Career Advising Workshop Exercise for Software Engineers

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The Challenge: Helping STEM Students Develop a Job Search Focus

Carnegie Mellon University’s Silicon Valley Campus (CMU-SV) attracts science, technology, engineering, and math (STEM) students who want to make an impact in Silicon Valley, an area known for its innovative and entrepreneurial culture. The goal of the various CMU-SV masters programs is to provide a transformative educational experience – one that changes how the students perform in the workplace. The students are immersed in a “learn-by-doing” environment that makes them valuable members of the workforce as they graduate with practical experience in high-demand technical areas.

Despite this “state-of-the-art” graduate education in software engineering and software management, when it comes time to find employment, these students are often confused about career direction. When asked, “Tell me about your ideal job,” many of the students describe generic software developer or software manager positions that, in reality, vary widely within the software industry. While they are full of enthusiasm and passion for the subject matter, some students have no clear notion of how to map passionate job activities into the job search, and they are often overwhelmed by the number of job postings in the software engineering and software management fields.

Some students seek STEM positions because they recognize those jobs are in high demand, not because they are naturally drawn to the profession. Some international students know that STEM jobs may offer easier visa transition and employment stability in the United States. But these students do not know how this new degree will compliment their previous degree, fit into a career trajectory, or to what extent they can
use their new skills in a variety of jobs. For these students, starting the job search is
difficult since “getting a high tech job” is difficult to translate into a concrete job search
strategy.

The challenge is connecting the student’s new skills to actual open jobs in the
workforce. This requires categorizing a plethora of jobs into areas of common skill,
activity, and personality. The various career development exercises and tools typically
used to assist students in their searches often contain generalized results pointing to broad
job types, and therefore do not appear to be tools to help software engineering and
software management students find specific examples of what jobs they should explore.
Another example of this issue is found in the Occupational Information Network
(O*NET) listings for software developers, specifically 15-1131, 15-1132, and 15-1134,
which are very general in nature. A career advisor cannot further guide a student into the
software industry based on this information. Career advisors are experts in the process of
identifying a career, counseling on how to find a job, and instilling networking skills.
CMU-SV’s career advisor is not an expert of every aspect of the software development
process, as she has never professionally written software. When students ask for advice
and guidance, she relies on domain knowledge and experience in working with previous
students. The current job index does not provide enough detail to guide a student into the
software profession, a challenge as these students have a small window of time (12
months) to finish their education and find a job.

As part of the CMU-SV masters program orientation, the authors sought to
provide concrete guidance to address this critical question. However, after extensive
research, the authors were unable to find an appropriate exercise or instrument that would
help students develop a focus within the industry as they pursued their graduate studies at CMU-SV. To solve these problems, the authors created a workshop to advise CMU-SV STEM graduate students to articulate their ideal job description by mapping the six Holland Codes to correspond with the software industry.

**STEM Information and Its Role on Helping Workers Compete**

The science, technology, engineering, and math (STEM) fields play an important role in Silicon Valley, known for its innovations and entrepreneurial culture. An increasing number of students are enrolling in STEM programs at universities, including Carnegie Mellon University in Silicon Valley, which offers graduate degrees in Software Engineering, Software Management, Electrical and Computer Engineering, and Information Technology. But the recent increase in students enrolling in these programs may not be enough: it is estimated that the United States will create eight million new STEM jobs by 2018 (Carnevale, Smith, & Strohl, 2010). A recent U.S. Department of Commerce report shows that in the past decade STEM jobs grew at three times the rate of non-STEM jobs, and that STEM workers have greater job stability. Occupations in these fields are expected to grow by 17 percent by 2018, nearly double the rate of growth in non-STEM occupations. (Langdon, McKittrick, Beede, Khan and Doms, 2011) And locally, STEM jobs will account for six percent of all jobs in California by 2018, with a total of 1.1 million STEM jobs, up from 894,860 in 2008. (Carnevale, Smith, & Melton, n.d.).

Employers throughout Silicon Valley understand that to remain globally competitive in an innovative economy there must be a reliable talent pipeline producing well-qualified STEM-competent workers. Most jobs now require science and math
competencies, the use of technology and critical thinking skills, computational training skills, project-based learning, and working virtually to solve issues and problems.

**Educational Context of the Romero-Sedano Exercise**

The educational objectives of CMU-SV’s graduate programs focus on substantially increasing the leadership potential and the business and technical relevance of software professionals, greatly expanding their career opportunities. To achieve this goal, students need to master modern software engineering and product development methods, learn to align project decisions with business goals, and develop the communication, teamwork, and negotiation skills critical to successful technical leadership. The students achieve these skills through authentic project work reflective of real-world scenarios. The programs use “learn-by-doing” and “story-centered curriculum” pedagogy as the mechanism for the students to acquire these skills. The programs minimize the transfer between the educational experience and the workplace by situating the student in a realistic, problem-centric context (Bareiss & Sedano, 2009). Whenever possible, students experience the learning objectives by executing a real-world or synthetic project. If implementing a project is too time consuming, then the faculty simulate the learning. Thus, the students create authentic work products in a team setting, which is exactly the way they will be required to perform in industry.

