Developing the Entrepreneurial Self: Integrating Professional Growth in an Engineering Design and Entrepreneurship Course Sequence

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Entrepreneuring oneself: Integrating professional growth in an engineering design and entrepreneurship course sequence

Abstract

In the Department of Engineering Education and Leadership at the University of Texas at El Paso, we have a required two-course sequence at the junior level covering engineering design and engineering entrepreneurship. In its original embodiment, we knew that our students learned a great deal about product-market fit, design, and business models, but the course lacked content that provided direct learning about the students’ aspirations, professional growth, and career planning. To address this gap, we integrated design thinking about the students’ own lives into the formal content of the courses, using “Designing Your Life” (DYL) as one of our textbooks. Our idea was that the empirical design methodologies of Lean Launchpad and DYL would be mutually reinforcing—enabling each student to apply the hypothesis-testing approach of Lean Launchpad to his or her own professional development. Based on an in-class survey and a follow-up interview, data from two cohorts of students in this course sequence suggest that the DYL content made a difference in some students’ planning and life choices. About a third of the students reported changing their career plans in some way. Some of the DYL activities were more helpful than others. While no student found all of the activities had meaning for them, each of the DYL activities had meaning for some students. However, most of the students did not see the DYL content and the courses’ design and entrepreneurship content as mutually reinforcing. Future use of DYL should continue to maintain a variety of activities while strengthening the connection between the DYL activities and the design and entrepreneurship content of the courses.

Introduction

In the Department of Engineering Education and Leadership at the University of Texas at El Paso, we aim to instill entrepreneurial skills and values in all of our undergraduate students, many of whom choose our program precisely because they are interested in entrepreneurial careers. We therefore have a required two-course sequence in our Bachelors of Science in Engineering Leadership program covering engineering design and engineering entrepreneurship [1]. These are junior-level, project-based courses with Lean Launchpad [2], [3] and I-Corps [4] as principal inspirations for their curriculum and delivery. But while our students learned a great deal about product-market fit, design, and business models, the course lacked content that provided direct learning about the students’ aspirations, professional growth, career planning.

We realized that it might be possible to fill this gap by applying the courses’ lessons of design and entrepreneurship to each student’s own professional self. In a sense, each student would be her or his own people group. To this end, we integrated design thinking about the students’ own lives into the formal content of the course. Using “Designing Your Life” (DYL) [5] as one of our textbooks, we developed modules that complemented the course’s curriculum on design and entrepreneurship for start-ups. DYL applies design thinking through activities such as journaling of engagement, mind-mapping of interests,
and interviews with people who could serve as examples for careers and lives. We are now in the second year of applying this model in our course sequence. Based on surveys of and interviews with two student cohorts, in this paper we report on the extent to which this approach actually made a difference in students’ planning and life choices, discuss the kinds of decisions and actions students have taken as a result, and explore the extent to which the DYL and entrepreneurship content were mutually reinforcing.

**Background**

“Designing Your Life” is a hugely popular book [6], but our survey of the research literature suggests that evaluations of its use and effectiveness in guiding individuals through career planning are limited. Indeed, much of the available literature comprises dissertations and theses. Most of the reported research that we identified did not address whether DYL actually leads to change or confirmation of career plans.

Two studies have looked at a DYL course offered to undergraduates at Stanford University from 2010 to 2012. The data in the first study indicated that DYL led to increased career development self-efficacy and led to decreased dysfunctional beliefs but did not have a significant effect on career uncertainty, contextual stressors, or negative affect [7]. Overall, DYL did not promote career decision-making but instead counteracted common myths about careers and built self-confidence through productive action. As a result, the DYL course did not significantly affect the students’ status of their choices regarding career paths. In the second study, the evidence suggested that DYL led to change in personal growth initiative and, to a lesser extent, change in presence of meaning in life [8]. But this study did not report whether DYL actually led students to change (or confirm) their career plans.

