

# Uncovering Student Values for Hiring in the Software Industry

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This article provides an analysis of student responses to an exercise used in a computer ethics and a software engineering course to raise awareness of issues related to hiring, including issues of professional responsibility and diversity. Students from two different universities were asked to evaluate four candidates for two positions in a fictitious software company. They then developed a set of criteria for evaluation and constructed an argument to support their choices. After discussing their choice with others in the class, students could change their hiring decisions. Students' hiring criteria were coded using emergent categories, inferences in the arguments were coded according to the criteria, and reasons for changing hiring decisions were coded. Students considered criteria that fell into five areas: technical skills, soft skills, personal traits, previous employment, and career/job considerations. Reasons for changing hiring choices included previous experience, diversity considerations, people skills, leadership skills, and reaching consensus. The article also reports inferences students made about the job candidates.

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## 1. INTRODUCTION

In many computer science programs, most students intend to work in industry after they graduate. They will immediately encounter two related scenarios that they will not likely have thought about until it is perhaps too late. The first is to construct a resumé and develop a story about who they are, what their professional goals are, and why they are interested in a particular company or organization. The second is that when they are working in industry they likely will be faced with the task of hiring new personnel.

This article describes an exercise that is designed to get students thinking about presenting themselves as job applicants by asking them to make hiring decisions. The motivation behind this exercise is to encourage students to reflect on skill sets they want to see in job candidates. The exercise also provides a mechanism to determine target program outcomes, as seen by students. For example, if a student determines that a hiring criterion for a software developer is the ability to develop test plans, then it is reasonable to assume that this student believes developing test plans should be a program outcome of a Computer Science (CS) major.

Asking students to make hiring decisions encourages reflective practice. Schön [1995] argues that experts have “built in” or tacit knowledge and it is through the art of reflection on their activities that they improve their craft. Hiring new employees requires judgment about humans and appropriate skill sets. Asking students to make hiring decisions forces them to think about rubrics and articulate the rationale for their choices. The hiring exercise is based on this theory that reflective practice will advance students’ knowledge.

In addition to encouraging learning through reflective practice, the hiring exercise activity provides instructors and researchers a lens to view program outcomes valued by students. The Accreditation Board for Engineering and Technology (ABET) proposes 11 engineering program outcomes [Lattuca et al. 2006], some of which include applying knowledge of math/science, conducting experiments, designing systems, functioning on teams, identifying problems, understanding ethical responsibility, and communicating effectively. The hiring exercise provides an opportunity for instructors and students to see alignment (or misalignment) of students’ values and departments’ values.

The exercise was administered in the context of computer ethics and software engineering courses, where issues of professional responsibility and diversity were raised and discussed. Students were given a brief, which describes a small fictitious software company, DotEdu. Students were asked to evaluate the candidates, explicitly list criteria used to evaluate them, choose a candidate for each position, and construct an argument to support those choices. The remainder of this article describes related work, the exercise in more detail, and results obtained by analyzing students’ work, their decisions, and criteria for hiring.

## 2. PREVIOUS WORK

There have been many studies on the criteria industry uses to predict effectiveness; we present a small sampling here. Bailey and Stefaniak [1999]

used surveys, interviews, and focus groups to determine what employers in the IT industry valued as important non-technical skills for employees. They identified a large number of both soft skills and business skills and ranked them according to how frequently they were mentioned by the 325 IT professionals surveyed.

Ferguson [2005] administered a survey to corporate CIOs or their chief recruiters to elicit the technical and non-technical criteria that they valued. In addition, respondents were asked to state how much each criteria had changed in importance over the past three years. One of the rationales behind this design was to compare to see if the events of September 11, 2001 had changed the emphasis in hiring criteria.

Tapia and Kvasny [2004] identify several factors in the recruitment and retention of women and minorities. They argue that there are a number of recruitment and organizational strategies that can attract and retain under-represented groups.

Lang et al. [1999] conducted a study of aerospace and defense companies to find out what knowledge, skills, and experience industry personnel thought were important for engineering graduates. The three most important undergraduate outcomes were design skills, an upper-division team-based capstone experience, and an understanding of the concept that form follows function. A survey instrument was used to elicit criteria important when assessing college graduates.

In this study, we examine the students' hiring criteria and process.

### 3. INSTITUTIONAL BACKGROUND

Students from two universities completed the hiring exercise; therefore, the context for the activity differed. At the University of Washington, Tacoma (UWT), 30 students completed the exercise in a computer ethics course. The course is ten weeks long with topics from general ethical frameworks to professional responsibility. The primary mode of inquiry includes argument and evidence. The only prerequisite for the computer ethics course is CS1. All students were transfer students from community colleges; therefore, there was a mix of traditional and non-traditional students.

At the University of Portland (UP), seven senior-standing students completed the exercise in a software engineering course. The course includes a major design and implementation project, in addition to covering several development models. The university attracts traditional-age students directly from high school. Human subjects approval was sought and received at both UWT and UP.

UWT students read three articles related to educational software, gender, and reverse discrimination [Adam 2000; Campbell 1999; Sher 1999] prior to completing the exercise. Campbell [1999] discusses how educational software can be developed to be more inclusive, especially of women. Adam [2000] examines some work on gender and computing and argues for feminist ethics to shape the way in which discussions about gender and computing are framed. Sher [1999] discusses the philosophical basis for reverse discrimination in

hiring and argues that reverse discrimination based solely on race and/or gender is at best an approximation to determining who has been disadvantaged by past discrimination.

UWT students also heard from a panel consisting of people who have experience hiring. The panel discussed resumés, how diversity affects hiring decisions, and general societal issues.

UP students were given the Adam [2000] and Sher [1999] articles as optional reading prior to completing the hiring exercise.

Although the settings differed for the two subject populations, many characteristics of the study were consistent across the two institutions. Using two institutions countered biases of studying a single population. Students at both institutions were given the same hiring brief (with cities and companies customized to each location) and asked to list their criteria, their choices for hiring, and a justification for who they chose. Students submitted their hiring deliverables prior to formal discussions in the lecture. The exercise was completed at the end of the academic term at each institution.

