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INFORMATION SYSTEMS EDUCATION JOURNAL

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Will Computer Engineer Barbie® Impact Young Women's Career Choices?

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Abstract

Controversy and fanfare accompanied the announcement in 2010 by Mattel, Inc. of the Barbie® doll's 126th career - computer engineer. Even though women have been and still are in a minority in the information technology (IT) and computer science (CS) fields, enough women voted for the computer engineer as the next career for Barbie® on Mattel's website that it won the overall vote, while the winning choice voted for by young girls was news anchorwoman. The discrepancy resulted in Mattel producing Barbie® dolls in both careers. This paper reports the results of a survey completed by women in the IT and CS fields regarding their attitudes about and purchases of Computer Engineer Barbie®.

Keywords: women in computing, women in IS, recruiting women, enrollment, recruiting

1. INTRODUCTION

Although women have been involved throughout the history of computers and information technology, they have always been in the minority in those fields. Numerous articles and books have been written about the lack of women in the computing and information technology fields. Researchers have looked into why women do not choose computer science (CS) or information technology (IT) in college and why those that do often leave for other majors. Some of the reasons why young women do not choose CS/IT majors overlap with those cited by young men as those majors have experienced low enrollments of both genders in the past decade. The reasons given by both genders for not choosing these fields include the negative "geek" image of people working in the various areas of computer and information technology, and the perception that jobs are being outsourced and off-shored.

While recruiting both genders has recently been difficult, recruiting women has been and remains more problematic.

A number of programs have been developed at CS/IT departments at institutes of higher education aimed at recruiting and retaining young women. These programs often produce positive local results, but overall, the numbers of women in CS/IT fields has not improved.

Figure 1 Computer Engineer Barbie

One reason may be that young women are ruling out this career choice early, before those recruitment programs reach them in high school. If this is the case, one could argue that young women's exposure to possible CS/IT careers should begin earlier. Thus, it was of interest that toy manufacturer, Mattel, began producing Computer Engineer (CE) Barbie® dolls in the fall of 2010. (Fig. 1).

The release of CE Barbie® was preceded by some controversy surrounding the voting on Mattel's website. Even though women have been and still are in a minority in the IT and CS fields, enough women voted for the computer engineer career for Barbie® on Mattel's website that it won the overall vote, while the winning choice voted for by young girls was news anchorwoman. The discrepancy resulted in Mattel producing dolls representing both careers. This paper reports the results of a survey completed by women in the IT and CS fields regarding their attitudes about and purchases of Computer Engineer Barbie®.

2. CONTRIBUTIONS OF WOMEN TO COMPUTING IGNORED

One of the mysteries about the current low representation of women in computer and information technology is that women have a long history of contributions to the field. From Ada Augusta Lovelace in the late nineteenth century to the 2008 Turing Award recipient, Barbara Liskov in the last decade, women have made important contributions in the areas of programming, searching, sorting, compilers and human computing interaction (Gürer, 2002; The Ada Project, n.d.). One of the possible explanations is that until relatively recently, the contributions of women to the field of computing were largely overlooked. As Jean Bartik, one of the group of women hired to program the ENIAC computer during World War II, was quoted "We had worked hard to get it ready to go. We couldn't believe we were ignored." (Todd, Mardis & Wyatt, 2005) Even current computer science texts that recount the history of computers often fail to mention these early female pioneers (E.g., Savitch, 2009; Russell & Norvig, 1995).

3. WHY WOMEN DO NOT CHOOSE A COMPUTING CAREER

Even though enrollment in computer related programs has increased over the last three years and the percentage of women has increased 2.5% (Thibodeau, 2011), women remain a distinct minority at 13.8%. According to the National Center for Women & Information Technology (2010), the percentage of women enrolled in computer programs peaked in the mid-1980's, ~~and~~ declined sharply in the mid-1990's and has remained low. When women do pursue careers in CS or IT, they change careers at twice the rate that men do.

There have been many studies on the reasons women do not choose a CS/IT career path. The most notable examination of this phenomenon was published by Margolis and Fisher in 2002. In their book, "Unlocking the Clubhouse", Margolis and Fisher note that men and women surf the web to the same degree and make the same amount of online purchases, but that women are not learning to invent, create and design computer technology nor do they contribute in other ways. A recent NY Times article notes the small percentage of women who contribute to Wikipedia (Cohen, 2011). As to why this matters, Margolis and Fisher note that women are missing out on a promising career choice and that experience in information technology contributes to many fields. The result is that computers and software end up being designed for males, just as early voice recognition software, car airbags and artificial heart valves were and women cannot benefit from the new developments.

