

# Workshop - Envisioning the First-Year Engineering Body of Knowledge

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**Abstract** - Over the years, many first year “Introduction to Engineering” courses have been developed, often from scratch, by various universities. These courses contain a wide variety of both content and outcomes, and are not necessarily integrated into the rest of the curriculum. Prior research has resulted in the development of a taxonomy for “Introduction to Engineering” courses, defining a common nomenclature suitable for describing course content and defining distinct types of courses. A next step in this research is the development of a Body of Knowledge, defined in terms of Knowledge Areas that can be used to develop a variety of feasible curriculum models and example courses that can then be readily adopted by programs. Body of Knowledge documents have been successfully used in other fields to help stratify content into varying tiers of importance. This session invites those who are either curious or who are interested in participating at some level to join together and discuss what a First-Year Engineering Body of Knowledge document should consist of and how its development should be approached.

*Index Terms* - body of knowledge, classification scheme, first-year taxonomy.

## BACKGROUND

The origins of this workshop involve research undertaken beginning in 2012 to define a classification scheme for first-year engineering courses [1]-[3]. The impetus for this research came from several observations. First, as successful models are typically not well disseminated, those charged with developing a first-year engineering course or course sequence are left to their own devices to reinvent the wheel. Second, as the concept of “first-year engineering” is not well defined, instructors have designed such courses to cover what they personally feel is important, leading to a potential grab bag of unrelated topics, with overall content and outcomes varying widely from institution to institution. Finally, first-year engineering courses are often not well integrated into the rest of the curriculum. By not making the connections to engineering evident, a student can be easily dissuaded from continuing in an engineering discipline.

The initial stage of the research involved performing searches of university websites for syllabi of courses whose title indicated that they were first-year introductory engineering courses. Each syllabus was examined to ensure that the course was geared towards introducing engineering

in general terms to an interdisciplinary assortment of engineering majors instead of being discipline-specific, focused on orientation to the collegiate environment, or designed as a service course for non-majors. An exhaustive list of course topics was generated from the 28 syllabi that met the search criteria. The objectives were found to cluster into four categories: engineering skills, professional skills, orientation to the academic environment, and orientation to the engineering profession. A Catalyzing Collaborative Conversations workshop organized by the directors of the first year engineering programs at Ohio Northern University and Virginia Tech was held at the 2012 Frontiers in Education Conference to discuss establishing the classification scheme [3]. Based on the results of small group discussions, a Delphi procedure was then employed to work with larger groups of participants, with the first round of questions being based on the generated list of course topics. The second round involving soliciting feedback to a draft of a classification scheme, and the third round involving the analysis of one’s introduction to engineering course through the application of a proposed classification scheme [4]. The results from this process indicate that first-year engineering course topics can be grouped into eight primary categories: design, latent curriculum or professional skills, engineering professionalism, academic success, mathematical skills, engineering-specific technology, communication, and global topics in engineering [5]. The taxonomy based on these categories has been tested in multiple settings and used by three institutions to date in order to examine and refine the content of their first-year programs. Through this first-year engineering taxonomy, work continues in defining a common nomenclature suitable for describing course topics, student outcomes, and assessment metrics as well as defining ‘foci’ or distinct types of courses. However, to continue with these efforts, additional steps need to be taken.

## WORKSHOP PURPOSE

For many years, fields such as computer science have successfully employed the concept of a discipline-specific Body of Knowledge, defined in terms of Knowledge Areas that are used to develop a variety of feasible curriculum models and example courses ready for adoption by programs. The purpose of this workshop is to take that first step toward the development of a similar Body of Knowledge for the first-year general (i.e., common to all

disciplines) engineering curriculum. Moreover, a secondary goal is to advance the usefulness of the classification scheme through targeted improvements found through its application.

### WORKSHOP FORMAT

In this workshop, the latest version of the first-year taxonomy will be presented, including a set of takeaway materials that attendees can utilize to classify and examine their introductory engineering courses. Next, participants will organize into small groups to discuss potential limitations of the taxonomy and propose changes that would make results more informative, such as a scale representing depth of coverage rather than a binary “yes/no” decision whether a topic was covered or not and alternate methods of classifying a course through guiding questions. Finally, one or more frameworks from successfully implemented Body of Knowledge efforts in other disciplines will be presented, and attendees will be asked to help envision what a similar effort for establishing a First-Year Engineering Body of Knowledge would consist of and how it should be approached.

There are two long-term goals that the organizers hope to achieve as a result of this workshop - beyond promoting greater awareness of the issues and establishing a network of interested professionals willing to collaborate in this effort. The first goal is to produce a document, similar to the “Computer Science Curricula 2013” document [6] but lesser in scope, which will present a variety of first-year course models that are grounded in well-defined outcomes and Knowledge Areas derived from the classification scheme. The second goal is to develop resource materials, primarily in the form of textbook chapters that specifically relate to individual Knowledge Areas and associated outcomes. In this way, customized texts can be readily created for the specific implementation that an institution desires to use for their first-year engineering curriculum.

Those interested in this workshop are strongly encouraged to bring the syllabi (or syllabus) for their introduction to engineering sequence (or course) or any other materials they deem potentially helpful for classifying their course and/or guiding further discussion.

### REFERENCES

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