# Work in Progress: Evaluating the Current State of the First-Year Seminar Program at Penn State University

**Prof. Bradley J. Sottile, Pennsylvania State University**

Brad Sottile is Assistant Teaching Professor of Computer Science and Engineering, and Aerospace Engineering in The Pennsylvania State University's College of Engineering, School of Electrical Engineering and Computer Science.

**Mrs. Abbie Canale, Pennsylvania State University**

Assistant Teaching Professor

**Ms. Yu Xia, Emporia State University**
**Dr. Tim Kane, Pennsylvania State University**

TMOTHY J. KANE, Ph.D is Professor of Electrical Engineering and Meteorology and Atmospheric Science at Penn State. His educational research interests include enhancing engineering education, collaborative learning, and increasing student involvement.

**Dr. Stephanie Cutler, Pennsylvania State University**

Dr. Stephanie Cutler has degrees in Mechanical Engineering, Industrial and Systems Engineering, and a PhD in Engineering Education from Virginia Tech. She is an Associate Research Professor and the Director of Assessment and Instructional Support in the Leonhard Center at Penn State.

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## Introduction

The demand for innovative and diverse engineers is growing, especially the need for creative problem solvers [1], [2], [3], [4]. As such, attracting and retaining engineering students is crucial. In addition to technical rigor, there is a clear understanding that a range of intrapersonal (e.g., self-regulation) and interpersonal competencies (e.g., empathy) highly influence educational and career success. The Pennsylvania State University (Penn State), a large, public, research-intensive institution, has been offering experiences for first year students in its College of Engineering (COE) since 1998 [5].

One feature of the present first-year seminar (FYS) program at Penn State's COE is that it is highly distributed, with courses being taught in nearly all undergraduate programs and at the College level – notably, options exist for students to take a course offered by a COE academic department or a generalized/non-discipline-specific seminar offered under the auspices of the COE itself. This FYS program is relatively "light touch," consisting of a one semester credit hour course. There is no institutional requirement that students in the FYS even be pursuing a COE major, but the typical pattern seen is that the departmental seminars usually enroll students intending those disciplines, while the generalized seminars typically enroll students from a wide variety of intended COE majors. While that structure offers inherent flexibility, given the loose coupling prevalent in higher education [6], it also creates administrative and coordination challenges in the administration of the program.

The retention of students in the engineering program is important. Knowledge of a student's level of creative self-efficacy has been shown to improve prediction of their persistence to the final year and graduation [7]. It has also been shown that a first-year place-based learning community similarly improves outcomes for students well into their second, third, and fourth years, especially for students from underrepresented groups and for first-generation students [8]. However, retention may not always be the best indicator of program success; it has been shown that success is influenced by multiple aspects of student encounters in their first-year life [9], such as how well they integrate into university life (academically, socially, and emotionally), as well as their intrinsic motivation, perception of support, and satisfaction with their chosen degree program [10], [11].

Different pedagogical approaches/strategies can have a huge impact on first-year students. For example, problem-based learning (PBL) has a history of producing strong educational results in engineering [12]. The concept of utilizing a multidisciplinary approach for first-year engineering students has been increasingly studied over recent years and has been shown to provide students with a better appreciation for other engineering disciplines [13]. Integrating transdisciplinary knowledge development into engineering programs starting in first-year engineering courses might also provide new pathways for transforming curricula aimed at educating the 21st-century engineer [14].

Mental Health and Wellbeing (MHW) has been attributed to student success in higher education. While engineering undergraduates and their faculty agree on the need for improved dissemination of information, students desire a broader scope, including information relating to courses and hands-on experiences [15]. Mindfulness training can support the development of intrapersonal and interpersonal competencies that transfer directly into supporting students' engineering education experience as well as their personal lives [16].

Inclusion and a sense of belonging matter as well. Creating learning communities for students with diverse academic backgrounds is a great place to start in the first-year; it has been shown that students placed in learning communities have a higher successful course completion rate of first-year STEM courses than the comparison group of non-learning community students, and the second-year and third-year retention rates have improved by about 10% above the historic retention rates [17]. Research in engineering education has highlighted the importance of identity and motivation for several student outcomes including persistence. It is imperative to understand how students are developing a sense of identity and utilizing their identities to guide goal-setting processes and actions in their new engineering environment [18].