Margolis and Fisher indicate that the gender differences are the result of early exposure to subtle and not-so-subtle biases. As an example, they quote a children's book entitled "I'm glad

I'm a Boy! I'm glad I'm a Girl" (Darrow, 1970) which states "boys invent things and girls use things that boys invent." Girls grow up with the father being the one who brings the computer into the house, and the male siblings joining him in using it. Later, in middle and high school, the boys are the ones who gravitate to the computer lab and in college, females described the culture in the computer science major as "insular, isolating and out of balance."

Throughout Margolis and Fisher's book, females' lack of confidence in their knowledge and abilities is pointed out. They report that females seem to be full of self-doubt and they worry about being perceived as "stupid", whereas males with similar experience and knowledge did not have these fears. This seems to be an extension of the lack of confidence in math and science that many females experience at the onset of puberty. Others report similar findings relating to females' self-confidence regarding computer and technical ability. For example, Hunsinger, Holt & Knight (2009) found that a large majority of females surveyed agreed with the statement "Majoring or double-majoring in CIS before graduating from college would be difficult for me." Colyar & Woodward (2008) and Irani (2004) reported that females and males had the same level of confidence in mathematics, but women's confidence was lower than men's confidence in the areas of programming, networks and cryptography.

Efforts Aimed at Recruiting and retaining Female CS/IT Majors

Efforts at attracting and retaining females into computer-related majors have met with success at the institutions where concerted efforts have been made. These efforts have included outreach activities, enhanced recruitment, scholarships, course and curriculum re-design, tutoring, and mentoring (e.g., Margolis & Fisher, 2002; Beck, 2007; Gerhardt-Powals & Trail, 2008; Mento, Sorkin & Prettyman, 2008; Mathis, 2008; Craig, 2009; Leitherer & Tupper, 2009; Alvarado and Dodds, 2010; Sorkin, Gore, Mento & Stanton , 2010; Tupper Leitherer, Sorkin & Gore, 2010). For the most part, these efforts require significant financial resources and time investment, though Barker et al. (2010) claim a good strategy is more important than the financial investment.

Post College Career Change Rates

After college, women in IT careers leave the field at twice the rate of men even though there are several organizations, such as the Anita Borg Institute, the National Center for Women and Information Technology (NCWIT) and Women in Technology International (WITI) that encourage and support women in computer related fields. As in college, the women who do change careers mention the culture as a issue. Anita Borg is quoted as saying "I really believe women bring incredible richness and diversity of thought, perspective and new ways of looking at problems…But to get to that, first you have to create an environment where women are really comfortable contributing." (Bentsen, 2000). In a 2011 article, Vijayan confirms the difference in culture by saying "they <women> need to not only constantly push themselves forward but also find someone who can help them" as he advocates that women find one or more mentors in their organization to sponsor and recognize their achievements.

4. TOYS AND CAREER CHOICES

One of the assumptions made by the authors of this paper is that Computer Engineer Barbie purchases that were made for a young girl indicate a belief that the doll may encourage the girl to pursue a career in a computer-related area. There is some evidence that supports the belief that a toy might influence the choice of career (e.g., Cooper & Robinson, 1989; Miller, 1996).

More to the point of this paper, there is research that indicates that the toys available for girls reinforce societal and parental messages about the careers available for girls. In a report done for the Department of Health, Education and Welfare in 1977 (Riley & Powers, 1977), the authors studied pre-school age and elementary age children who were exposed to non-sexist toys and games for four months in a classroom setting. An example of the non-sexist toys and games supplied to classrooms is "Our Helpers Play People" by Milton Bradley (Trademarkia.com), which consists of cardboard cutouts of people depicted in a number of both stereotypical and non-stereotypical occupations. For example, it includes both female and male construction workers and both female and male doctors, all with mixed ethnicity. For the most part, Riley and Powers found that the toys had only a limited impact on the personal career aspirations of the children overall, but the toys did have an impact on perceptions on what are acceptable occupations for both sexes. Kacerguis and Adams (1979) reported that "girls, almost two decades prior to the time of actual vocational decisions, are acutely aware of

the limited vocational options available to them" and stated "toys may be viewed as offering experimentation with future roles and present an opportunity to rehearse a future occupational opportunity on the child's level."