#### 4. THE EXERCISE

*DotEdu Brief:* Students were given a brief about DotEdu and the candidates. The brief defined what a program manager is, described DotEdu and its mission, the kind of software it produces, and its commitment to diversity. The brief also provided summaries of four candidates. Appendix A contains the complete hiring brief.

*Candidates:* Here is a simplified summary of each candidate.

*Mary Plata:* graduated three years ago, 3.7 GPA; since graduation, worked as an instructor for courses in C and C++ at a nearby university; excellent teaching reviews; designed the Web pages for her high school; organizes events for the elementary school that her six-year-old son attends; wants to be involved in developing software; wants to be a part of a company that contributes to society; strongest in the technical part of the interview; seems friendly; probably will work well with others; not afraid to speak her mind; white female (exact ethnicity unknown).

*Oscar Escalante:* graduated six years ago, 3.0 GPA; since graduation, worked at Weyerhaeuser (Web development) and then another company (either Boeing or Intel, depending on the university) (software developer); meets deadlines and works well with others on the team; designed Web pages for his church; had trouble in introductory science classes and wants to help freshmen in similar situations; wants to expand the scope of his skills in software development; left Weyerhaeuser because they downsized and offered him a good exit package; had much trouble with the technical part of the interview; seemed unconfident; friendly, enthusiastic; probably will work well with others; Hispanic male.

*Joseph Anderson:* graduated four years ago, 3.8 GPA; since graduation, co-founded a company called GameHouse Software (ten employees; strategy, board, and real-time games) with other graduates; works with computer clubs in local high schools; left GameHouse because Nintendo bought the company

and the cofounders split the profits; wants to continue with the same kinds of programming at GameHouse; no trouble with the technical part of the interview; quiet person, but when talking about software and applications, he gets motivated and excited; probably will work well with others; white male (exact ethnicity unknown).

*Michael Simmon:* graduated four years ago, 3.4 GPA; was manager at a family hardware store after high school; since graduation from college, worked 60-hour work weeks at Microsoft (web development for MSN) and either Boeing (entry-level development for the visualization of mechanics of parts of planes) or Nike (entry-level development for the visualization of shoes) (depending on university); hard-working, contributed to design discussions, never afraid to speak what he was thinking; left Boeing/Nike because of downsizing; when growing up, his only access to computers was at school; wants to give back to kids who grew up like he did; had some trouble with the technical parts of the interview; friendly, not afraid to speak his ideas and defend them; black male.

*Hiring Deliverable:* Students were asked to list their criteria for evaluating the candidates. They were encouraged (but not required) to use a numeric table to summarize their analysis. Also, they were required to provide a written argument to support their choices. Also, if there was other information that would help make the decision, students were asked to specify what information would be helpful.

#### 4.1 In-class Discussion

On the day the assignment was due (the last class period of the academic term), students engaged in discussions about the hiring decisions. At UWT, students engaged in small group discussions, organized so that there were students with different choices for program manager. In these discussions, the goal for a student was to try to convince others that his or her choices were the right ones. This took about 40 minutes. The instructor facilitated discussion within the groups. Then there was a full class discussion, where each group shared what was discussed. Topics included what criteria were used, what the points of disagreement were, what it means to be a good program manager or software developer, and diversity issues. This took about 45 minutes. Finally, there was a short general discussion, followed by an exercise in which the entire class acted as the hiring committee to vote on whom to offer positions.

At UP, all 7 students participated in a discussion. Students revealed their choices for each position. Following an initial vote, students provided criteria for their selections and tried to convince others to make the same decisions. First, students discussed the best candidate for the program manager position. Second, the discussion turned to who to hire for the software developer position. In total, the discussion lasted 40 minutes.

#### 4.2 In-Class “Post-Discussion” Questions

After the discussion finished, students were asked to complete an in-class exercise, in which they individually answered the following questions: 1) What were the two most relevant points in the in-class discussion?, 2) What were the

Table I. Subject Populations

	UWT	UP
Male	20 (90.9%)	6 (100%)
Female	2 (9.1%)	0 (0%)

two least relevant points in the in-class discussion?, 3) What are your (possibly new) choices for the two positions?, and 4) Why did you change your position (or not)?

## 5. RESULTS

### 5.1 Recruiting and Data Collection

After the discussion was over, students were asked to sign consent forms to allow their responses (the prediscussion assignment and post-discussion exercise) be used for analysis. There was no remuneration to participate in the research. The resulting dataset for analysis includes work submitted by 22/30 UWT students and 6/7 UP students who gave consent. The UWT students in our study included a full range of students in the major, from those just entering the major at the junior level to those nearing graduation. All six UP students were seniors with one semester to complete before graduation. Table I shows the subject populations with respect to gender (those who gave consent) from each institution.

### 5.2 Data Analysis

To gain an understanding of students' decision-making processes, we answer the following research questions:

- (1) What were the criteria that students used?
- (2) What personas did students develop in their justifications?
- (3) What were students' hiring choices?
- (4) How many students changed their hiring choices? Why?

**5.2.1 Student Criteria.** We gathered criteria from tables presented in the hiring deliverables. Of 28 submissions, 25 included tables that were used for the data analysis. Using content analysis [Stemler 2001], we coded each criterion appearing in any table into 42 emergent categories. We did not use a priori categories when coding the criteria; instead, analysis was data-driven and led to 42 categories that students used. See Appendix C for the list of initial categories. Following the initial coding, we grouped similar categories. For example, the new combined category called Management included Management Skill, Supervisory Skill, Ability to Motivate Others, and Leadership. During each grouping of initial categories, we argued to consensus about each merger. The merged set included 25 distinct categories. Table II shows the 25 distinct categories and their popularity grouped into five areas: technical skills, soft skills, personal traits, previous experience, and company/job considerations.