Given the age of Penn State's FYS program in its COE, the importance of having a robust first-year engagement program for engineering students, the diffuse and loosely coupled nature of the present program, and the changes being seen in students coming out of the COVID-19 pandemic [19], [20], it was felt the time was right to evaluate the state of Penn State's engineering FYS program.

## Methods

This work was an exploratory evaluation to understand the current practices across the overall Penn State COE FYS program. This study utilizes a multi-stage mixed methods research design, combining elements of both exploratory and explanatory mixed methods research design typologies [21]. As this study was a program evaluation, it was exempt from Institutional Research Board (IRB) review.

### *Data Collection*

Data collection went through three key phases. First, 26 copies of FYS instructor syllabi were collected and coded for basic information and key components (see details in Instruments section below); at the same time, orienting conversations were carried out with both COE FYS faculty and faculty undergraduate program coordinators. Second, integrating insights of the preliminary results from these data and previous survey results, an updated survey was developed and distributed to faculty, students, and administrative policymakers. Third, further follow-up focus groups and individual interviews were conducted to explore participants' feelings, both about the present FYS model and potential alternative FYS models that the COE at Penn State might consider adopting.

## *Participants*

### *First-Year Seminar Students*

During the Spring 2022 semester a survey link was sent to all first-year students in Penn State's COE. Emails were ultimately sent to 1,204 students inviting them to complete the survey. A total of 176 student responses were received, corresponding to a response rate of 14.6%. A gift card raffle was used to incentivize student participation.

### *Non-Student Stakeholders*

During the Spring 2022 semester, a survey link was sent to other non-student stakeholders. In total, 38 stakeholders responded to the survey, among whom 7 self-identified as adjunct faculty (for our purposes, defined to be professional staff who teach as a subsidiary duty), 3 as holding some rank of dean (assistant or associate), 4 as department head, 7 as professional track faculty (teaching- or research-line), 10 as tenure-line faculty, and 7 as a faculty undergraduate program coordinator. In terms of experience, of the 38 participants 6 members had no experience teaching FYS, 14 members had 0-3 years' experience, 7 members had 3-7 years' experience, 5 members had 7-12 years' experience, and 6 members had more than 12 years' experience.

In the focus group interviews, in total 22 stakeholders from various departments participated, among whom 5 self-identified as adjunct faculty, 3 as holding some rank of dean, 3 as department head, 3 as professional track faculty, 3 as tenure-line faculty, and 5 as a faculty undergraduate program coordinator.

## *Instruments*

### *Syllabus Analysis*

FYS course syllabi were analyzed utilizing a detailed coding scheme, with attention to items such as length, course organization, academic integrity, course goals and outcomes, and course evaluation. A copy of the codebook can be found in Appendix A.

### *Student Survey*

To evaluate the efficacy of Penn State's COE FYS courses, a student survey explored the following major aspects of student FYS experiences. Inquiries presented to students included:

- Overall student satisfaction on a 5-point Likert-type scale.
- Workload, by asking the number of hours spent on tasks and assignments for their FYS each week on 5-point Likert-type scale from less than 1 hour to more than 6 hours.
- Learning activities to assess the engagement in various activities and interaction with peers, instructors, and academic advisors, on 4-point Likert-type scale from not at all to 5 or more times.
- FYS objectives on 5-point Likert-type scale from strongly disagree to strongly agree; and changes in confidence and motivation in educational and career areas on 5-point Likert-type scale from decreased greatly to increased greatly.

- Pre- and post-FYS major choice.

*Non-Student Stakeholder Survey*

A short survey about the current and future options for FYS courses was administered to 38 COE non-student stakeholders identified by the Penn State's COE Taskforce on First-Year Engagement. Specially, stakeholders were asked about their initial thoughts regarding converting the current 1-credit FYS model to a possible 3-credit FYS model that would take the place of a general education requirement. Inquiries were posed to solicit how respondents viewed the FYS program, factors impacting their support for a 3-credit model, and for general inputs and suggestions. The Taskforce asked respondents the following four questions:

1. How do you define success for a First-Year Seminar?
2. Moving forward, what would you like to see from a First-Year Seminar experience?
3. What factors would impact your support of a 3-credit model?
4. What other information would you like the Taskforce to consider as they move forward?