Given that research, the Barbie doll series is an interesting conundrum. By many, the doll is reviled as the ultimate sexist toy, with her impossible physical dimensions sending unhealthy messages to young girls by promoting negative body images (Stone, 2010; Dittmar et al, 2006). On the other hand, the Barbie doll has become a "rite of passage" for many young girls in the United States. According to Stone (2010), in America, girls between the ages of three and six own an average of twelve Barbie dolls and 90% of girls between the ages of three and ten own at least one. Although the sales of Barbie dolls declined after dolls like the Bratz® were introduced in 2001 (Ferrell & Hartline, 2008), Stone (2010) reports that the doll was still the number one most famous doll internationally.

Reid-Walsh and Mitchell (2000) argue that the Barbie doll "does not occupy one unified space within women's lives" and that women recount conventional and unconventional "Barbie-play". The conventional accounts include staging Barbie's dates, weddings and fashion shows. The unconventional accounts include girls who constructed houses, churches, schools and stores that Barbie lived and worked in and one woman who constructed her own Barbie house out of left-over construction materials from the re-modeling of her parents' house. She even added an alarm system to keep her little sister out of it.

The objective~~point~~ of the Barbie dolls' creator, Ruth Handler, was to present an alternative to the toys available for girls in the 1950's (Parker, 2008; Valis, 2010; Stone, 2010). The toys available for girls of that time period were baby dolls, kitchen sets, and little vacuum cleaners. These toys reinforced the notion that girls would grow up and become mothers and housekeepers. Barbie promoted imagination of a different sort and fairly early on, presented the image of a career woman, rather than a housekeeper. In fact, many believed that the doll led young girls astray from traditional female roles by promoting the image of a woman who ventured into unconventional (for the time) careers (Valis, 2010).

5. MOTIVATION FOR THE STUDY

Despite the many efforts at recruiting and retaining women in computing majors by many institutions, their representation remains low. It might be assumed that these efforts are not enough to overcome the fact that females rule out a career in computing very early on. The reasons include

- the lack of well-known female role models in the field of computers and information technology,
- the male-dominance of computers at home and at school,
- the male "geek" stereotype of those working in computing fields

These reasons are pervasive throughout society and therefore affect females' views of computing and technology careers from their early years.

In addition, research has shown that the major influences on women's career choices are parents, teachers and guidance counselors. Unfortunately, many parents, teachers and guidance counselors are not knowledgeable about the variety of careers one could pursue that involve computers and information technology. (Hunsinger et al., 2009; Woratschek et al., 2009; Saunders et al., 2008; Tillberg and Cohoon, 2005; Adya and Kaiser, 2005)

It is against this backdrop that in January of 2010, Mattel set up a website where people could vote for the Barbie® doll's next career. The choices on the website were architect, news anchorwoman, computer engineer, environmentalist and surgeon. The voting was open for one month. (Zimmerman, 2010 and 2010a). Zimmerman (2010) reports that women in the computing and engineering fields began encouraging others to vote for the computer engineer career. Twitter logged 1840 tweets on the subject and a number of technology-related websites mentioned the voting. At the end of the voting period, Mattel reported that the career that won the popular vote was computer engineer, but that the career that was most popular with young girls was news anchorwoman. Mattel diplomatically started producing Barbie® dolls in both careers later in 2010.

When one of the authors of this paper tried to order a Computer Engineer Barbie® in early October of 2010, she found that it was on backorder and did not receive it until mid-December. This prompted her and her co-

author to consider whether other adult women were purchasing the doll and whether the purchases were for themselves as display items in an office as was the case for one of the authors of this paper, or if the purchases were for young girls. We also were curious whether women in computing and IT careers think the dolls might encourage girls to consider computer and IT careers.

6. METHODOLOGY

An online survey was developed, with eleven brief questions, which participants were encouraged to complete anonymously. Females in academia as well as industry were contacted via email. The email list was developed by researching other institutions in Western Pennsylvania. Females in industry were contacted via the Pittsburgh and Johnstown chapters of Association of Information Technology Professionals (AITP).

