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Professional Attitudes Learning Outcome: Development and Assessment of Affective Learning

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Abstract

The American Society of Civil Engineers (ASCE) Body of Knowledge recommends one of the important learning outcomes for civil engineering is Professional Attitudes. The Department of Civil and Environmental Engineering at Rose-Hulman Institute of Technology adopted a Professional Attitudes student outcome in its program. The program is assessing affective learning in a number of outcomes. The depth and breadth of knowledge for civil engineers is beyond the limits of a baccalaureate degree, so development of positive affective learning can facilitate stronger long-term learning.

The program examined twenty-four professional attitudes identified by ASCE. The twenty-four attitudes were sorted into six groups and then prioritized by the program. The top four priority groups were subsequently identified for adoption in the program.

Affective learning about professional attitudes is already an important part of learning in the program, but assessment of that learning was not present despite the availability of instruments for doing so. Assessment was thus first prioritized so the program could then improve what was already present. The paper provides a summary of the selection of attitudes, development of assessment tools, and an examination of current student learning in the selected attitudes. The early results over the past two years suggest a need to consider refinement of the some of the assessment tools but also unveiled some areas in which significant program improvements could be made.

The paper includes examples for how programs could approach assessment of affective learning and develop improvements to affective learning of professional attitudes.

Introduction

In 2019, the Department of Civil and Environmental Engineering at Rose-Hulman Institute of Technology adopted a continuous improvement program comprised of the ASCE Civil Engineering Body of Knowledge (Sutterer et al., 2019). This included Professional Attitudes as a student outcome for our program. This paper summarizes the incorporation of learning and assessment of Professional Attitudes in our continuous improvement program, some examples of assessment results, and recommendations for other programs who may be interested in prioritizing professional attitudes in their program.

Identifying Which Attitudes to Prioritize

Attitudes can be described as learned predispositions to respond in a consistently favorable or unfavorable manner (Fishbein and Ajzen 1975). Professional attitudes are the positive and constructive attitudes that a civil engineer should display (ASCE, 2018). ASCE identified twenty-four professional attitudes that may be important to civil engineers, shown in Table 1.

We value all of the attitudes identified by ASCE, but because it would not be practical for the program to assess all of the attitudes, we concluded we would need to select only some to prioritize for assessment. Five of the attitudes identified by ASCE (creativity, curiosity, entrepreneurship, intuition, and good judgement) were already prioritized elsewhere in our program and also seemed to involve skill as well, so they were set aside from the others into their own group. The remaining 19 attitudes were sorted into five attitude groups of similar character. These five attitude groups were ranked as being high (H), medium (M), or low priority (L) for assessment. We then elected to address only the four attitude groups of high or medium ranking. For the four high priority assessment groups, we selected one attitude from each group we felt represented the others. The selected attitudes for each group are in bold italics in Figure 1. We thus prioritized assessment of integrity, dependability, consideration of others, and flexibility.

Figure 1: Sorting Professional Attitudes Identified by ASCE

H	Honesty
	Integrity

H	Commitment
	Dependability
	Persistence
	Thoroughness

H	***consideration of others***
	Empathy
	Fairness
	Respect
	Sensitivity
	Tolerance
	Thoughtfulness

M	high expectations
	flexibility
	optimism
	positivity

L	confidence
	self-esteem

Attitude or Skill?	creativity
	curiosity
	entrepreneurship
	intuition
	good judgment

We agreed on the following definitions for the four prioritized professional attitudes.

- *Integrity* is firm adherence to a code of especially moral values
- *Dependability* is defined as the quality of being able to be counted on or relied upon
- *Consideration of Others* is thoughtful and sympathetic regard to the needs of others
- *Flexibility* is the ability to change or be changed according to the situation and is critical for civil engineers working within a diverse group and in an ever-changing environment.

Fostering Affective Learning

Cognitive learning. Across our curriculum, we naturally teach cognitive knowledge about professional attitudes in various course activities. This is mostly because our faculty have all worked in professional practice, so the technical "in practice" examples we share regularly features good professional attitudes. We also formally teach professional attitudes in teamwork and leadership lessons. This includes, for example

- Ethics thread: Learning in our ethics thread across the curriculum includes lessons in integrity and honesty
- Leadership thread: Our teamwork and leadership learning, also a thread across the curriculum, includes dependability, consideration of others, empathy and respect, and flexibility.
- Civil engineering case studies: Most of our faculty include case study learning in at least some of their classes. Some have planned learning even in required classes, such as "Professional Issues Friday"

Despite faculty-driven learning about professional attitudes, it is not a program learning thread and is currently faculty-dependent. Part of our decision to include this outcome in our continuous improvement program was to help us decide whether there is a need for a formal learning thread in our curriculum.