### *Data Analysis*

Syllabi was coded by one author and audited by a second author, with discrepancies resolved through discussion between coders. For the student survey, descriptive statistics were applied to the quantitative data from the surveys and thematic analysis was conducted to analyze the responses to open-ended questions. For the stakeholder survey with open-ended questions, responses were analyzed using thematic analysis. Similar participant responses were grouped around summary themes to help consolidate the results and to present an overall picture of the data. We attempted to compare groups with different experience levels and to observe any emerging patterns, however, we did not see obvious significant differences, a finding likely driven by the extant sample size.

### *Limitations*

Several limitations are inherent in this work. While student survey response rates were broadly consistent with response rates seen in survey research, it is possible students with unusually high levels of interest in the FYS program (e.g., those holding strong views about the program) were overrepresented in the student sample. Additionally, the non-student sample was fairly small. Finally, given intra-institutional dynamics, the results from this study might not be immediately generalizable outside of the institutional context.

## Results and Discussion

### *Syllabi Coding Analysis Results*

Table 1 shows the syllabus statements reviewed in the coding analysis and the percentage of instructors who included those topics in their course document. This review found that faculty expectations for expectations in FYS sections varied greatly by instructor. The FYS goals and objectives outlined by the COE were not being consistently communicated to students via the instructors' syllabi. The Engineering Passport to Success, a COE-sponsored collection of assignments which represent the only centralized content in FYS courses across all sections, were referenced in only half of the reviewed syllabi. The most common component across most FYS sections is that students earned portions of their grades based on attendance, participation, and at least 1 out-of-class assignment. It was felt that these discrepancies provided an opportunity to provide a consistent and inclusive syllabus for instructors to adopt for their sections in a future iteration of Penn State's COE FYS program.

**Table 1. Coding of Syllabus Statements Across 26 Instructors**

| Syllabus Element | Frequency |
|---|---|
| Included FYS goal # 1: To engage students in learning and orient them to the scholarly community from the outset of their undergraduate studies in a way that will bridge to later experiences in their chosen majors | 4% |
| Included FYS goal # 2: To facilitate students' adjustment to the expectations, demanding workload, increased liberties, and other aspects of the transition to college | 8% |
| Included FYS objective # 1: To introduce students to university study | 27% |
| Included FYS objective # 2: To introduce students to Penn State as an academic community, including fields of study and areas of interest available to students | 46% |
| Included FYS objective # 3: To acquaint students with the learning tools and resources available at Penn State | 58% |
| Included FYS objective # 4: To provide an opportunity for students to develop relationships with full-time faculty and other students in an academic area of interest | 46% |
| Included FYS objective # 5: To introduce students to their responsibilities as part of the University community | 12% |
| Included reference to the Engineering Passport for Success | 54% |
| Engineering Passport for Success integrated into the syllabus | 46% |
| Grade based in part on attendance | 81% |
| Grade based in part on participation | 85% |
| Grade included at least 1 out-of-class assignment | 88% |

***FYS Students Survey Results***

*Experience*

Students largely rated their FYS course as a satisfying experience as is shown in Figure 1. Many students reported experiencing positive personal growth and confidence in their decision to pursue degrees in engineering and computer science. In the open response questions, many students commented that good instructors, guest speakers, field trips, groupwork, creating resumes, learning about career paths, and learning about campus resources contributed to a positive learning experience. Critiques included lack of information across all engineering majors and fields, lack of information on future careers (especially those outside of research), and a lack of opportunities for student collaboration.

