Abstract - The Signals and Systems Concept Inventory (SSCI) is a 25 question multiple choice exam designed to assess students' conceptual understanding in Signals and Systems (S&S), a common core course in electrical and computer engineering curricula. The SSCI provides both formative assessment to instructors looking to improve students' conceptual understanding in their courses, and summative assessment which can be used as part of the accreditation process. The SSCI is a mature instrument in its seventh year of development, given to over 1800 students by more than 30 instructors. This workshop will employ the active and collaborative learning techniques we advocate for improving students' conceptual understanding. The workshop will describe the concepts assessed by the SSCI and the design of the SSCI questions. We will review the extensive pre-test/post-test data collected with the SSCI, including student gain data, the impact of instructional format on conceptual understanding, and the relative difficulty the SSCI questions. We'll also discuss which misconceptions the SSCI finds to be most resistant to instruction. The workshop will provide examples of how other instructors have incorporated the SSCI into their research on S&S pedagogy.

Index Terms – Signals and Systems, Assessment, Concept Inventory, Active Learning.

WORKSHOP OVERVIEW

Concept inventories are gaining momentum in a wide range of engineering, math and science courses as valuable assessment instruments. The Concept Inventory Central website [1] at Purdue lists over two dozen concept inventories. The SSCI [2,3] is a mature concept inventory in its seventh year of development and fourth version, funded by the NSF Division of Undergraduate Education. Dozens of instructors have given the SSCI to thousands of students. This workshop will provide attendees with a clear understanding of what the SSCI is, what the SSCI measures, and how they can use the SSCI to get a better sense of which concepts their students understand and don't understand.

The target audience for this workshop is instructors of signals and system (S&S) courses. The workshop will also be helpful to faculty developing concept inventories for other courses, and faculty interested in incorporating pre/post assessment as part of their ABET accreditation data. Topics covered in the workshop include

- Core concepts in S&S courses covered by the SSCI
- The SSCI questions, and what conceptual questions look like for an abstract mathematical course like S&S.
- The value of a pre-test/post-test protocol administering a concept inventory at the start and end of a course.
- The SSCI development and validation process
- Results from clinical interviews of S&S students using SSCI questions
- Baseline data collected during the SSCI development process
- Examples of using the SSCI in pedagogical research on S&S
- Examples of active learning exercises for S&S courses

Specific examples of the data presented will include

- Comparison of gains in conceptual understanding for active learning and traditional lecture courses
- Difficulty index data measuring which concepts are hardest for students to get correct
- Persistence data measuring which misconceptions are most difficult for students to unlearn
- Item response theory analysis for the SSCI calibrating the relative difficulty of different questions
- Content and construct validity
- Reliability data

Each participant will receive copies of the most recent versions of the SSCI and the SSCI instructor’s manual.

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REFERENCES