

Development of the Persistence in Engineering (PIE) Survey Instrument

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Method and Background

The Persistence In Engineering (PIE) survey was developed to identify and characterize the fundamental factors that influence students' intentions to pursue an engineering degree over the course of their undergraduate career, and upon graduation, to practice engineering as a profession. The PIE survey is one of five data-gathering methods used in the APS. This research brief discusses the initial development and refinement of the PIE survey instrument and its role as part of the Academic Pathways Study (APS) of the Center for the Advancement of Engineering Education (CAEE).

The PIE survey aims to identify salient correlates of persistence in engineering – both academic and professional—and thereby extend the research base on engineering student learning and retention. Variations of the survey instrument will be given to participants in three cohorts of students. The initial version of the PIE instrument was given to 160 students at four of the CAEE partner universities (referred to as Cohort 1).

Development of the PIE survey has been an iterative process, and its scope and content are evolving. As each administration of the survey reveals new insights, the survey variables and items are evaluated and refined. Development of the PIE instrument focuses on formulating and categorizing key research questions clustered around the concept of persistence in engineering. Most of these operational research questions were based on findings identified in an initial literature review of factors influencing retention in engineering. The operational research questions were analyzed further, initially by the survey authors, and then by the greater APS team. Based on these discussions, several key variables were identified.

Development of the PIE survey has resulted in the formulation of a knowledge base which forms the basis of a mixed-methods approach in which key issues can be identified and explored as they arise.

In addition to the literature review and APS discussions, existing national surveys on undergraduate education were also reviewed. Several variables directly related to the goals of the APS survey were identified and incorporated. These processes ultimately yielded the 26 PIE survey variables (see full text article at http://www.asee.org/acPapers/2005-1983_Final.pdf for the complete list of variables and the rationale as to why they relate to persistence in engineering). In order to measure each variable, a set of survey items were formulated and/or borrowed from the literature.

Conceptually, each PIE survey variable is associated with one of the four fundamental APS research question categories (skills, identity, education, and workplace). The PIE survey is administered in fall and spring of each academic year and the variables are being refined after each administration. Responses to each survey are being analyzed both qualitatively and quantitatively. Consideration of the responses has resulted in the refinement or deletion of existing variables and the addition of new ones.

What We Found

Reliability analyses were performed on the Spring and Fall 2004 surveys. The Cronbach's alpha scores for the variables from the Fall 2004 survey yielded stronger evidence for internal consistency on 13 of the 21 PIE variables compared to the Spring 2004 survey variables, suggesting that the majority of survey variables were internally consistent.

Implications of Findings

In summary, the PIE survey has contributed the following important outcomes to engineering education research:

1. The identification of a set of key variables characterizing core issues related to retention in engineering education today in the US, and the synthesis of those variables in a survey instrument. The resulting PIE survey is based on the literature, comprehensive, and responsive to new insights and variables as they emerge from ongoing APS work.
2. A dynamic survey validation process that draws upon itself as well as other data sources within the APS for continued evolution (as indicated by the improvement in the internal consistency results over time).
3. The formulation of a knowledge base which can inform and enrich the structured interview and ethnographic data sets within the study. This forms the basis of a mixed-methods approach, in which key issues can be identified and explored as they arise.