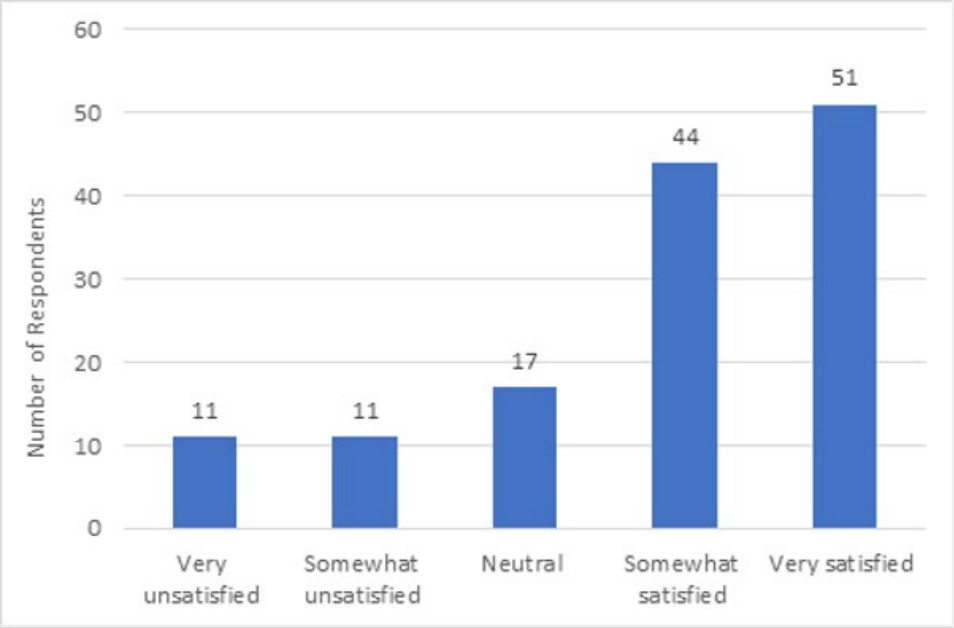


**Figure 1. Overall student satisfaction with their FYS experience (*n*=134)**

*Workload*

To gain the student perspective of workload, the survey asked about the number of hours spent weekly on tasks and assignments for their FYS. The average amount of time spent on assignments was estimated at 1.5 hours per week, which seemed a little low to us given institutional and federal standards for 45 hours of student work to achieve one semester credit hour.

*Learning Activities*

To explore student engagement within their FYS course, the survey asked students about their participation in various learning activities. As shown in Figure 2, students mostly engaged in discussions, followed by engagement with guest speakers, interactions with peers outside of class

time, and groupwork. Some also attended a student organization meeting or other sponsored event. The smallest number of students reported interacting with their instructor or a faculty member outside of class or meeting with an academic advisor. In the open-ended questions asking what they would change about the FYS, students answered that they would like more fields trips, more groupwork and peer interactions, more guest speakers from industry, and to have an interview workshop.