7. RESULTS

Overall Survey Results

A total of fifty-two responses were received. (Table 1) The results of the survey indicate that only twenty-one of the fifty-two respondents (40% of the total.) were aware that Mattel had released the Computer Engineer Barbie® in fall of 2010, prior to the survey. Six of the twenty-one (29%) respondents who had prior awareness of the doll had voted for the Computer Engineer Barbie, on Mattel's website. Of those respondents who had voted, three out of the six (50% of those who voted) had encouraged other women to vote as well.

Table 1.
Overall survey results

Question	Yes	No	Maybe
Aware of CE Barbie®?	40%	60%	
Voted for CE Barbie®?	12%	85%	
Purchased CE Barbie®?	8%	92%	
Owned Barbie® dolls as a child	65%	35%	
Will CE Barbie® influence career choices?	17%	25%	56%

Only four of the total respondents (8% of the total; 19% of those with prior awareness) had purchased a Computer Engineer Barbie. Two had purchased it for themselves, one respondent purchased it for another adult, and two people made the purchase for a child other than their own. None of the respondents who purchased the doll said the purchase was for their own child.

Thirty-four of the respondents (65%) owned one or more Barbie® dolls as a child, but only twenty-eight (54%) actively played with the dolls as a child.

Only nine respondents (17% of the total) answered "yes" to the question about whether Computer Engineer Barbie® would influence a young woman's decision to choose a career in some area of computer or information technology. Twenty-nine respondents (56%) answered "maybe" and thirteen (25%) answered "no".

A vast majority of the respondents (83%) said that they do mentor and/or encourage young women to enter a computer science or information technology fields. Additional demographic data collected can be found in Appendix B.

The last question in the survey asked what influenced the respondents' career choices. The most popular answers to this question were teachers, parent or other relative and job opportunities. Of the remaining choices that were provided, guidance counselors had the least impact (6%) on career choices.

More Detailed Analysis

Table 2.
Comparison of Opinions Regarding Possible Influence on Career Choices between Owners and Non-owners of Barbie® dolls.

		Will CE Barbie® influence girls' career choices?		
		Yes	**Maybe**	**No**
Owned Barbie® dolls	**Yes**	7 (20%)	19 (56%)	7 (20%)
	No	2 (11%)	10 (56%)	6 (33%)

There appears to be a difference between the respondents who owned Barbie® dolls as a child and those who did not. (Table 2) As shown in the table, those respondents who owned Barbie® dolls in the past were more likely to answer "yes" to the question about whether CE Barbie® would have an influence on girls' career

choices. Statistical tests were not performed due to the low number of those who did not own Barbie® dolls as children and who also answered "yes" to the influence of CE Barbie.

Further analysis of the survey results indicates that of those six respondents who had voted:

- Two purchased dolls for a child who was not a relative
- Three owned Barbie® dolls as a child, but only two actively played with them
- All said "maybe" to influencing a career choice
- The ages ranged from 30 to over 60
- All had over 15 years of experience
- All had doctorates
- All were in education

Of the four respondents who had purchased the Computer Engineer Barbie® doll,

- Only two owned Barbie® dolls as a child
- One said no to CE Barbie® influencing career choice

Given the small number of respondents overall and the very low number who voted for the computing engineer career and who purchased a CE Barbie, no statistical analyses can be made. However, it does appear that prior ownership of Barbie dolls does not seem to affect the number who voted, the number who purchased CE Barbie dolls, nor the opinions of the possible influence of CE Barbie on young girls' career choices.

Respondent Comments

The comments made by survey respondents reveal reasons for their answers to the question about the possible influence on careers choices. Those who answered "yes" to that question say that simply bringing attention to careers in technology and potential role-playing will be beneficial. Those who responded "no" to that question feel that Barbie is merely a fashion icon. Please note the respondent comments in this section for the most part, have been copied verbatim from the survey except that minor typographical errors have been corrected.