For the program manager position, the average number of distinct criteria students identified in the hiring deliverable was 5.48, with a minimum of 2



Table II. Hiring Criteria Categories

Category	Program Manager			Software Developer		
	Total	UWT	UP	Total	UWT	UP
<i>TECHNICAL SKILLS</i>	25 (100%)	19 (100%)	6 (100%)	25 (100%)	19 (100%)	6 (100%)
Technical Ability	18	14	4	20	15	5
Software Engineering Exp./Skill	8	6	2	8	6	2
Domain/User Knowledge	3	3	0	4	4	0
Visual Information Skills	1	1	0	3	3	0
Flexible Skills	1	1	0	1	1	0
<i>SOFT SKILLS</i>	22 (88%)	17 (89%)	5 (83%)	21 (84%)	16 (84%)	5 (83%)
Social/People Skills	12	8	4	10	7	3
Management of Others	10	8	2	6	5	1
Communication Skills	9	7	2	9	7	2
Team Skills	8	7	1	9	8	1
Organizational Skills	5	4	1	2	2	0
<i>PREVIOUS EXPERIENCE</i>	14 (56%)	10 (53%)	4 (67%)	15 (60%)	10 (53%)	5 (83%)
Previous Employment	10	8	2	10	8	2
Educational Background	6	6	0	7	6	1
Teaching Experience/ Interest in Education	3	2	1	4	3	1
References/Resume	3	2	1	3	2	1
Volunteer Activities	2	2	0	2	2	0
<i>PERSONAL TRAITS</i>	12 (48%)	11 (58%)	1 (17%)	12 (48%)	11 (58%)	1 (17%)
Personality	6	6	0	6	6	0
Diversity	6	5	1	6	5	1
Creativity	3	3	0	3	3	0
Self-Motivated/Initiative	3	3	0	3	3	0
Work Ethic	1	1	0	2	2	0
Answered Questions Directly	1	1	0	1	1	0
<i>COMPANY/JOB CONSIDERATIONS</i>	11 (44%)	9 (47%)	2 (33%)	11 (44%)	9 (47%)	2 (33%)
Commitment to Company Values	5	3	2	5	3	2
Reason for Wanting Position	4	4	0	4	4	0
Professional Development Opportunity	2	2	0	2	2	0
Prospect for 3–5 Years of Employment	1	1	0	1	1	0

criteria and a maximum of 8 criteria. For the software developer, the average number of distinct criteria was 5.56, with a minimum of 2 and a maximum of 12.

Table II shows that technical skills were considered most often, followed by soft skills. Previous experience was related to the other categories, but was explicitly mentioned by more than half of the students. Table II indicates that 4 of the 5 areas had similar percentages of students from each university.

However, just 1 of 6 (17%) of UP students used a personal trait as a criterion, while 11 of 19 (58%) UWT students considered a personal trait to be a criterion.

**5.2.2 *Persona Development.*** Bob Broad, an English composition professor, makes the conjecture that rubrics codify what we value, but the values are manifested in the comments made while grading papers [Broad 2003]. The hiring criteria of the exercise correspond to the rubrics, while the arguments for the hiring decisions indicate the true values. Following this principle, we performed analyses on the arguments contained in the hiring deliverables.

In addition to coding criteria students used in making hiring decisions we coded students' inferences regarding each candidate persona. Appendix A contains the brief students read prior to making their hiring decisions. In their prose students were asked to justify their hiring decisions.

In our analysis, we distinguish between factual statements and inferences, where inferences are statements or claims not directly stated in the description. We coded arguments from all 28 hiring deliverables. For each, we independently coded the arguments and the researchers argued to consensus. Here is a sample of inferences from each criteria above.

*Technical Skills:* "Joseph has a very strong understanding of software architecture. Joseph has owned a company and knows the software development cycle well. He will be able to communicate with other developers and the program manager in order to get the software out on time."

The inferences about Joseph include a strong understanding of software architecture, knowing the software development cycle well, and communication skills. These items were not explicitly stated in the hiring exercise.

*Soft Skills:* "Her [Mary] technical background will enable her to speak confidentially [confidently] and accurately about whatever information she's trying to convey."

The inference about Mary is that she can speak confidently and accurately.

*Personal Traits:* "I would read into this [60-hour work week] some form of laziness on his [Michael's] part and an unwillingness to do what it takes to get the job done."

The inference about Michael is that he is lazy.

*Previous Experience:* "His [Joseph's] elective in AI might be useful in educational software, because he might have the ability to make software that would use dynamic content based on the ability and the development of the person [software user] using it."

The inference is that Joseph's background in AI will help create dynamic content for users.

*Company/Job Considerations:* "Some will question the ability of this company to hold onto and interest someone who has shown the entrepreneurial (sic) talent the [that] Joseph has shown, it is this risk-taking talent, however, that is key to growth within our industry."

The inference about the job is that it is necessary to take risks to grow the company.

We classified inferences by person (Mary, Joseph, Oscar, and Michael). When classifying whether a statement was an inference or not, we argued to



Table III. Persona Inferences

Candidate	Total	UWT	UP
Joseph	74	58	16
Mary	61	52	9
Oscar	32	24	8
Michael	24	20	4

Table IV. Program Manager/Software Developer Hiring Decisions

PM / SD	Total	UWT	UP
Mary/Joseph	12	11	1
Michael/Joseph	4	3	1
Michael/Mary	4	3	1
Mary/Michael	4	2	2
Joseph/Mary	2	2	0
Joseph/Michael	1	1	0
Oscar/Joseph	1	0	1

consensus. Table III shows the number of inferences made per hiring candidate. We also calculated the number of persona inferences made versus the hiring choices. The average number of inferences made about the chosen Program Manager is 2.32 and the average number of inferences made about the chosen Software Developer is 2.35. The average number of inferences made about the two unselected candidates together is 2.14. We could interpret this to mean that students tended to embellish the personas of the people they wanted to hire. Some students made more inferences than others. The maximum number of inferences for all four candidates made by one student is 18 and the minimum is 0.

Appendix C shows the aggregate persona developments for each candidate. One interesting observation is that Mary's persona developments with respect to her technical skills are concentrated in the area of understanding the software user. She also has the most inferences in the category of soft skills. Joseph's inferences regarding technical skills are centered around his technical knowledge and his ability to create successful and quality software. Michael's inferences are centered around his personal traits. Oscar's inferences are both positive and negative in each category.

