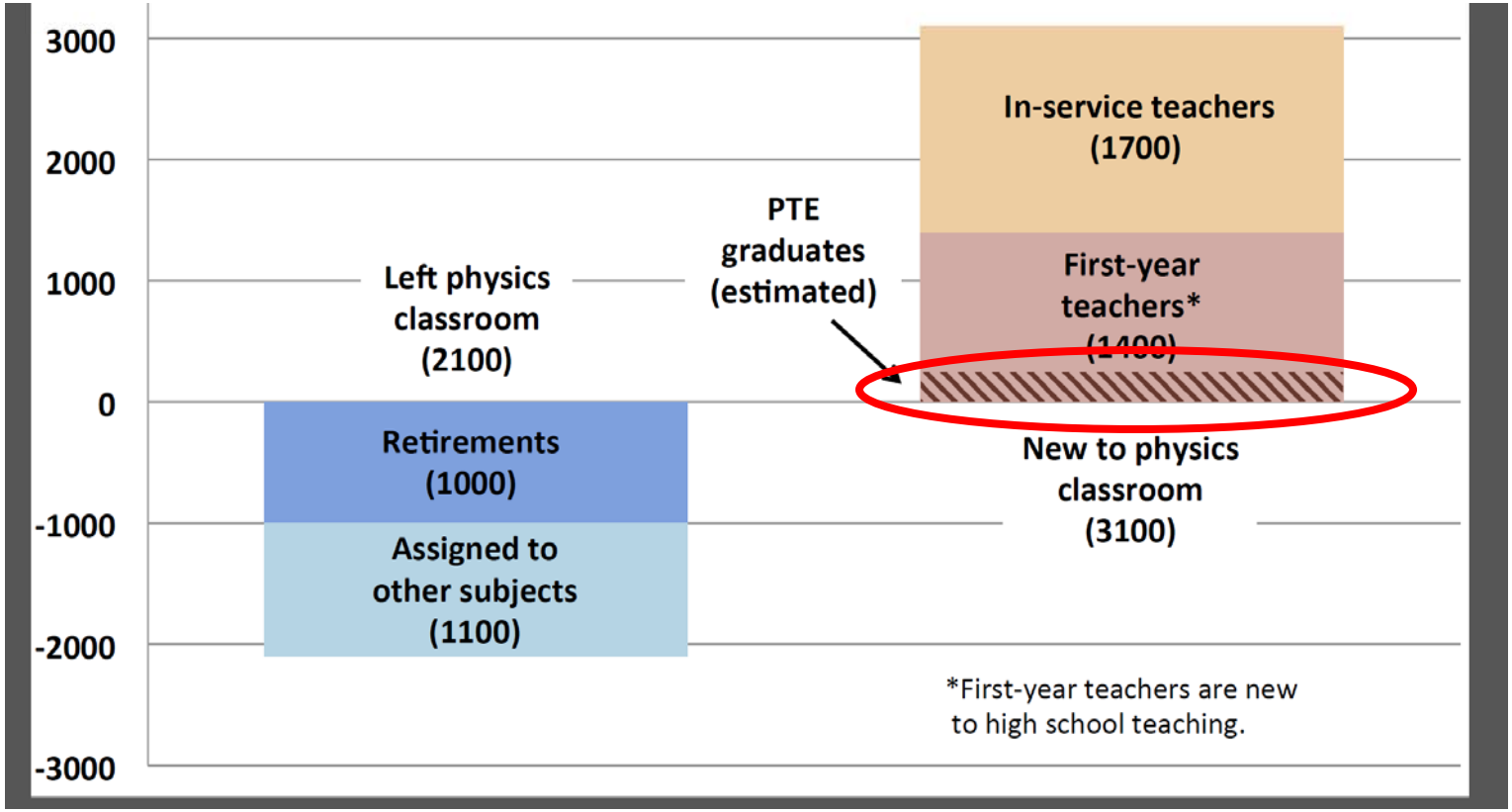
Newton and Watson, *Research on Science Education Survey* (1968), p. 26

Distribution of Physics Teacher Graduates from U.S. Institutions, 2007-2009



Meltzer, Plisch, and Vokos, *Transforming the Preparation of Physics Teachers* (2012), p. 14

Physics Teacher Education programs produce an *insignificant* fraction of new physics teachers



Meltzer, Plisch, and Vokos, *Transforming the Preparation of Physics Teachers* (2012), p. 17

Results from Research in Physics Teacher Education

- Physics teachers or preservice teachers often underestimate and/or do not address their students' alternative conceptions in physics [1-3]
- Special courses on physics concepts and pedagogy for teachers have often been shown effective in improving students' understanding and/or teaching practices [4-8]
- Preservice and in-service physics teachers value and require close and extended supervision by expert physics teachers as they plan and and implement structured lab activities [9-15]
- Involving undergraduate students in research-based instruction supported by pedagogical training can potentially impact physics teacher recruitment [16]

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