Developing an instrument to assess student's prior knowledge and possible interest in public policy courses

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Introduction

Awareness and understanding of the public policy process and analysis have emerged as key themes of undergraduate engineering education. Undergraduate engineering students need to know this process and analysis to support the current and future regulation of technology.[1–3] Identification of students' knowledge, attitudes and beliefs towards public policy is needed. The author reports the design process of a survey that sought to identify these characteristics in undergrads engineering students. Results from the pilot are also shared.

Different courses have been created among several universities to teach public policy to undergrad engineering students. In previous works, researchers have presented some of their course experiences teaching public policy to undergrad engineering students[2]. They agreed that students show interest in public policy and most of them reported positive experiences. They also agreed that it was difficult to provide experiential learning environments. Faculty reported teacher centered pedagogies like classes and expert speakers in public policy making, and student centered methods such as case studies and role plays.[4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19] The process to define the learning goals and the contents to reach them, was kept out of the papers.

However, according to the traditional method for curriculum design, it is plausible to think that students' were not asked about their preferences, believes and/or perceptions in regard of public policy. Current tendencies in curricular design[20] emphasize the relevance to include in the content definition, students' perceptions, expectations and prior knowledge. In fact, identifying and correcting prior knowledge is essential to enable students' learning of new knowledge and facilitate the transfer to other contexts.[21]

Therefore, one of the logic steps is to define a strategy to identify students' prior knowledge in public policy, and their attitudes and beliefs toward it. The researchers proposed a survey research design to uncover these characteristics. A survey is a "method able to estimate with considerable precision the percentage of a population that has a particular attribute by obtaining data from a small fraction of the total population"[22]. This work presents the process followed to create the survey and the results from the pilot. The findings using the final version of the tool will be reported in a future Journal article.

Method

Survey design

The survey asked students about the following topics: Understanding of public policy, possible future policy participation (two yes/no questions), prior policy knowledge (3 open-ended

questions and three yes/no questions), interest in public policy (4 yes/no questions and 3 open-ended questions) and demographic information (11 questions). In appendix A, the complete collection of questions used for the pilot study can be found.

Strategy for a "good question construction"[23] included support from undergrad students. Five undergrad students were recruited: one senior mechanical engineering student and a group of students of environmental and ecological engineering: one senior, one sophomore and one junior. As a result, some of the wording was changed. For example, one of the questions asked: "What policy issues are currently most salient to you?" Most of the students agreed that the word salient was not quite clear for them. Vague or ambitious and open ended questions, like those assessing their prior knowledge in policy, were changed. Two examples are "what is your understanding of public policy", and "what do you think is the role of engineering in society". Students also suggested the researchers to choose between "policy" and "public policy" and use it in the survey. The use of both could cause confusion. The researchers decided to use only the term public policy. Finally, yes/no questions were changed and open space for explanations and Likert scales were included.

The next step in survey design is to perform a pilot test of the questions[23]. The researchers sent the survey through the office of the registrar to a sample of students once, following the principles of cross sectional design[23]. The invitation to complete the survey was sent to 2000 thousand engineering students. The rate of participants in the pilot was 0.01.

Results

Twenty participants took the pilot. 50% were male, and 50% were female. 60% were Caucasian, 20% Asian and 5% from each of the following ethnic groups: Black/African American, Native American, Hispanic/Latino, and multiracial. 35% of the subjects who took the survey were senior engineering students, 30% were sophomores, 15% were Junior and 10% freshman, and 10% were in a different situation.

A definition of public policy can include elements like regulation, decisions, commitment and actions related with the government. Also that, it affects all the citizens including the federal, state, local governments, Public Universities and NGOs. [24] 15 individuals wrote their definitions (75%). 9 subjects wrote about law, rules or regulation. For example, one of the subjects answered that "Public policy is any sort of law, program, etc that is created and promoted by the government". Another wrote that public policy was a "law or a standard that has been clearly defined by the establishment". 10 subjects (66%) also included in their definitions the citizens and the society in general as recipients of the policies. None mentioned that public policy could be institutional, local, regional or global. 10 respondents (66%) mentioned in their definitions that public policy impacted the citizens (society, general public). None, again, discriminate in terms of the scope of the impact. None mentioned topics related to commitment, neither for decisions.

Subjects showed high interest in pursuing public policy careers and in taking public policy courses. Among the 24 respondents, 17 (70%) said that they are or might be interested in a career in public policy. 20 (83%) have not taken any policy related course, yet 16 (66%) were interested in taking public policy related courses.

17 subjects (70%) have never been involved in creating or influencing public policy, but 22 (92%) agreed that understanding the public policy process was relevant. However, only the 58% expressed interest in taking an engineering public policy related course.

Students expressed strong interest in economic and environmental issues. Other subjects they mentioned were healthcare and education, taxes, energy, encouraging American innovation, and immigration.