**Goals of CMU-SV Student Orientation**

At the beginning of each new graduate program, CMU-SV hosts an Orientation for new students. The purpose of Orientation is to introduce incoming students to the culture and norms of the unique campus experience. The goals of Orientation are to welcome the students and have them feel part of the campus community, start the team
formation process by equipping students with skills to build high performing teams, and communicate core values on how to run effective meetings. The goal of the exercise is to give students an opportunity to start thinking about their career goals and how the graduate program will impact their career goals.

**STEM and Holland Codes**

During Orientation, the authors wanted an exercise that would tackle an important topic from day one – what will the students do after graduation? When asked, “tell me about your ideal job,” most students would describe a stereotypical software development or software management position that would apply to many job postings in the software industry. When the students start their job search, they can struggle with filtering appropriate positions from the morass. Some can rely on necessary technologies (e.g., “I want a Java position”) or types of companies (e.g., “I want to work for Apple”), yet others simply don’t know where to start. Typical job descriptions sometimes do not help as companies will list technical requirements, such as programming languages and technical frameworks which are often overly ambitious or just plain wrong. For example, if a programming language was invented five years ago, it’s impossible for anyone to have eight years of experience with it, but students will see job postings with that requirement. When considering job activities, there is little guidance to which ones are more important to the employer. The authors needed a way to start the conversation about career planning from a different perspective. Often the sheer number of job postings in software engineering and software management fields overwhelms the students. After the authors were unable to find an exercise to accomplish this goal, the
authors created a variant of Richard Bolles’ (2012) “Holland Party Game” for software professionals.

**Romero-Sedano Exercise Description**

The “Holland Party Game” was presented to the students as a fun exercise that was non-threatening in tone and that had no perfect answers. The six different groups (Realistic, Investigative, Artistic, Social, Enterprising and Conventional) were described to the students, who then identified their top three Holland Codes. The authors hung up large sheets of papers around the room with a letter representing each Holland Code. The students were then divided into groups based upon their top Holland Code. If a group had more than eight people in it, the group was subdivided into two separate groups. After the students discussed what they had in common in the software industry, each group verbally generated their ideal job description. Each group reported back to everyone in the workshop.

**Romero-Sedano Exercise Results**

Before the event, the authors suspected that certain job activities would show up in certain groups. For example, the authors expected that people who love solving bugs and problems in software would be in the “Investigative” group. Instead of biasing the participants towards our initial thoughts, open-ended prompts were purposefully provided to the students.

After transcribing the session recordings, the authors mined the data looking for trends and patterns. Eventually, the authors classified the responses into three categories, “Attitudes and Career Values,” “Passionate Activities,” and “Job Types.” For our next
Orientation, the authors will begin with this framework and validate whether people in the group resonate with it or not and ask how to improve the framework.

Here’s an example of using this framework: a student realized that she had artistic tendencies and should explore creative fields in the software industry. She searched for jobs that utilize her technical skills as well as her artistic side. She is now employed in a startup working in User Interface design and programming, and she feels more satisfied than if she had taken any another position.

**Initial Results by Holland Code**

The following are the initial results of the matching of software industry skills with the Holland code descriptions:

1. **Realistic**

In general, realistic people are “the doers.” They tend to follow tradition, have common sense, and take a more practical approach to life. They tend to have mechanical or physical abilities, enjoy operating equipment or machinery, using tools, and working outside (Bolles, 2012).

**Realistic in the Software Industry**

**Attitude / Career Values**

- Works an idea from inception to customer delivery
- Prefers autonomy (e.g. the freedom of an early startup)

**Passionate Activities**

- Building software that solves real problems
- Getting things done
- Problem solving
• Developing open source software and getting paid for doing it

Job Types
• Developer
• Sponsored open source contributor
• Startup software engineer
• Senior software engineer
• Principal software engineer

2. Investigative

In general, investigative people are “the thinkers.” They love to learn, analyze, solve problems, and conduct research. They tend to be independent and inquisitive (Bolles, 2012).

Investigative in Software Industry

Attitude / Career Values
• Finds the best solution
• Works with data
• Is intuitive

Passionate Activities
• Problem solving, digging into problems
• Scaling software
• Understanding how software works at every layer
• Understanding the big picture of code
• Writing future-proof code that will deal with future requirements and changes
• Designing algorithms
Job Types

- Developer
- Field engineer (someone who troubleshoots client installation issues)

3. Artistic

In general, artistic people are “the creators.” They appreciate art, creativity, innovation and self-exploration. They enjoy various types of work related to fine arts, visual arts, writing and anything that utilizes the imagination. They prefer a more independent and unstructured approach to life (Bolles, 2012).