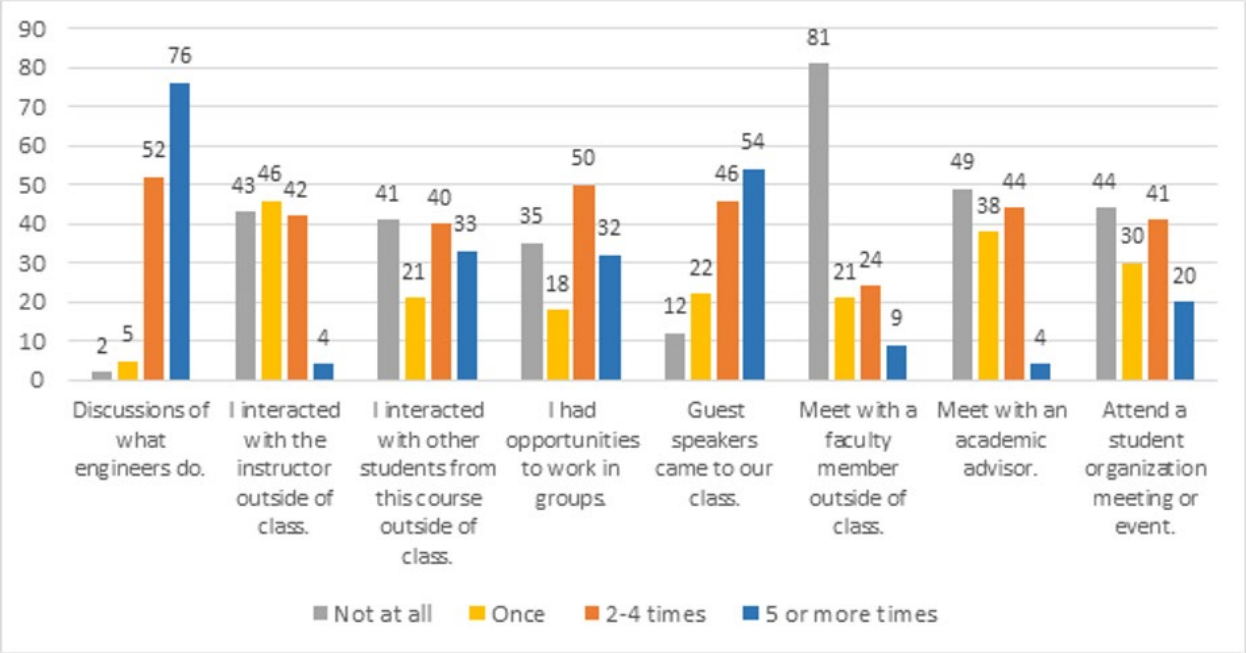


**Figure 2. Student-Reported Frequencies of FYS Learning Activities (*n*=135)**

*FYS Objectives*

Students were asked to rate their satisfaction of their FYS meeting the objectives outlined by Penn State's COE and the connection to resources related to MHW. The students' responses are presented as Figure 3. Most students agreed or strongly agreed that their FYS helped them to meet these objectives. These results suggested that even if instructors were not explicitly listing the FYS program objectives in their syllabi, students were still achieving the program objectives through FYS course activities.

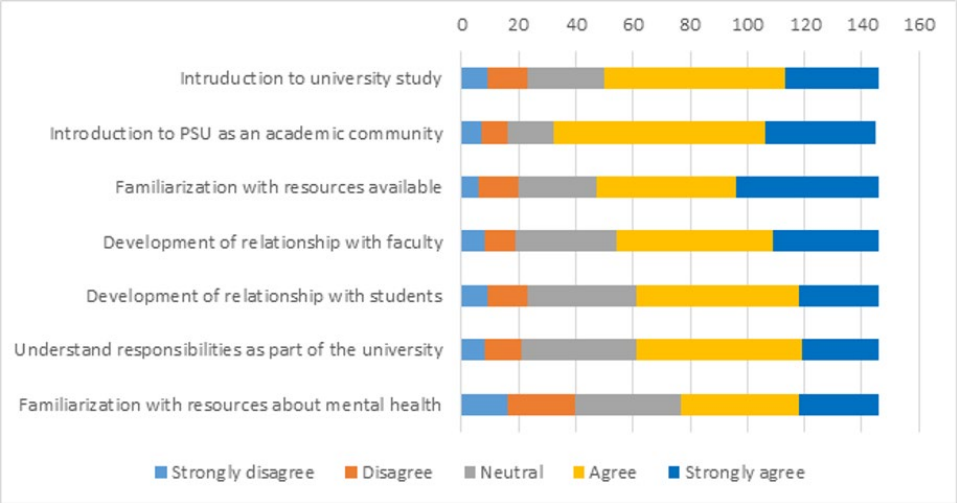


**Figure 3. Student Agreement for FYS Course Meeting FYS Program Objectives (*n*=146)**

### *Non-Student Stakeholder Survey Results*

A summary of responses to a survey about the current and future options for FYS courses at Penn State was conducted. Respondents were asked generalized questions about their views of the current state of the FYS program. Participants were asked for their initial feedback on possibly converting the current one credit FYS to a three credit FYS model, taking the place of a general education requirement. The goal was to gain an overall understanding of how stakeholders view the FYS, understand deciding factors impacting support for a three credit FYS model, and to solicit general input and suggestions prior to developing a new FYS model.

Similar participant responses were grouped around summary themes to consolidate results and present an overall picture of the data. An attempt to compare groups with different experience levels to observe emerging patterns was made, however, there were no immediately obvious significant differences. The detailed stakeholder responses are presented in Appendix B.

### *Discussion and Directions for Future Work*

Disconnects in the perceptions of the subjects are apparent in this dataset. There was fairly broad consensus across stakeholders that the current FYS program had deficits, though student reports of those deficits presented somewhat inconsistent findings. This finding of engineering student and faculty disconnects is, however, consistent with other contemporaneous findings being noted in the Research 1 institutional context [22]. The traditional approach for addressing perception gaps is usually increased or improved communication [23], which may be especially true in an institutional context where first-year engagement programs have limited scope (e.g., delivered primarily via a one credit FYS course, as is the case at Penn State). Engagement and student persistence are linked, albeit in nuanced ways [24], which needs to be considered carefully by both researchers and practitioners in the context of an engineering student's first year of tertiary study.

Penn State's COE is presently working through a redevelopment process for FYS courses targeted towards remedying some of the inconsistencies and deficits identified in the instant work. Penn State has taken the approach of building out approximately 8 plug-and-play pre-planned hybrid instruction modules intended for use by FYS instructors, which should aid in solidifying participant's views regarding the consistency and – ideally – the efficacy of the program, including in existing areas of deficiency such as presenting holistically information about engineering careers. That development work is ongoing, with a program re-evaluation planned upon the completion of that work to assess its efficacy. It is expected that those updated evaluation results will be further disseminated with an eye towards providing a useful model for other similarly situated institutions, partly with an eye towards mitigating some of the challenges inherent to the administration of such a loosely coupled system as conceptualized by Weick [6].