Debrief

About the data analysis

It is relevant to teach about public policy to undergrad engineering students, and specially to civil engineers because is one of the ABET learning outcomes for professionals of these field [1,3]. According to Bransford, Brown and Cocking [21], learning a new theme is feasible if there is some prior knowledge about the topic. Researchers found that participants in the pilot had insufficient knowledge about the concept of public policy. Only the 62% of the subjects provided an answer, but their answers missed several elements identified in the literature[2]. A course in public policy should build student's knowledge from the basic concepts, and should explain its relevance and its current and future implications as professionals.

The interest reported by the students in developing a career in public policy without knowing entirely what it means (most students have not been involved in public policy analysis or creation), open new venues for future research focused on understanding what it means for them "a career in public policy" and why this career is attractive.

Finally, students mentioned that they were interested in public policy issues regard the environment, like global warming. They also mentioned economics and energy issues. In order to engage students, curriculum design should address public policy at different levels to address these subjects.

About improving the tool

Although the questions were piloted, answers showed that still, it was necessary to change the flow of the interview. For example, in the pilot the first question was "how do you define public policy". This question is assuming that students know what public policy is and that they are able to give us a definition. The new version was improved by incorporating forks in the flow. Subjects were asked according to their answers. For example, the survey asked first if the

participant knew what public policy was. Only if, the response was positive, the survey asked for a definition.

Schedule of the research should include time for getting the approval of the instruments that are going to be used to collect, analyze and storage the data.

Since just 24 people were recruited in the pilot, it was necessary to deal with this issue. Based on literature, offering cash or a prize to participants were the two options that were considered.[23] Dealing with cash is inconvenient, it requires that the researchers meet the students and control that students do not take the survey more than once. Besides, it is more difficult to keep the respondents' identity safe. Since it was better for researchers to handle the incentive administration online using the Web, and "any incentive handled via web would increase the number of participants"[25], the researchers chose the option two: they offered one prize to the first group of respondents, and another to the total number of people who took the survey. Considering the expectation of recruiting at least 500 subjects, researchers decided to offer one prize to the first 100 students and another to all the population of subjects. This new recruiting strategy was more effective, yet researchers did not reach the expected number of respondents when the new version was sent. A future research trying to understand if there is any correlation between the low number of participants and low interest in public policy might be conducted.

According to experts [2], one of the topics engineering students should be more familiar with, is civics. In the final version of the survey, researchers included self-assessment questions about their knowledge of civics. These questions were taken from the webpages Daily Paul.com [26] and Civics quiz.com [27]. Those web pages provide free sample questions that are asked to those asking for the United States Citizenship. Some examples of the questions we used are "What are the three branches of the government?", "The house of representatives has how many voting members?", and "Mention at least five agencies of the executive branch".

Finally, it is relevant to mentioned that this author found a tool to assess the "motivation for public service" in the literature.[28] The construct of "motivation for public policy service" was defined by the following fourth dimensions: Attraction to Public policy making, commitment to the public interest and/or civic duty, compassion and self-sacrifice. The survey reported in this work, assessed the attraction to public policy making, but it did not include the other three dimensions[28]. New studies on motivation in regard to public policy may include these dimensions to verify if, the motivation for public service, is correlated with the motivation to be involved in Public Policy.

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Appendix A

First set of questions developed to determine student's perception and possible interest in Public Policy.

What is the current level of students' interest and knowledge about the interaction between engineering and policy?

Future Policy Participation

1.	Are you interested in a career in policy?
2.	Do you think you will ever use knowledge and skills from a policy course in your career?

Prior policy knowledge

3.	What is your understanding of public policy?
4.	What do you think is the role of engineering in society?
5.	What do you think is the role of engineers in society?
6.	Have you ever been involved in creating or influencing public policy?
7.	Have you ever been involved in creating or influencing public policy related to engineering?

8. Have you taken a policy related course?

Interest in policy

9. Would you be interested in taking a policy course?
10. Would you be interested in taking an engineering policy course?
11. What policy issues are currently most salient to you?
12. How is this issue related to engineering?
13. What do you think an engineering policy course should teach?
14. Do you think there is a personal benefit to being involved in public policy?
15. Do you think it is beneficial for engineers to be involved in public policy?

Demographics

16. Gender
17. Current department
18. Year
19. Race
20. Residence
21. Mother's profession
22. Father's profession
23. Do you receive financial aid?
24. Do you have college graduates in your family?
25. Do you have engineers in your family?
26. What extracurricular activities are you involved in?

Recent Graduates

1. Are you currently practicing engineering?
2. Do you currently participate in public policy discussions or creation?
3. If yes, are they engineering related policies?
4. Do you think your education at Purdue prepared to be a competent engineer?
5. Do you think your education at Purdue prepared you participate effectively in policy discussions?
6. If yes, what specifically was most helpful?
7. If no, what could have been done differently?