**5.2.3 Hiring Choices.** Based on the hiring deliverable students chose the combinations for program manager and software developer as shown in Table IV.

**5.2.4 Changes in Hiring Choices.** After the in-class discussion, students were asked to vote again for program manager and software developer. Table V shows the changes for the seven students who changed their vote for at least one position.

The discussion may have had more influence on the UP students, as four of six (67%) UP students changed their vote. Two students at UWT left class before completing the post-discussion exercise. Just three of 20 (15%) UWT students revised their initial hiring decision.

Table V. Before and After Discussion Hiring Decisions of Students Who Made Changes

Before PM/SD	After PM/SD	Total	UWT	UP
Mary/Joseph	Mary/Michael	1	1	0
Michael/Joseph	Mary/Joseph	2	1	1
Michael/Mary	Mary/Joseph	2	1	1
Oscar/Joseph	Re-open/Joseph	1	0	1
Mary/Michael	Mary/Oscar	1	0	1

Reasons cited by students for changing hiring decisions included previous experience, diversity considerations, people skills, leadership skills, and reaching consensus. One UP student elected to re-open the PM position to look for more qualified candidates.

*5.2.5 Introduction of Bias.* As in any intervention and research study, there were opportunities for bias, although the researchers took care in minimizing the effects of bias in this study. For example, there was bias in the subject population—not all students enrolled in the courses consented to participate in the study. Also, specific courses were chosen in which to conduct the study—computer ethics and software engineering. Therefore, the students who participated were a selected subset of all computer science majors. The hiring brief used to elicit the data was intentionally biased to solicit hiring criteria. The hiring brief could be biased in that not all possible hiring criteria were present in the data analysis. Finally, the data analysis could introduce bias as the data was interpreted by the researchers. The researchers tried to limit the bias in this study by piloting the exercise at UWT, conducting the study at two universities, and using emergent categories for criteria while performing the content analysis.

### 5.3 Discussion

Asking students to complete the hiring exercise gave us insight into what they think is important in hiring, which leads to what is important in preparing successful students for the software industry. Once educators know what the students value, design for curriculum and projects may be better informed. For example, over 80% of the students in the study believed soft skills such as team skills, social skills, management skills, and organizational skills are important in hiring; therefore, projects could be designed to better develop these skills. A second immeasurable benefit to the exercise is giving students an opportunity to think about what is important before facing a real hiring decision in industry. It is not too surprising that the students thought technical and soft skills were important when hiring people. What is more surprising is that almost half thought personality, previous experience, and fit within the company were also important considerations. This suggests that the students considered a broad range of criteria.

In justifying decisions, some students made inferences about the strengths and weaknesses of the candidates. Joseph had the most inferences and was also chosen for one of the positions by 20 of 28 students. Mary had the next highest number of inferences and was chosen by 22 of 28 students. Oscar had just one vote prior to the discussion and had 32 inferences. What is interesting

is that most of Oscar's inferences were negative (see Appendix C) and were used as supporting evidence for not hiring him. There is some interplay between with the inferences and gender of the candidates. Inferences made about Mary because she was female included: she can design software for females, and that women generally have more people skills than males.

Gender and race considerations did not play as much of a role in decision-making as expected, even after students read the Adam and Sher articles. Taking a constructivist view, the purpose of our work is to understand what students bring to the decision-making process. If we want students to make hiring decisions that are not based solely on utilitarian and technical criteria, then we must teach other values that might be relevant (such as social justice), and then show how those values could influence the decision-making process. The exercise described in this article uncovers those processes in a concrete way.

## 6. FUTURE WORK

The existing data provides a rich source for future analysis. A preliminary analysis of inferences provides evidence that students make inferences about candidates and about the job responsibilities. We will develop an emergent classification based on the inferences to reveal the most frequent inferences. Also, students listed information not mentioned in the exercise brief that would help in making a hiring decision. We will code what kinds of information they request. From the criteria listed in Table I, we know that at least six students considered diversity when hiring. Future work includes coding all arguments referring to diversity. In the post-discussion exercise, students were asked to list the most and least relevant points made in the discussion. Future work includes identifying what influenced students during the discussion.

Possible extensions to the work include gathering data from more institutions, gathering data from faculty and working professionals, and modifying the exercise. Modifications to the exercise include comparing the situated exercise as described in the paper to an exercise where students are asked to list hiring criteria for a program manager position and software developer position in the absence of candidates. We speculate that students will list fewer criteria in the more abstract version of the exercise. Another modification is switching the names of the candidates to see if the change affects students' decisions.

## 7. CONCLUSIONS

This article described an exercise to elicit criteria used in making hiring decisions and presented results of a study conducted at two universities. The exercise provided a concrete context by providing a fictitious company, DotEdu, and four candidates for the positions of program manager and software developer. After students completed a written analysis of their hiring criteria and decisions, they engaged in a discussion and re-voted for the positions on a post-discussion questionnaire. Students considered a variety of factors when determining their criteria. The five areas were technical skills, soft skills, personal traits, previous experience, and company/job considerations. Students

also made inferences about the candidates and the open job positions. Future work consists of further analysis of data already collected, widening the pool of participants for the study, and modifying the biographies of the candidates to see if names and/or gender affect students' decisions.

The results of this study can be used directly to inform teaching and curriculum development. Finding out what students value as important criteria in hiring are the same characteristics that are important (in their view) to develop while earning a degree in computer science. Additionally, educators may use the exercise with their own students to learn of their beliefs.

## APPENDICES

### APPENDIX A—HIRING ACTIVITY

Given the descriptions of the candidates, who would you hire for each of the two positions that DotEdu is filling?

#### **Program Manager**

#### **Software Developer**

List specific criteria by which you evaluated the candidates. Explain what each criterion is. For example, if “people skills” is one of your criteria, explain what you mean by it. For each candidate, give a rating for that candidate on each criterion (on a scale of 0 through 4, where 4 is best). A table similar to a source analysis table would be appropriate. In the overall rating of the candidate, the relative weights of each criterion need not be equal.

The way in which you evaluate for each position might be different. If so, explain your method of evaluation for each position.