Artistic in Software Industry

Attitude / Career Values

- Prefers blurring the boundaries, prefers the messy blends
- Wants to work in an environment where failure is ok, otherwise experimentation is impossible
- Needs empowerment to try new ideas

Passionate Activities

- Trying new things and enjoying variety
- Exploring alternative ways and mixing things up
- Welcomes feedback on ideas
- Writing user narrative stories and scenarios
- Solving problems

Job types

- Developer
- Product owner / Product
• “Story card writer”
• User interface designer

4. Social

In general, social people are “the helpers.” As good listeners, they enjoy helping, teaching, and training. They enjoy working in team-oriented situations. They possess good written and verbal communication skills (Bolles, 2012).

Social in Software Industry

Attitude / Career Values
• Loves bouncing ideas off other people

Passionate Activities
• Collaborating
• Demoing
• Performing code reviews
• Pair programming
• Mentoring

Job Types
• Developer
• Team lead
• Scrum master
• Inter-team liaison
• Sales engineer (an engineer who supports the sales team, visiting prospective clients)
• Connector or Linker
5. **Enterprising**

In general, enterprising people are “the persuaders.” They lead, influence, persuade and motivate others. They thrive on taking risks and making decisions. They enjoy power and status. They take a spontaneous approach to things. They tend to have good verbal skills and enjoy meeting new people. They enjoy the limelight such as public speaking and being in front of people (Bolles, 2012).

**Enterprising in Software Industry**

**Attitude / Career Values**

- Takes initiative
- Is in control and in charge
- Manages the end-to-end responsibility for a product

**Passionate Activities**

- Managing people
- Leading teams
- Strategizing
- Building up products
- Starting a company

**Job types**

- Team lead
- VP of Engineering
- CTO
- CIO
• Entrepreneur

6. Conventional

In general, conventional people are “the organizers.” They love organization, accuracy, and efficiency. They work well with data, numbers, finances, process, and procedures. They follow through on tasks and issues. They prefer structure and are methodical in their approach (Bolles, 2012).

*Conventional in Software Industry*

Attitude / Career Values

• Creates and adheres to processes

• Does it step-by-step

Passionate Activities

• Planning and organizing a software product

• Designing a system from requirements to quality code

Job Types

• Developer

• Process manager

• Project manager

Sample Sizes

The workshop exercise was done twice with two different student populations in each round (see Table 1).

<table>
<thead>
<tr>
<th>Holland Type</th>
<th>Round 1 Software Management</th>
<th>Round 2 Software Engineering</th>
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<td><strong>Table 1: Numbers &amp; Percentages of Students in Workshop</strong></td>
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Interestingly, the Occupational Information Network (O*NET) listings for software developers, 15-1131, 15-1132, and 15-1134 have the interests IRC, CIR, and IC. 51% of our students listed one of these Holland Codes as their top code.

The creation of this particular exercise was only possible by the joint collaboration of a career adviser and a faculty member with expertise in the domain. Each brought their insight into how to advise STEM graduate students and what opportunities exist for them in Silicon Valley.

**Future Research**

The followings tasks will be helpful in coming years to execute this exercise, including:

- Use a formal assessment to verify the student’s Holland Type, instead of an informal Holland Type handout
- Create pre and post surveys to measure changes in the students’ positions
- Try this with a different discipline
- Alter the room activity to have the participants validate the Attitudes, Passionate Activities, and Job Types in the framework results
Conclusion

The implementation of the modified Holland Party Game into the CMU-SV Orientation was an excellent strategy to benchmark the starting point of the new class and their views on career goals and what professional opportunities they have identified. The activity has already resulted in more traffic to the CMU-SV Career and Professional Development Center, as well as more students who are ahead in terms of their career research compared to students from prior years.

Adapting the Holland Party Game to the software industry enabled CMU-SV students to clearly articulate those aspects of software development and product development that most appealed to them. This exercise served as a starting point for career planning discussions and reframed the question “what is your ideal job” to “what do you most enjoy about your profession?” Once students understood which job functions invoked their professional passion, they were able to selectively target jobs that reflected their professional priorities.
References


About the authors

Mikelynn Romero is the Associate Director of Career Services and Student Affairs at Carnegie Mellon University in Silicon Valley. Mikelynn Romero, M.Ed. is a two-time graduate of the University of Southern California, where she attained her Bachelor of Arts in Political Science and her Master of Education in Postsecondary Administration and Student Affairs. Mikelynn's professional career began in the hiring department of the Los Angeles office of the global law firm of Skadden, Arps, Slate, Meagher, and Flom LLP. Since graduate school Mikelynn has worked at Trinity University, the University of Southern California, the New Mexico Higher Education Department, Los Alamos National Laboratory and managed a statewide talent attraction program called NM CareerMatch.

Her professional interests are talent attraction, career development and student development theory. She is a member of ACPA - College Student Educators International, NACE – National Association of Colleges and Employers, NASPA - Student Affairs Administrators in Higher Education, NCDA – National Career Development Association and recently served as President of the NCDA’s New Mexico Chapter. In 2009, Mikelynn was honored as one of New Mexico’s “Women of Influence” by the New Mexico Business Weekly. Contact her as follows:

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