Those respondents who said "**yes**" to CE Barbie® influencing career choices, made the following comments:

- I think "role models" are very important. Just bringing attention to computing careers period -- disregarding any gender issues -- will be a plus for both genders to consider computing as a career option. To what extent it might influence females vs. males will be interesting to try to discern. (Also please note below I am currently an educator but formerly worked as a computer systems analyst, project manager, and senior consultant.)
- It's a simple matter of getting the 'idea' that women can choose technology planted in little girls' minds.
- I personally do not feel that Barbie (the way she is built) is a good role model. However, if a girl has a Barbie I prefer that it is Computer Engineer. It will influence some girls in that direction.
- Role playing with dolls was a popular activity when my friends and I got together as children. Barbie was one of our favorites since she was more "realistic" than just baby dolls. We were able to simulate situations of parties, luncheons, weddings, dates, etc. Having dolls that lead girls to project career situations also is critical to opening doors for girls to consider all types of careers.

Those who said that **"maybe"** to CE Barbie® influencing career choices, made the comments listed below:

- Depends on the age of the child, and the "play" setting or group the child participates in or with.
- I think it's a positive step, but a very small one. There are so many influences on girls that don't encourage them to pursue careers in computer science, engineering, mathematics ...
- My daughter is a huge fan of Barbie dolls. She often gets ideas about careers from them, so having computer engineering represented is important.
- I would rather see a "barbie" created by a computer modeling program based on 'normal' female physical parameters.
- The degree of influence will depend on the popularity of this version of the doll.
- I don't think it will cause young women to avoid a computing career. The media attention of this new career may bring computing careers into a young woman's awareness.
- A Computer Engineer Barbie does, at least, make it clear that women (including beautiful and young ones) may choose a career in computer engineering. It allows a girl to consider herself in that role.

Those who said **"no"** to CE Barbie® influencing career choices, made the comments listed below:

- Not anymore than owning a fire truck encourages someone to become a firefighter.
- I don't think that girls associate Barbie with careers. Instead their focus is on her as a fashion icon.
- My impression of how kids play with Barbies is that they usually take the clothes off.
- I think the obstacle to CE Barbie making any impact it that it has virtually no shelf space. In traveling the US and Canada, I've only seen this "I Can Be" option available in 2 locations of about 50 visits to large retail stores. As far as her ability to inspire girls for computing careers, I don't hold much hope. CE Barbie has gadgets, but there's virtually no depiction of her solving problems, taking care of others, etc. There's no "verb" to go with her name. Her box is a cubicle. There are no other living beings with her (cats, dogs, kids). She has a laptop and a phone. She types all day, alone in a cubicle.

8. LIMITATIONS AND DISCUSSION

Two questions were flawed in the way they were constructed and given the small sample size, no statistical analyses were appropriate. The two flawed questions are the ones that asked respondents about their age and number of years in the field. In both, the choices included overlapping ranges.

Additionally, the sample size was small, the response rate was rather low and it was not a random sample. The number of requests that were sent out is unknown, since some requests were made through professional organizations. However, given that most of the respondents were in education and the number of requests to educators is known. The response rate was less than 17%.

Given the limitations, there is a general consensus in the responses that the CE Barbie® doll itself may have some influence in the career choices of young girls. When the "yes" and "maybe" answers to the questions are added together, both prior owners and non-owners of Barbie® dolls tend to believe that CE Barbie® may have an influence (>70%).

But this influence can only happen if they are exposed to the doll. In June of 2011, a quick computer search showed that Target.com was out of stock of the doll. Both Walmart.com and ToysRUs.com did not list the doll at all. If the dolls are not on store shelves and websites, they will not have any influence at all. The careers from the Barbie® "I can be" series that were available on Walmart.com were:

- Lifeguard
- Doctor
- Vet
- Ballet teacher
- Pizza chef

On ToysRUs.com, those careers were available as well as the following:

- Movie star
- Cheerleader
- Preschool teacher
- Nurse
- Newborn baby doctor

A subsequent search for "Computer Engineer Barbie" performed a week later produced no results on Target.com.

We would be remiss ~~in noting~~ if we did not note that organizations and groups that encourage girls to pursue careers in science, technology, math, and engineering suggest toys for girls such as puzzles and construction sets. (E.g., Halpern, Aronson, Reimer, Simpkins, Star, & Wentzel, 2007)

9. CONCLUSION

In general, most respondents believed that a Computer Engineer Barbie® doll may bring awareness of CS, IT and engineering careers to young girls. This corresponds to the research mentioned in section 5 which found that exposure to careers in which women are a minority influences the careers that children believe are acceptable. However, if girls are not aware of the doll, they may not be aware of the career choice, and a search of the websites of three major retailers in June of 2011 produced no results when the term "Computer Engineer Barbie" was entered.