The two studies from Stanford both focused on an entire course devoted to DYL. A different study of using DYL as a component of an undergraduate course at a Catholic liberal arts university in the Midwest looked at the effects of DYL on self-efficacy and career indecision. The study’s data suggested that using DYL moderately increased students’ sense of knowing what to do in life [9]. A fourth study, conducted at Arizona State University, focused on a single technique from DYL, the “odyssey plan,” in which students map out multiple ways in which their life could unfold. The study’s results suggested that in using the odyssey plan, by both first-year and fourth-year students, the students generally chose to be contributing members of society, recognized a need for experience, and referenced having a family or loved ones as an important aspect of success [10]. Again, though, neither of these studies reported whether DYL led to actual changes in (or confirmation of) students’ specific career plans.

The data in [7] indicated that DYL increased students’ design thinking with respect to idea generation and novel ideas. This suggests that DYL could have synergistic effects in an engineering course built around design thinking. Indeed, a course that involved both design thinking and Lean Launchpad-style empirical validation could both benefit from the additional methodological teachings of DYL and, conversely, help students see how techniques of design thinking and empirical validation can be applied to one’s own career
and life. In our junior-level course sequence, given a people group, students apply design-thinking skills and Lean Launchpad’s empirical techniques to identify and provide solutions for a significant problem facing the people group; in DYL, the people group is effectively the student him- or herself.

Accordingly, in this paper we explore whether DYL actually leads students to change (or confirm) career plans, identify which DYL activities students found most valuable, and examine whether DYL had a synergistic relationship with the course sequence’s main design and entrepreneurship content.

Research questions

Our research intervention involved applying DYL’s “entrepreneuring oneself” approach in the junior-level course sequence, and our study thus looks at the effects of this intervention. In particular, we look at the impact of the course activities associated with DYL through two cohorts of students who completed these activities. Specifically, we seek to determine the extent to which integrating DYL into the course sequence actually made a difference in students’ planning and life choices, the kinds of decisions and actions students have taken as a result, and the extent to which the integration of DYL into the course sequence had synergistic effects on learning. Our hypotheses are:

1. The DYL activities led students to change their career choice.
2. Some of the DYL activities were more useful than others.
3. The DYL and the other course content mutually reinforced each other.

Methodology

The study took place at the University of Texas at El Paso (UTEP) in the Department of Engineering Education and Leadership. UTEP’s student population is 80% Hispanic, with another 5% Mexican nationals [11]. And because 84% of UTEP’s students are employed [12] and have limited time for activities outside of class, to be effective this reflection about career choices has to be provided in the context of a course.

The pool of possible participants comprised 34 students: the 17 students from the 2016-2017 course sequence and the 17 students in the 2017-2018 course sequence. All subjects were then students in courses taught by one or both of the investigators. Subjects Participants were recruited via in-class presentations. Of the 34 possible participants, some had not continued in the program, were otherwise unavailable at the time of the study, or chose not to participate. Ultimately, 25 subjects participated in the study: 13 from the 2016-2017 cohort and 12 from the 2017-2018 cohort, resulting in a response rate of 74%. Of the participants, 11 were female and 14 were male.

The participating students completed an in-class survey that took about 30 minutes. These were followed, within a week of the survey, with follow-up interviews, to clarify ambiguous answers or to obtain missing answers, that took about 15 minutes. The survey asked seven open-ended and Likert-style questions:
1. Before doing the designing your life activities, what was your intended career?
2. After doing the designing your life activities, what was your intended career?
3. What were the major factors that led you to keep or change your intended career?
4. Here are the principal activities from designing your life (listed below). For each activity, please answer the following questions:
   - How important was this activity in helping you choose a career? Why? (1 = not at all important, 7 = very important);
   - How did this activity influence your career choice?
5. Were there any other activities or lessons that you think would have been valuable for you in figuring out your choice of career?
6. To what extent did designing your life affect whether you seek to pursue a career with a significant entrepreneurial component?
7. The designing your life course activities took place in the context of a two-course sequence in engineering design and engineering entrepreneurship.
   a. Did the things you learned in the course about engineering design and engineering entrepreneurship help you with the designing your life course activities? Please explain.
   b. Did the designing your life course activities help you in the course about engineering design and engineering entrepreneurship? Please explain.