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**Appendix A**

The coding scheme for the syllabi review included the following:

- Length
    - Number of characters (including spaces)
    - Number of words
- Course instructor information
- Academic integrity
    - Academic integrity statement
    - Reference to Penn State's academic integrity policy
    - Links to academic integrity resources
- Students with disabilities statement
- ABET links and outcomes
- Prerequisites
- Required text
- Course organization
    - Course outline
    - Course objectives
    - Course objectives – student-centered outcomes
    - Course objectives – professional skills
- Engineering Passport for Success
    - Integration
- FYS goals and objectives
    - Includes FYS Goal 1

    - Includes FYS Goal 2
    - Includes FYS Objective 1
    - Includes FYS Objective 2
    - Includes FYS Objective 3
    - Includes FYS Objective 4
    - Includes FYS Objective 5
- Includes grading information:
    - Attendance
    - Participation
    - Written assignment
    - Out-of-class assignment
    - In-class assignment
    - Project
    - Presentation
    - Quiz or exam
    - Unique grading categories
    - Number of grading activities

Besides open-ended questions on the lengths of a syllabus, unique grading categories, and number of grading activities, all other components were coded binary with 1 for the inclusion on the specific item and 0 for its absence.

**Appendix B**

**Table 2. Non-Student Stakeholder Survey Qualitative Responses Regarding FYS Success**

| **Q1. How do you define success in a First-Year Seminar?** |
|---|
| Students exhibit a preparedness for college-level success and major selection |
| Students pursue and are retained in engineering |
| Students develop insights into engineering and career options it offers |
| Students exhibit engagement and willingness to make a difference with DEI issues |
| Students make connections and build community |
| Students successfully complete the seminar |
| Students leave with lessons to last a lifetime |

**Table 3. Non-Student Stakeholder Survey Qualitative Responses Regarding FYS Experience Preferences**

| **Q2. What would you like to see from a FYS experience?** |
|---|
| *From a Faculty Perspective:* |
| Guidance from the college on standard topics common to all departments |
| Additional industry engagement |
| Resources for instructors for student guidance |
| Teachers collaborating and learning from each other |
| Encouragement for faculty to increase interaction with students |
| A core set of learning outcomes with scope for faculty to add major specific materials |

| *From a Student Perspective:* |
|---|
| Community building and sharing activities/opportunities |
| Support of major exploration |
| Exposure to technical writing and professionalism |
| More design-based/problem-based learning activities |
| Training on life skills – economics, physical safety |
| Addition of DEI, Ethics, and sustainability topics |

**Table 4. Non-Student Stakeholder Survey Qualitative Responses Regarding FYS Credit Requirement**

| **Q3. The Taskforce is considering a three-credit model for the First-Year Seminar. What factors would impact your support of a three-credit model?** |
|---|
| Provision of broad guidelines with scope for instructors to be creative |
| No additional burden on students |
| Increase the credit hrs. needed for graduation |
| Resolution of General Education requirement issue |
| Resolution of the issue of increased faculty load |
| The course covers college success strategies, special technology interest exploration, and major exploration in equal proportion |
| Materials on preparedness for college-level transition/success, Preparedness for major exploration, develop a sense of belonging |
| More interactive activities + enrichment activities for students |
| A phased introduction of the course and time for developing the course |
| *Note*. Of the 38 participants, 26 were supportive and/or listed the issues that would impact their support of the 3-credit model, 9 were unsupportive and listed why they are unsupportive, 2 were non-committal, and one put down not applicable and did not answer. |

**Table 5. Stakeholder Survey Qualitative Responses Regarding Future Directions**

| **Q4. What other information would you like the Taskforce to consider as they move forward?** |
|---|
| Create a uniform FYS creation process and standardized program across campuses |
| Monitor and control added workload for the faculty |
| Be selective about who gets to teach the course |
| Caution standardization. Unique courses are also successful |
| More focus and time allowed for major discovery |
| Consider letting students take 3 1CR seminars |
| Focus on imparting success strategies to students |
| Resolve classroom shortages and keep small class size |

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