Also, if there is any information about the candidates that you think would help you make a decision (for example more specific information or a response to a specific question that you would like to have ask each candidate), please describe what kind of information would be helpful.

Briefly explain (about 500 to 750 words) why the candidates you chose are more appropriate for the positions you assigned them, and why other candidates are less appropriate.

#### Scenario: Hiring at DotEdu Corporation

DotEdu is a software company based in Tacoma (Portland). It employs 45 people, 20 of which are software and Web developers. There are five sales in and marketing, five office assistants, five product managers, five program managers, and five officers (president, two VPs, a Chief Financial Officer, and a Chief Technology Officer).

The *sales and marketing* people are involved with the design of promotional materials and Web sites. They also deal with the paperwork associated with payments.

*Program managers* provide a link between the developers and the product managers. They set the development and testing schedule so that the developers have enough time to finish their code, so that the product gets out the

door in a timely fashion. Program managers generally have enough technical skill to be able to do development, and they understand enough about the technical details to appreciate the difficulties with developing software and can estimate how long it takes to fix bugs, provide more features, etc. Note that program managers are not normal “managers” in that they have no direct reports (people who are subordinate to them in the company’s organizational chart). Instead, they manage the flow of information between various people on a project so that people are working together towards the end product. They derive their authority through their ability to do this, rather than through a company’s organizational hierarchy.

*Product managers* provide a link between the program managers and the sales and marketing group so that the release of promotional materials coincide with the finishing of the code. They are more focused on the promotion of the products and are in direct contact with potential customers. They have some technical background but they tend to have more business skills than program managers.

Since DotEdu is a small company, in fact the job descriptions are a bit loose. If there is a coding crunch the President will sometimes contribute to the software development, or if the sales people need some help designing or developing a pamphlet, then developers who have some layout design background help when they can.

DotEdu develops software with an educational theme. For example, they have software for K-12 (similar to Microsoft’s Magic School Bus), reference software (History of Music, which is an encyclopedia of composers and performers from 1800 to present), and games with an educational flavor (similar to SimPlanet by Maxis).

The President of DotEdu has determined that there is a need to create a new line of software, called SciSoft, to help college freshmen learn the basic concepts of science (for example, visualization of the laws of gravitation and planetary motion, models of the atom, animation of basic cell functions, DNA, etc.). One of the goals of this line of software is to provide a tool for students who find traditional forms of presenting material (e.g., lectures, reading books) only partially effective.

The company is seeking to hire a program manager to be in charge of SciSoft. Also, a new software developer will be hired to design and implement the code base for SciSoft.

DotEdu is proud of its mission to diversity in hiring and its commitment to the community. Its employees are of many different racial backgrounds (40% white, 25% Asian-American, 20% Latino, 15% African-American). Of its software and Web developers, 30% are female (much higher than the industry average), 35% white, 30% Asian-American, 25% Latino, and 10% African-American. Here is its diversity statement (published on its Web site):

At DotEdu, we believe that diversity enriches our performance and products, the communities where we live and work, and the lives of our employees. As our workforce evolves to reflect the growing diversity of our communities and the global marketplace, our

efforts to understand, value, and incorporate differences become increasingly important.

By fully pursuing the company's mission and in keeping with what we value, DotEdu has established a comprehensive plan to promote and integrate diversity at every level within our organization and in everything we do. By achieving these goals, DotEdu hopes to enable its employees to realize their full potential.

Evidence of DotEdu's commitment to the community is that it sometimes donates of its K-12 software to relatively poor school districts.

There were ten applications for the positions, and they have been narrowed down to four outstanding candidates. They each had a one-day interview where they talked with five to seven different people in the company (typical was three developers, two product managers, a program manager, and one of the VPs). Information from their resumés and notes from their interviews are attached.

All of them have graduated from UWT (UP) with a degree in CSS (CS).

Your goal is to make the following decision regarding hiring: Who should be hired for the two positions (program manager and software developer)?

The context for the in-class activity will be the final hiring committee meeting to make the hiring decision(s). Each person will make a case for the decision he or she made.

*Note: All candidate descriptions below were customized with employment and educational history in the Portland metro area for the University of Portland students.*

#### Candidate #1: Mary Plata

##### **Education:**

Graduated from Lakeside H.S. (in Seattle) in 1997.

Associate of Science from Tacoma Community College in 2001.

Bachelor of Science from UWT (CSS) in 2003. GPA at UWT: 3.7.

##### **Employment:**

Cashier for the bookstore at Tacoma Community College (2001).

Office assistant for the Finance Department at UWT (2002).

Worked with Stephen Rondeau to install and maintain software on the break department's machines (2003).

Instructor for courses on C and C++ at University Extension, University of Washington, Seattle (2004–2005).

##### **Volunteer work:**

Helped design and set up the web page for Lakeside H.S. (2002).

Currently supervises two students who maintain the Lakeside H.S. Web site (2003–present). The Web site has received an award for its design.

Organizes events for the elementary school where her six year old son attends.



**Letters of Recommendation:**

From the manager at the Tacoma Community College bookstore: Very responsible, went beyond her official duties to help other workers, took initiative to suggest ideas for how to improve the bookstore.

From Stephen Rondeau: Was very capable, suggested ways to do things, finished all of the projects she was given on time and correctly.

From a faculty member at UWT: Very good student (3.9 in the class taken), participated in discussions in class, very creative answers on homework and tests. In the top 10% of students.

Student feedback from the University Extension courses: Excellent reviews, she clearly likes teaching and has knowledge of C and C++.

**Diversity considerations:**

White female. Unclear from visual appearance what exact ethnic background.

**Here are some notes from the interviews:**

When asked why she wanted to work for DotEdu, Mary said that although she thought teaching the C/C++ courses was rewarding, she wanted to be involved in the development of software. She said she was very interested in education, so what better place to work than at DotEdu?

When asked what her long-term career goals were, she said that she wanted to be a part of a company that contributes to society either as developer or as a manager.