The DYL activities used in the course were taken from the text and minimally modified to suit a classroom setting. The activities used in the course included:

- Creation of a life-design team
- Identification of key mentor(s)
- Creation of health/work/play/love dashboard
- Description of workview
- Liferview reflections
- Good time journal,
- Mindmap (based on good time journal)
- Odyssey plan (three alternative five-year plans),
- Life-design interviews
- Drafting of a job description and resume
- Choosing happiness discussion and reflection
- Failure immunity

Results

From the 25 surveys and associated follow-up interviews, responses were compiled, coded, and analyzed. We now turn to the data’s results with respect to our three hypotheses, and we also discuss the data results for the effect of DYL on entrepreneurial orientation.
Hypothesis 1

Our first hypothesis was that the DYL activities led students to change their career choice. Comparing the students’ answers as to their career plans before and after DYL, we observed that 36% of the students (n=9) reported changing their career plans, and 64% (n=16) reported not changing their career plans.

Perhaps not surprisingly, DYL had a greater impact on students who changed their career choice than on students who did not change their career choice. Students who reported a change in career choice had a statistically significantly higher mean importance score for DYL activities (4.93 on a scale from 1 to 7; p < 0.01) than those students who did not report a change in career choice (3.83). For these data, Hedge’s g was 0.76, indicating a medium, approaching a large, effect. An Anderson-Darling analysis of the data suggested that the data were normally distributed (p = 0.79). If importance scores for non-reported DYL activities are included, set to a nominal score of 1 on the 1-to-7 scale, the results are still significant (p < 0.05).

The validity of this result is limited by the lack of a control group, which was not realistically possible because (a) this is a required course in our program, and (b) students from other engineering majors would likely not serve as a valid control group because of self-selection bias of our majors. The best control would have been parallel sections of the course that omitted DYL, but this was not feasible for reasons of both logistics (our program’s small size would mean that sample sizes were too small to provide reliable results) and ethics (some students would not have the DYL content that the program perceived to be important to them). Nevertheless, this result is plausibly valid because the number of students changing career plans was so high. Over a third of the students reported that they changed career plans over this four-month period. If this were, in fact, the natural background rate of change of career plans, then on average every student would change career plans every year, which seems highly implausible. Rather, it is much more plausible that the observed rate of change in the course is attributable to using DYL.

The validity of this result may also have been limited by the student’s perceived desirability of reporting a significant impact of DYL, especially as the IRB consent form informed the students that the investigators conducting the study were the instructors in the course. However, the actual impact of this bias seems to have been low, as the students did not appear to hold back on negative evaluations. For one representative example, one student commented on the reflections on workview and lifeview that “I did not like this assignment & felt it was more ‘busy work’.” Another student judged three of the activities to be “not helpful.” To the extent that a please-the-experimenter bias was present in this study, future studies of our DYL program could be conducted by independent investigators.

A third issue with the study’s validity involves its retrospective nature. That is, the students were surveyed only at the conclusion of the course, and their recollections of their career choice before DYL could have been mistaken. This issue could be addressed
in future studies through a survey at the start of the course asking about the student’s current career choice.

For the subjects in this study, the most frequent career choice, both before and after DYL, was to be an engineer in industry. Of the students who reported changing career plans, three changed from engineer to business-related careers, two changed from engineer to teacher or professor, one changed from teacher to professor, and one unsure student decided to be an audio engineer.

Looking more closely at how DYL influenced these decisions, we found that of the 9 students who reported changing their career plans:

• 5 indicated that the change was based on DYL reflection activities (i.e., dashboard, workview/lifeview reflections)
• 1 indicated that the change was based on DYL life interviews
• 3 indicated that DYL had no impact on their decision

Thus, of students reporting a change in their career plans, 67% attributed it to DYL-related activities.

Of the 16 students who reported not changing their career plans:

• 11 indicated that the DYL activities led them to confirm their career choice
• 2 indicated that even though they continued with the same career choice they were to some extent questioning that choice
• 1 indicated that DYL changed the way the student thinks about things
• 1 indicated that the student had already done DYL-like activities
• 1 indicated that DYL had no impact on their decision

That is, out of the 25 students interviewed, only 4 students (16% of respondents) reported that the DYL activities did not have an impact. Conversely, 17 of the 25 students (68%) indicated that the activities influenced their career decisions, either influencing them to change or confirming their existing career plan.

**Hypothesis 2**

Our second hypothesis was that some DYL activities were more useful than others. The data suggest that this is true.

Overall, students’ mean assessments of the importance of the DYL activities in helping them choose a career varied, on scale of 1 to 7, from a low of 3.09 (mind-mapping) to a high of 4.96 (odyssey plan), as shown in Figure 1.