Affective learning. We hope we demonstrate to our students how we value good professional attitudes. Cognitive knowledge about professional attitudes is important, but knowing the right attitudes is not enough. Unlike cognitive learning, affective learning objectives include motivations, attitudes, values, enthusiasms, and feelings (Krathwohl et al., 1964). This kind of learning is important because it relates to learner's persistence in the face of challenge. Learners' persistence depends on whether they are performance oriented or learning oriented (NRC, 2000). Performance oriented learners are more worried about making errors, while learning oriented learners like new challenges. This is one reason STEM educators seek to develop graduates who are learning oriented. These types of learners are particularly motivated when they can see the value of their work, especially in their community (NRC, 2000), and affective learning is a crucial part of this motivation.

Engineers need to *value* good professional attitudes. This helps to assure the engineers' commitment to other important outcomes, such as ethical responsibilities, professional responsibilities, and lifelong learning (ASCE 2018). Valuing the right attitudes is a crucial step

beyond cognitive knowledge. This directed our planned learning and assessment of the Professional Attitudes outcome towards affective learning rather than just cognitive learning.

Consistent with ASCE, we think about affective learning using the framework provided by Krathwohl et al (1964) which ranks levels of affective learning within Blooms Taxonomy. We adopted the civil engineers' professional attitudes from Lynch et al. (2009) as follows.

1. Receiving: *describe* attitudes conducive to the effective practice of engineering;
2. Responding: *identify* situations where attitudes are or will be important to engineering success; *identify* the attitudes involved in real situations;
3. Valuing: *demonstrate* proper attitudes in engineering performance and interpretation of tasks; *commit* to them;
4. Organizing/conceptualizing: *lead* by example in the *application* of proper attitude in complex situations and with other professionals; *inspire* professional attitude in colleagues and clients; and
5. Characterizing: *develop* and *implement* a consistent expectation of proper professional attitude within the engineering unit and extending to other units with whom cooperation is necessary.

For both cognitive and affective learning about professional attitudes, we decided not to change the faculty-driven learning already under way in our program until we had completed several years' assessment. Once we have a baseline for this learning, our next step will be to identify ways we may need to improve this learning.

Assessment of Affective Learning

As already noted, we believe affective learning about professional attitudes is already an important part of our program, but assessment of that learning was not present despite the availability of instruments for doing so. In fact, our program is working on affective learning assessment for a number of our student outcomes, including professional attitudes. This is not simple because we are trying to assess how students are receiving, responding or valuing the learning. But some of the difficulty in assessing affective learning can simply be due to a program's inexperience with this type of assessment. Our approach was to just get started, gain experience, perhaps make some mistakes, and learn how to improve along the way. Following is our approach to affective assessment of the four professional attitudes we prioritized.

Dependability. We decided to assess Dependability using the Team Rating survey students provide of each member of their senior design team each term. Shown below in Table 1 is the current Team Rating guide for senior design. Our senior capstone design spans three quarters, and the team members rate each other at the end of each of the three quarters using this guide. Students choose which of the following descriptors applies to each group member and provides an explanation why they chose this descriptor. After each student is rated, they are provided the results and encouraged to use the feedback to improve. If a student was rated by their dependents to be at a level of Satisfactory or higher, this was rated a "Yes" for the dependability of that student.

Table 1 Dependability scale used for rating artifacts	
• *Excellent* - Consistently went above and beyond – tutored teammates, carried more than his/her fair share of the load. • *Very good* - Consistently did what he/she was supposed to do, very well prepared and cooperative. • *Satisfactory* - Usually did what he/she was supposed to do, acceptably prepared and cooperative.	Yes
• *Ordinary* – Often did what he/she was supposed to do, minimally prepared and cooperative. • *Marginal* - Sometimes failed to show up or complete tasks, rarely prepared. • *Deficient* - Often failed to show up or complete tasks, rarely prepared. • *Unsatisfactory* - Consistently failed to show up or complete tasks, unprepared. • *Superficial* - Practically no participation. • *No show* - No participation at all.	No

Consideration of others. For Consideration of Others, we decided to use the Service Learning Reflection from senior design projects, summarized below. The "Others" part of the Consideration of Others attitude likely includes the design, team, the client, and the users of the product. It asks students to do the following.