When asked by the developers technical questions, she demonstrated that she could design and write simple code (design of a tic-tac-toe game, and how to determine whether some has won in a game of tic-tac-toe). When asked to write Quicksort, she had trouble at first, but she eventually got it right. Had trouble remembering when it might be more appropriate to use a hash table than a binary search tree.

When asked what courses she took for electives, she said she took the database course, the networks course, the digital media course, the entrepreneurial course, and a capstone project where she implemented a medium-sized program (about 6000 lines of Java) to keep track of the sales records of a small company, along with a Web page to take orders.

She seems friendly, and she seemed excited about the idea of working at DotEdu. She probably will work well with the developers and program/product managers. She seemed to have a strong technical background and was not afraid to speak her mind.

Candidate #2: Oscar Escalante

**Education:**

Graduated from Foss H.S. in 1995.

Associate of Science from Green River Community College in 1998.

Bachelor of Science from UWT (CSS) in 2000. GPA at UWT: 3.0.

**Employment:**

Worked as a cashier at a Japanese restaurant near Green River C.C. (1996–1998).

Worked in the media department of the UWT library (1999–2000).

Web development at Weyerhaeuser Corporation (2000–2003).

Software engineer for Boeing Corporation (2004–2005).

**Volunteer work:**

Helped design, set up, and maintain a Web page for his church (1999–2001).

**Letters of Recommendation:**

From the manager at the UWT library: Very responsible, very efficient, did everything asked of him.

From a faculty member at UWT: An above-average student (3.5 in the class taken—the database class), showed interest and aptitude in database systems.

From a manager at Weyerhaeuser: Knowledgeable about Web page design, very creative when coming up with ideas for Web design.

From a manager at Boeing: Always met deadlines that were set, worked well with others on the team.

**Diversity considerations:**

Hispanic male.

**Here are some notes from the interviews:**

When asked why he wanted to work for DotEdu, Oscar said that he had trouble in some of his introductory science classes, and so he thought that with his background in computer science he could help students that were in a similar situation as his as a freshman.

When asked what sort of work he did for Weyerhaeuser and Boeing, Oscar said that he mostly worked on Web page design. He occasionally helped out others on the team with some back end code. He said he left Weyerhaeuser when they had to downsize; he accepted a good “exit” package. Boeing was looking for someone with his background and experience and so immediately hired him. He said that although he is still working at Boeing, he is seeking other career opportunities.

When asked what his long-term career goals were, Oscar said that although he feels that he is a strong Web developer, he wants to expand the scope of his skills into software development. He feels that either position (program manager or software developer) would be an advancement in his career and would likely have greater monetary rewards (greater salary), too. He said that with his five years of experience in industry, he can make important contributions to DotEdu. He also said that much of his work involved working closely with others on a team, and so he knows what it takes for a team to be successful.

When asked by the developers technical questions, he had some trouble (design of a tic-tac-toe game, and how to determine whether some has won in a game of tic-tac-toe). When asked to write Quicksort, he had trouble at first,

but he eventually got it right. Was stumped by the question on when it might be more appropriate to use a hash table than a binary search tree.

When asked what courses he took for electives, he said he took the database course, the networks course, the computer security course, the Web services course, and the entrepreneurial course. He also did an independent reading course where he read articles on testing and debugging in the software engineering cycle.

He seems friendly, and he seemed enthusiastic about the idea of working at DotEdu. He probably will work well with the developers and product/program managers, but Oscar seems quiet and when he seemed unconfident when he was answering the technical questions.

Candidate #3: Joseph Anderson

**Education:**

Graduated from Stadium H.S. in 1998.

Associate of Arts from Pierce Community College in 2000.

Bachelor of Science from UWT (CSS) in 2002. GPA at UWT: 3.8.

**Employment:**

Co-founded a startup company, GameHouse Software (10 employees), with other UWT graduates and some graduates from UW Seattle. The company produced strategy games, board games, and real-time computer games (2002–2005).

**Volunteer work:**

Has worked with the computer clubs in local high schools. Besides playing GameHouse software, the clubs also learn about computers in general.

**Letters of Recommendation:**

From a computer science instructor at Pierce Community College: Was always the best in the class and helped others in the class.

From a faculty member at UWT: Very good student (4.0 in the class taken), had complete mastery of the material in the class.

From a computer science teacher in one of the high schools he volunteers: Works well with the students, is able to transmit his excitement of the computer to the students.

**Diversity considerations:**

White male. Unclear from visual appearance what exact ethnic background.

**Here are some notes from the interviews:**

When asked why he no longer works for GameHouse, Joseph said that Nintendo offered to buy the code for all of the games that GameHouse had produced. So they decided to sell the company to them and split the profits among themselves.

When asked what his long-term career goals are, Joseph replied that he wants to continue with the kind of programming he had done with GameHouse, but he wants to move toward the area of educational software. He said that if he had not founded GameHouse, he would have looked into a career of teaching (either at the college level or at the high school level).

When asked by the developers technical questions, he demonstrated that he could design and write simple code (design of a tic-tac-toe game, and how to determine whether some has won in a game of tic-tac-toe). When asked to write Quicksort, he got it right. He also pointed out that Mergesort had a better worst case running time than Quicksort. Got the hash table versus binary search tree question right.

When asked what courses he took for electives, he said he took the database course, the networks course, the AI course, the robotics course, and a capstone project where he implemented a medium-sized program (about 6000 lines of Java) that simulated the interaction of bacteria and cells that fight bacteria in a human body. "It was all interesting to me," he said.

In general, Joseph is a quiet person, but when he starts talking about software and applications, he gets very motivated and excited. He probably will work well with the developers and program/product managers.

Candidate #4: Michael Simmon

**Education:**

Graduated from John F. Kennedy H.S. (Memphis, TN) in 1997.  
Associate of Science from Olympic Community College in 2000.  
Bachelor of Science from UWT (CSS) in 2002. GPA at UWT: 3.4.

**Employment:**

Manager at Simmons Hardware Store (15 employees) (1997–1999).  
Microsoft Corporation. Worked on some of the Web development for MSN. (2002)  
Boeing Corporation. Entry-level software development for the visualization of the mechanics of parts of the planes being designed (2003–2005).