The aggregate data tend to mask large differences in ratings from different students. Every DYL activity was rated as 6 or 7 by at least one student, and every activity was rated as 1 or 2 by at least one student. Figure 2 presents the number of students who rated DYL activities from 5 to 7. These data suggest that the most valuable DYL activities were, consonant with the results shown in Figure 1, mentors, health/work/play/love
dashboard, odyssey plans, job description/resume, and choosing happiness. But even mindmap, which scored the lowest, had its enthusiastic advocates.

Figure 1. Mean importance rating of DYL activities across all subjects (1 = not all important, 7 = very important).

Figure 2. Number of participants who rated DYL activities as 5 or higher in importance (1 = not all important, 7 = very important).
There were large differences in relative assessment of the importance of DYL activities between students who confirmed their choice of career and students who changed their choice of career. As shown in Figure 3, the good time journal activity, and to a lesser extent the life-design team, life-design interviews, and job description/resume activities, were relatively more important to the no-career-change students than to the career-change students. And the workview, lifeview reflections, choosing happiness, and especially the failure immunity DYL activities were relatively more important to the career-change students than to the no-career-change students.

**Figure 3.** Differences in importance scores between no-career-change group and career-change group. A positive value indicates that the no-career-change group rated the DYL activity higher in importance than career-change group, and a negative value indicates that the no-career-change group rated the DYL activity lower in importance than career-change group, relative to the mean rating for all DYL activities.

The participants’ qualitative responses in the surveys and interviews provided suggestive evidence that these differences were linked to the functions of the DYL activities. Specifically, the dashboard activity relates primarily to work-life balance, and this seemed to be of greater relative importance to students for whom DYL helped to confirm their career choice. Conversely, workview/lifeview was DYL’s key activity involving reflection, which was the DYL function most cited by the career-change students in explaining their decision. The choosing happiness and failure immunity DYL activities may have been relatively more important for the career-change students because they empowered the students to make changes in their lives. This remains speculative because some students’ recollections of these activities were at least partially inaccurate.
In sum, the data suggest that while no student found all of the activities had meaning for them, each of the DYL activities had meaning for some students. Further, the results suggest that certain activities may be better suited to helping students confirm their career plans while others may be better for helping students when they wish to change their career plans. Students who confirm their careers tend to find meaning in journaling positivity and energy in their daily activities, and students who change career plans tend to find meaning in reflection on their philosophies of life and work. Therefore, a balance of both types of activities will likely be useful in a classroom setting to help a variety of students at different points in their career path decision-making process.

Hypothesis 3

Our third hypothesis was that the DYL and other course content mutually reinforced each other. The data suggest that this hypothesis was largely untrue. As shown in Table 1, the survey and interviews, only 44% of the students reported that the DYL course activities helped them in the course about engineering design and engineering entrepreneurship, and only 32% reported that the things they learned in the course about engineering design and engineering entrepreneurship helped them with the DYL course activities. Likewise, only 32% of the students reported that they saw the DYL and the engineering design and engineering entrepreneurship content as mutually reinforcing. Many students reported that they saw no connection at all and that they regarded the DYL part of the course as “busy work”—despite the fact that more than a third of the students changed their choice of career. However, none of the four students who considered DYL busy work reported changing choice of career.

Table 1. Mutual impact of Designing Your Life (DYL) activities and engineering design and engineering entrepreneurship (DES/ENT) content in the course.

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<th>Helped</th>
<th>Did Not Help</th>
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<tr>
<td>DES/ENT → DYL</td>
<td>11</td>
<td>14</td>
<td>44%</td>
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<tr>
<td>DYL → DES/ENT</td>
<td>8</td>
<td>17</td>
<td>32%</td>
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<tr>
<td>DYL ↔ DES/ENT</td>
<td>8</td>
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<td>32%</td>
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There does not appear to be a relationship between a student’s decision to change career (or not) and the student’s perception of a connection between the DYL and other course content (Chi-square, p > 0.9).