- Explain how some knowledge from your undergraduate education and civil engineering skills were used in the project.
- Clearly indicate that the client was not charged a fee for this design work.
- Identify benefits to your client and society because of the free services you provided in this specific project.
- Identify benefits you received (might be esoteric) from providing free services for this specific project.
- Describe any knowledge gained and/or skills acquired through service or volunteer experiences outside of your coursework during your undergraduate education.

For these five responses, we prepared a rubric to rate the students' reflections.

I. Did the students/team actively participate?
II. Were/was the students/team attending to a task?
III. Did they identify a motivation to demonstrate "consideration of others" and was it about the "needs of others"?
IV. Did they describe reacting to the motivation to demonstrate consideration of others?
V. Did they react thoughtfully and sympathetically to the need?

For the actual assessment, we rated with a yes/no rating on whether the students' combined responses satisfied the rubric at a level expected of a graduating senior. We placed particular emphasis on III and IV in making the yes/no rating. Although the rubric I-V above is not perfectly aligned with the above responses, the service learning reflection had been used for years in senior design, and we did not wish to change that reflection at this stage of our work.

Flexibility. We were unable to identify an existing instrument for assessing flexibility and integrity. It was thus necessary to develop a tool to allow us to assess these two professional

attitudes. This consisted of a survey the seniors completed during the spring quarter of senior design. Since most of our students graduate in four years and only a rare few graduate in five years, this coincided with the final quarter of their fourth year, just before graduation. The portion of the survey to assess observed flexibility is shown in Table 2 below.

Table 2. Assessment of flexibility
Q1: Flexibility is the ability to change or be changed according to the situation. Which of the following identifies how your own attitude about flexibility has changed as an outcome of your learning in the civil engineering program?
Increased in importance
Remained the same
Decreased in importance
Q2: Flexibility is the ability to change or be changed according to the situation. Which of the following identifies your observation about demonstration of flexibility for your team?
Our team demonstrated a high level of flexibility in our work on the project and with each other.*
Our team demonstrated some flexibility in our work on the project and/or with each other, but there were times when we could have done better.
Our team struggles with demonstrating flexibility in our work on the project and/or with each other, and there is room for significant improvement in the future.
Our team did not demonstrate flexibility in our work on the project or with each other.

Students were also invited to provide additional comments if they wished to do so. If a student's response to Q2 was at the highest level (see *), that response was rated "Yes" for flexibility.

Integrity. As already noted, we were unable to identify an instrument to assess observed integrity, so we developed a survey of our graduating seniors. It is shown in Table 3 below.

Table 3. Assessment of integrity
Q1: Integrity can be defined as firm adherence to a value system. Which of the following identifies how your own attitude about integrity has changed as an outcome of your learning in the civil engineering program?
Increased in importance
Remained the same
Decreased in importance
Q2: Integrity can be defined as firm adherence to a value system. Which of the following identifies your observation of integrity for your team?
Integrity was a consideration in our work, and I never observed a potential compromise of integrity.*
Integrity was a consideration in our work, and I rarely observed a potential compromise of integrity.
Integrity was a consideration in our work, but there were some clear cases of a potential compromise of integrity.
Integrity was not a consideration in our work, but I never or rarely observed a potential compromise of integrity.
Integrity was not a consideration in our work, and there were some clear cases of a potential compromise of integrity.

Students were also invited to provide additional comments if they wished to do so. If a student's response to Q2 was at the highest level (see *), that response was rated a "Yes" for integrity.

Results. The results are shown in Table 4 below. Because part of affective learning is simply responding when asked, we tabulated not only the results of completed responses by students, but also the response rate. The Yes/No ratings indicated were for the purposes of our continuous improvement program, but the other results being collected will be used for more in-depth assessment of results later. The results of the Yes/No assessment for the 2021-22, 2022-23, and 2023-24 academic year are shown below.