**Volunteer work:**

None listed on the resumé.

**Letters of Recommendation:**

From a computer science instructor at Olympic Community College: Sometimes had trouble with the assignments, but he was always eventually finished the assignments.

From a faculty member at UWT: Very good student (3.7 in the class taken), had mastery of the material in the class. Seems to have an interest in science-related projects.

From a manager at Microsoft (MSN): Very hard-working. Often put in 60 hour work weeks. Did everything asked of him.

From a manager at Boeing: Very hard-working. Seemed to really enjoy the work. Always contributed in the design discussions. Was never afraid to speak what he was thinking.

**Diversity considerations:**

Black male.

**Here are some notes from the interviews:**

When asked why he moved from Tennessee, he said that after he graduated high school, his uncle offered him a job. So, he moved to Bremerton and worked there. Then he decided to pursue a bachelors degree at Olympic Community College. When asked why he quit Microsoft, Michael said that he didn't want to work 60-hour work weeks anymore, for the kinds of things he was doing at MSN. When asked why is looking for a job now, he said that Boeing had just laid him off in recent layoffs. Since he had little seniority, he was targeted to be laid off.

When asked what his long-term career goals are, Michael replied that going to school opened his eyes to a whole new world of possibilities for software. His family was poor, and his only access to computers was at school. When he showed an aptitude for science and mathematics in high school, his family bought a PC (when Michael was a junior in high school). He said he wanted to give back to kids who grew up like he did by writing educational software for them.

When asked by the developers technical questions, he demonstrated that he could design and write simple code (design of a tic-tac-toe game, and how to determine whether some has won in a game of tic-tac-toe). When asked to write Quicksort, he got it right. Had trouble remembering when it might be more appropriate to use a hash table than a binary search tree.

When asked what courses he took for electives, he said he took the database course, the advances in object-oriented design course, the client-server course, the embedded systems course, and an internship at Microsoft in the MSN team where he helped with some of the Web development. He said he enjoyed all of courses, although he especially liked the courses where they had big software projects.

In general, Michael is friendly and is not afraid to speak his ideas and defend them.

## APPENDIX B—CONTENT ANALYSIS INITIAL CODING CATEGORIES

### *Initial Hiring Criteria Categories for Software Developer and Program Manager:*

- Organizational Skills
- GPA
- Teaching Experience
- Education
- Supervision Skills
- Programming Experience

Communication Skills  
Responsible Personality  
Creativity  
Science Knowledge  
Self-Motivated  
Team Skills  
Technical Ability  
Diversity  
Volunteer Activities  
Management Experience  
Growth in Company  
Large Project Skills  
Time Management<sup>1</sup>  
Previous Employment  
Social Skills/People Skills  
Commitment to Company Values  
Outgoing Personality  
Work Ethic  
Reason for Applying for Position  
Graphic Design Ability  
Multitasking Ability  
Answered Questions Directly  
Prospect for 3–5 Years  
References  
Long-Term Goal  
User Understanding  
Charisma  
Ability to Motivate Others  
Confidence  
Design/Architecture Skills  
Organize/Present Information<sup>1</sup>  
User Interface Skills  
Flexible Skill Set  
Leadership  
Individualism  
Start-Up Experience

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<sup>1</sup>Criteria used for software developer position only.



## APPENDIX C—PERSONA DEVELOPMENTS

Mary:

### Technical Skills

#### A. User Understanding

Can design software for females; can design intuitive software; useful perspective in judging the features of educational software; understanding of the various methods of learning and how to make software especially effective; has an understanding of what would work well for the user of the product; able to input great ideas toward the project; would enhance quality of product.

#### B. Technical Understanding

Expertise in C and C++ will make her excellent software developer; does not know difference between binary search tree and hash table; not a strong technical grasp on the questions.

### Soft Skills

#### A. Communication

Good communication skills; has communication skills; communicate with other developers; communication skills; can speak confidently and accurately about whatever information she's trying to convey; proven ability communicating to those less technically competent than her.

#### B. Leadership/Supervision

Good management skills; can manage a group effectively; social skills to help with managing process; effective leader; can handle and guide a group of people effectively; talent for leadership; supervise and manage tasks with personnel that are not under her direct supervision; invoke sense of leadership over her team and keep them on track to meet deadlines; sympathize with team and make it easy for her to encourage and motivate them; better at supervising than sitting down and writing code; would fit very well into a leadership position.

#### C. Organizational Skills

Well-organized; able to create a plan, execute that plan; well-organized; able to organize groups.

#### D. Teamwork/People Skills

Would work well with the team; excellent people skills; works well with others; women generally have more people skills than males; people skills.

### Previous Experience

Used to hard work grading papers late in the night; sparkling student feedback; knows enough C and C++ to teach it; took initiative to learn a programming language well; ability to work with school administration and students; knows how to structure learning environments; good teacher.

### Personal Traits

#### A. Dedication

Will go out of way to develop product to full potential; dedication to students; will work at her fullest; strong commitment for education and community.

#### B. Other Traits

Enthusiastic; self-starter; well-rounded abilities; interested in improving the school experience for all students; passionate about work; confident; willing to initiate programs; perhaps does not interview well.

#### Company/Job Considerations

Can suggest learning concepts; strong ability to advance in company if her work in software development were to follow the same excellence that she has employed in academic work; identify her with the goals and value of DotEdu; could help sales and marketing team; probably stay for a long duration; able to be easily integrated into the team.

Joseph:

#### Technical Skills

##### A. User Understanding

Good understanding of user interfaces and HCI; knows how to make software fun, interactive, addictive; may have insight as how users would view SciSoft project.

##### B. Technical Understanding

Very strong understanding of software architecture; knows data structures, algorithms, software design well; knows software development cycle well; could create dynamic content; masterful in computer technology application; proven knowledge; can handle going into a project facing the unknown and can bootstrap himself to make a solid project; programming seems second-natured; deeply knows about problem details; technically-oriented; strong development background; demonstrated fundamental understanding of algorithms; could apply himself to hard problems.