Another issue with CE Barbie®, as some of the respondents commented, is that there is no indication of what CE Barbie® does during her workday. It is not surprising that young girls voted for the news anchorwoman career choice because they can see at least some of what that career entails on television. The other careers presented as choices on Mattel's website are unlikely to have a presence in the lives of young

girls. Young girls are likely to imitate careers with which they are familiar. They are exposed early in life to doctors, nurses, teachers and television personalities and their exposure to the other career choices presented on Mattel's website (computer engineer, architect, and environmentalist) is probably quite limited. One might conclude that the only reason that CE Barbie® was produced was due to the ground-swell of voting that came from women in computer science, information technology and engineering fields.

It is also not surprising that major retailers are not stocking the CE Barbie® because they will stock what customers want. Girls aren't likely to be familiar with any computer-related career unless it is a career held by a close family member. Awareness of the doll and ordering one directly from Mattel may be the only way one could purchase the doll.

An interesting follow-up for the future will be to survey females entering computing and engineering majors to see if any owned a Computer Engineer Barbie® as a child.

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APPENDIX A

Survey Questions

1. Are you aware that Mattel® released "Computer Engineer" Barbie in the fall of 2010? (Yes/No)
2. Prior to the release, did you vote on the Mattel® website for "Computer Engineer" to be Barbie's next career?(Yes/No)
    a. If you voted, did you encourage other women to vote? (Yes/No)
3. Have you purchased at least one Computer Engineer Barbie? (Yes/No)
    a. If so, was it (check as many as apply)
        i. For yourself
        ii. For another adult
        iii. For your own child
        iv. For a child other than your own
4. Did you own one or more Barbie doll when you were a child? (Yes/No)
    a. If so, did you actively play with Barbie dolls when you were a child?(Yes/No)
5. Whether or not you purchased one, do you think that Computer Engineer Barbie will have an influence in a young women's decision to choose a career in some area of Computer Science/Information Technology/Information Systems/Computer Engineering? (Yes/No/Maybe)
    a. Please enter any comments about the potential influence of Computer Engineer Barbie here. (text area for comments)
6. Do you mentor/encourage young women to enter the computer science/information systems/information technology fields? (yes/no)
7. What is your age range?
    a. 20-25
    b. 25-30
    c. 30-40
    d. 40-50
    e. 50-60
    f. Over 60
8. Are you currently employed in some area of Computer Science/Information Technology/Information Systems/Computer Engineering?(Yes/No)
    a. If so, how many years have you been in the field?
        i. 0-5
        ii. 5-10
        iii. 10-15
        iv. 15-20
        v. Over 20
    b. What is the highest educational level obtained?
        i. High school
        ii. Associate's degree
        iii. Bachelor's degree
        iv. Master's degree
        v. Doctorate
9. What most closely describes the industry in which you are employed?
    a. Government
    b. Healthcare
    c. Education
    d. Consulting
    e. Other (text box for input)
10. What most closely describes your job title?
    a. Project manager
    b. Computer Engineer
    c. Software Engineer
    d. Systems Analyst
    e. Database Administrator
    f. Network/Systems Administrator
    g. Computer Support
    h. Educator
    i. Software Trainer
    j. Other (text box for input)
11. Which of the following influenced your career choice? (check as many as apply)
    a. Parent or other relative
    b. Friends
    c. Guidance counselor
    d. Teacher or professor
    e. Research done by yourself
    f. Job opportunities
    g. Opportunity for a good salary
    h. Other (text box for input)

Thank You for your time and participation in this research endeavor!!!

APPENDIX B
Survey Demographics

Age of survey respondents:

Years	20-25	25-30	30-40	40-50	50-60	Over 60
No. of respondents	0	3	7	12	21	9

Educational level of survey respondents:

Education level	Bachelor's degree	Master's degree	Doctorate degree
No. of respondents	5	10	37

Job titles of survey respondents:

Job title	Educator/Professor	Other
No. of respondents	41	11

Years of experiences of survey respondents:

Years of experience	5-10	10-15	15-20	Over 20	Blank
No. of respondents	8	3	12	25	4