Some of the students did see the connection explicitly. For example, one student wrote, “By applying design principles to my life, I was able to take a more objective look at my life and perform a qualitative analysis to it.” Another student wrote, “It was like an exchange. Both things helped me understand both transversely.” The students who saw no connection often saw DYL being about self-discovery, in contrast to the course’s design and entrepreneurship content. For example, one student wrote, “It felt like the class [was] about product design & entrepreneurship. Designing your life activities felt like a counseling session of a ‘get to know yourself’ crash course. They were completely different things.” This is not to say that the students did not find value in DYL. In fact, this same student went on to write, “However, I do believe the designing your life...
activities were important and should be discussed, but earlier on in the program, NOT when you’re almost done and it feels like it’s too late to go back and try something else!”

**Impact on Entrepreneurship**

This study did not have a hypothesis relating students’ attitudes about entrepreneurship and DYL because the course sequence itself had a significant entrepreneurship component. While requiring students to take an entrepreneurship course does not necessarily change students’ entrepreneurial intentions [13], it was uncertain if the DYL content in the course would affect whether students sought to pursue a career with a significant entrepreneurial component. In our study, this issue was complicated by the fact that most of the course content—the non-DYL content on design thinking and Lean Launchpad—was inherently entrepreneurial, so we were concerned that it would be difficult to separate DYL’s impact on entrepreneurial intent from the impact of the other course content. With that caveat in mind, 32% (8 of 25) of the students reported that the course’s DYL material did affect whether students sought to pursue a career with a significant entrepreneurial component.

Interestingly, this effect was not necessarily to increase entrepreneurial interest. In some cases, the student already had a strong entrepreneurial intent. For example, one student wrote “The designing your life activities helped me realize that I’ve always been an entrepreneur at heart.” For other students, the DYL activities may have confirmed non-interest in entrepreneurship. One student wrote, “It didn’t. I don’t want to do anything with that.” And for other students, the DYL activities related to personal insight unrelated to entrepreneurship. For example, one student wrote, “It helped me to discover who I am as person, and what I wanted for my life, not to pursue a career with a significant entrepreneurial component.”

The effect of DYL on entrepreneurial intent does not appear to be correlated with the student’s decision to change (or not to change) careers (Chi-square, p > 0.9).

**Recent Developments and Future Plans**

The junior-level course sequence uses the Innovation Canvas [14] as an organizing schema. The first semester focuses primarily on the Explore, Ideate, and Design quadrants of the Innovation Canvas, and the second semester focuses primarily on the Market quadrant. In the first year of integrating DYL in the junior sequence, we included it in the second semester. We now see DYL as relating most strongly to the explore-ideate-design material, and consequently in the second year of using DYL we have moved DYL into the first semester of the sequence. Correspondingly, we are introducing “Business Model You” [15] (BMY), which applies the concepts of the Business Model Canvas to one’s own life, just as the students are working on the “market” quadrant of Innovation Canvas, which corresponds to the Business Model Canvas. In this way, we expect that the supporting texts, DYL and BMY, parallel the engineering design and engineering entrepreneurship content of the course sequence’s two semesters. By the end of the two-course sequence, students will have developed a life plan, interviewed role
models, developed a career-support team, and applied hypothesis testing toward shaping their futures.

Our greatest concern from our experience with DYL involves the students’ not perceiving the methodological connections between DYL and the course’s design-thinking and entrepreneurship content. As a result, we plan in future years to introduce course activities in which students will be guided to see these connections.

The introduction of DYL into the curriculum, as described in this paper, was the department’s first effort to include career reflection beyond advising. The data we report here represent our first opportunity to evaluate this initiative, and we may refine our use of DYL as we gain additional results and experience. Some students reported that they would have benefited from having DYL earlier in their academic program. Possibly we could thread DYL through the curriculum, particularly in the first three years, in ways similar to which we now thread the topics of leadership, business acumen, and project management.

**Conclusion**

Based on an in-class survey and a follow-up interview, data from two cohorts of students in a junior-level course sequence on design and entrepreneurship suggest that DYL content actually made a difference in students’ planning and life choices: about a third of the students reported changing their career plans, and nearly half reported that it helped confirm their original career plans. Some of the DYL activities were more helpful than others; while no student found all of the activities had meaning for them, each of the DYL activities had meaning for some students. However, most of the students did not see the DYL content and the course’s design and entrepreneurship content as mutually reinforcing. We plan to address this by introducing course activities in which students will be guided to see these connections.

**References**