##### C. Successes and Quality

Completed larger projects in an economically profitable way; capable of producing successful products and projects; ability to create high quality code quickly; ability to develop quality software; most likely to produce high quality work.

#### Soft Skills

##### A. Communication

Can communicate; may have limited growth within company because of his communication abilities; able to communicate well; lacked some people and communication skills; may not relate well to others in general conversational terms.

##### B. Leadership and Supervision

Strong ability to manage software projects successfully; capable of managing a business and unknown risks; good leader for the team; would try to take over the project instead of encouraging others; asset in generating quality work from his peers.

##### C. Organizational Skills

Organizational skills.

##### D. Teamwork

Exceptional teamwork skills; strong team skills; can work in a small company environment and is a team player.

### **Previous Experience**

Graphics/animation experience; helped run successful company; previous work in game programming would go along well with the development of SciSoft; experience with creating entertaining games; has experience in developing software; may not have done any work and was simply along for the ride (GameHouse); possible management experience; middle-level developer (experience level); not clear how much software experience; can bring insight into situation with experience at GameHouse; management role in running his own company.

### **Personal Traits**

#### **A. Enthusiasm/Passion**

Passion for science; has drive as a person; motivated; energetic; energized; enthusiasm for software.

#### **B. Talent/Skill**

Is able to apply creativity and knowledge; entrepreneurial (sic) talent; extremely talented; skilled to start own business; varied skills.

#### **C. Commitment/Dedication**

Committed to doing high quality work; committed to helping people learn; takes what he does seriously; good work ethic.

#### **D. Initiative**

Took initiative to start own company; initiative.

#### **E. Other**

Shows a zeal in helping others learn; creative; lack of assertiveness; shy.

### **Company/Job Considerations**

Will be a benefit to the educational nature of DotEdu's software; would find software development beneath him; being a program manager would be dull; looking to gain experience in the field of educational software; positions would not satisfy him very long; may be difficult for him to relinquish control and subjugate himself to the mission of DotEdu; not convinced that he wanted to work at DotEdu.

Michael:

### **Technical Skills**

Answers contained frivolous information; will slow down production; has balance of software engineering knowledge and technical competency.

### **Soft Skills**

#### **A. Communication**

Strong ability to communicate; communicates well; people and communication skills.

#### **B. Management**

Has experience that will enable him to learn and to manage his group more easily.

### **Previous Experience**

Worked on several large projects; lack of experience; laid off from previous job.

### **Personal Traits**

#### **A. Commitment/Dedication**

Work ethic; shows a drive for completing projects; driven to succeed; strong work ethic; hard worker; willing to put in extra hours if necessary; would put considerable effort into his work; will be reluctant to put long hours to meet the deadline of the project; not willing to put in long hours; laziness on his part and an unwillingness to do what it takes to get the job done.

#### **B. Other**

Can work while going to school; resourceful in overcoming poverty; potential to do well academically; has initiative and drive; excellent ability to learn new things; has confidence needed to perform duties; defends position, may be stubborn; honest.

### **Company/Job Considerations**

Shows a deep dedication to the values of DotEdu; may not be greatest employee; may benefit from mentoring atmosphere at DotEdu; would stick around if treated right.

Oscar:

### **Technical Skills**

#### **A. User Understanding**

Would understand user requirements; understands how college students feel about lacking knowledge in science.

#### **B. Technical Skills**

Has not mastered technical skills; ability to complete larger team projects; not exceptional at programming; knowledge/skill limited to Web development; lacks technical knowledge even after 5 years; weak technical skills.

### **Soft Skills**

Not effective communicator; too shy to lead a group effectively and speak his mind; difficult to motivate team to make deadlines; would take over project instead of encouraging others; may bring team down; works well with people.

### **Previous Experience**

### **Personal Traits**

No interest in the educational system; believes in giving back to the community; shy; mediocre commitment; lacks confidence; unconfident.

### **Company/Job Considerations**

Struggle finding long-term success in advancement within the company; at the first chance to find another position, he will be gone; largely interested in monetary advancement; may contribute less than other candidates.

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## REFERENCES

- ADAM, A. 2000. Gender and computer ethics. *Comput. Soc.* 30, 4, 17–24.
- BAILEY, J.L. AND STEFANIAK, G. 1999. Preparing the information technology workforce for the new millennium. *ACM SIGCPR Comput. Personnel* 20, 4, 4–15.
- BROAD, B. 2003. *What We Really Value*. Utah State University Press, Logan, UT.
- CAMPBELL, K. 1999/2000. The Promise of computer-based learning: designing for inclusivity. *IEEE Technol. Soc. Mag.* 18, 4, 28–34.
- FERGUSON, E. 2005. Changing qualifications for entry-level application developers. *J. Comput. Sci. Colleges* 20, 4, 106–111.
- LATTUCA, L.R., TERENCEZINI, P.T., AND VOKWEIN, J.F. 2006. Engineering Change: A Study of the Impact of EC2000, Executive Summary. ABET, Inc. <http://www.abet.org/Linked%20Documents-UPDATE/White%20Papers/Engineering%20Change.pdf> (accessed April 24, 2007).
- LANG, J.D., CRUSE, S., MCVEY, F.D., AND MCMASTERS, J. 1999. Industry expectations of new engineers: a survey to assist curriculum designers. *J. Eng. Educ.* 88, 1, 43–51.
- SCHÖN, D.A. 1995. *The Reflective Practitioner: How Professionals Think in Action*. Arena, Aldershot, England.
- SHER, G. 1999. Justifying Reverse Discrimination in Employment. In *The Right Thing to Do: Basic Readings in Moral Philosophy* 2nd Ed. J. Rachels, Ed. McGraw-Hill, New York, NY, 305–315.
- STEMLER, S. 2001. An overview of content analysis. *Pract. Assess., Res. Eval.* 7, 17. <http://pareonline.net/gervn.asp?v=7&n=17>.
- TAPIA, A.H. AND KVASNY, L. 2004. Recruitment is never enough: retention of women and minorities in the IT workplace. In *Proceedings of the SIGMIS Conference on Computer Personnel Research: Careers, Culture, and Ethics in a Networked Environment*. 84–91.

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