Table 4. Assessment results

Acad Year	Integrity		Dependability		Consid. of Others		Flexibility	
	Response	Rating	Response	Rating	Response	Rating	Response	Rating
21-22	86%	56%	87%	71%	95%	60%	86%	76%
22-23	62%	62%	87%	90%	85%	65%	62%	100%
23-24	82%	67%	95%	94%	94%	68%	82%	78%
	P	>75%	P	>85%	P	>85%	P	>75%
	W	50%-75%	W	70%-85%	W	70%-85%	W	50%-75%
	F	<50%	F	<70%	F	<70%	F	<50%

The index results above have been color coded to indicate performance considered to be "passing" (green), in a "watch" status (orange) or "failing" (light red).

It is not the intent of this paper to provide an in-depth analysis of our assessment results, but some observations about what we have learned could be helpful.

- Integrity – we were at first disappointed to observe a lower integrity rating. But several factors are being considered. (1) We set a high standard that the student *never* observed a *potential* compromise of integrity. (2) Multiple students could observe a single student demonstrating a *potential* compromise of integrity. Combined, these two aspects mean that a single student *potentially* comprising integrity could result in multiple students not choosing this option and thus lowering the score. We are re-evaluating whether this instrument is effectively indexing integrity.
- Dependability – we expected high dependability from our students. This was marginal for 2021-22 but much higher for the two subsequent years. It is likely the lower performance during 2021-22 was due to some team dynamics issues we observed for a few senior design teams that year.
- Consideration of Others – we believe this is a strength of our program, but as noted above, the results were not good. We are uncertain we have good alignment of the service learning response requirements with the rubric we are using. Use of the service learning reflection is not likely a good choice of assessment instrument. Some senior projects are excellent learning and great works that require consideration of others, but the service learning reflection expectations may not cause students to verbalize a response that aligns with our aspirations for this professional attitude. We are currently evaluating that assessment tool.

- Flexibility – we place a strong emphasis on flexibility in the learning for our students. Our students highly value flexibility. We believe at this time the results are representative of our observations but will continue to evaluate this tool going forward.

Conclusions and Recommendations

Professional attitudes are crucial to a successful civil engineer. There is no reason why professional attitudes cannot be a part of planned learning in any program, and most programs probably include professional attitudes learning in their courses. We believe this has been true for our program, but when we began to seek ways to assess that learning, it was not easy. Needing to assess learning about professional attitudes has caused us to look more closely at that learning, to talk about it as a faculty body, and to prioritize at least some exposure to this in some of our required classes. We believe this is an improvement to sustaining student learning in professional attitudes. It is not necessary for professional attitudes to be a program's student outcome, but it is very helpful for the faculty to communicate about this and consider ways to assure the learning is not neglected.

We undertook assessment of professional attitudes without implementing any change in our program. Our desire was to identify a baseline of expectations in the attitude groups we identified and then modify learning to address needs. Even though we identified a need for a different assessment instrument for consideration of others, and perhaps a need to make a change in how we assess integrity, we believe was can confidently identify some learning opportunities as well. The first of these could be simply be in how the faculty themselves address learning about professional attitude in their classes. Up to now, we have not intentionally incorporated learning specifically to develop learning about professional attitudes. The content is present, but not necessarily written into class learning objectives or specific lessons. This work provided herein gives the program a foundation to begin discussions about this. In this regard, we should likely develop a learning thread in the curriculum that makes this learning more intentional.

Having committed the past six years to outcomes assessment that spans the ASCE BOK (ASCE, 2018), our program is streamlining assessment to prioritize which learning is part of the formal continuous improvement program for accreditation. Professional attitudes is not likely to be included as one of the learning outcomes, however the program remains committed to learning in professional attitudes and to assessment of affective learning in addition to cognitive learning. More information about these changes are provided in a separate paper (Hanson, et al. 2025).

Affective learning in professional attitudes holds a higher assurance that students will carry important behaviors into their work after graduation. Promoting affective learning is not difficult and is probably already occurring in many programs. Assessment of affective learning is not difficult to start. For these reasons, affective learning about professional attitudes should be a part of every program's curriculum. It is likely that within most if not all programs, there is already faculty-driven affective learning. Even so, it is also likely that there are missed opportunities for improving affective learning in most programs. Certainly, learning can be improved without assessment, but steady and reliable improvement in learning is difficult to achieve and sustain without sustained assessment of that learning. Thus, if a program values affective learning about professional attitudes, it should as a minimum assess this learning,

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