Are Engineering Design Graphics Educators Satisfied with their Jobs? A National "Snapshot" into the Lives of These Professionals

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Abstract

For the past twenty years, professionals in the field of engineering design graphics have seen major changes in both the content taught and the type of tools used in the classroom. With these changes, few have looked at job satisfaction among educators in engineering/technical graphics. Therefore, the authors of this research study investigated educators' contentment with their current positions as engineering/technical professionals and the factors that are influencing their level of job satisfaction.

During the fall of 2001, a questionnaire was sent to all of the members in the Engineering Design Graphics Division of the America Society for Engineering Education living in the United States and Canada. The questionnaire was designed to look at job satisfaction and to identify motivational factors that influence educators' perception of their work environment(s). The instrument, originally developed and validated by Mottaz in 1981, was design to measure the intrinsic and extrinsic variables associated with job satisfaction.[1] Questions in the survey looked at job responsibilities, salary, supervision, autonomy, promotion, co-workers, challenges, and general working conditions. With slight modifications, the instrument was re-written to adapt it to engineering/technical graphics educators and the types of environments they commonly work in. This paper will discuss some of the findings of this study and suggest areas for improvement so that, as the profession grows, our dedication to our students can grow with it.

Introduction

The instructor is the heart of the educational process, and the quality and success of any institution are based on its faculty and their productivity. The role of instructor, for those that teach in either an engineering or technology-based institution, is increasingly important as society becomes more technological advanced and as people rely on their institutions of higher education to "pave the way" for the future. Considering the important task given to professionals in higher education, this study was designed to examine the job satisfaction of instructors that teach engineering/technical graphics. The researchers based the need for this study on previous research conducted in other fields related to both secondary and post-secondary education, which looked into the present and future well-being of teachers.[2] For example, Cetron and Gayle, in their 1991 book titled *Educational Renaissance,* discussed issues related to educational reform at all levels, with a particular focus on educators and their retention. These researchers concluded that educators leave the profession because of lack of commitment, stress, burnout, salaries, and lack

of administrative support.[3] These findings indicated that the "relationship between job satisfaction and turnover seem to be unequivocal."[4] Therefore, a need existed to look into job satisfaction as it related to areas associated with the environment in which learning takes place.

Given the ever changing environment in education, and the constant demand on educators to do more in areas of teaching, research, and service, the authors of this study wanted to find ways to improve the work place environments for engineering/technical graphics instructors. However, before this can be done, the attitudes of educators, and the intrinsic and extrinsic variables that affect their professional life, need to be analyzed. Intrinsic variables are those rewards that are personal to each individual instructor. Examples of intrinsic variables are achievement, recognition, and advancement opportunities. Extrinsic variables are variables that affect the overall structure and environment of an organization and are independent of the educator. Examples of extrinsic variables are pay, working conditions, and job security.[3] The purpose of this study was to explore these variables, and their affect on job satisfaction among engineering/technical graphics educators. The study was also designed to look for correlations between them. The following research questions were addressed in the study. First, which intrinsic and extrinsic variables significantly contribute to job satisfaction? Second, do engineering/technical graphics educators differ in the variables they feel are important for job satisfaction? Also, what are these variables, and are they statistically significant? This study addresses these questions, the contentment instructors have to their current positions as engineering/technical professionals, and the factors that are influencing their level of job satisfaction.

Review of Literature

For years, professionals in fields of educational research have studied why people choose education as a career. In 1981, the National Education Association conducted a study looking at this issue. This study found that people choose educational fields because they have a desire to work with other people, a direct interest in a given subject matter, and want to continue to research and increase their knowledge base in a given discipline. It also found that education related fields attract people that want to influence society by offering a better education to students and the people they come in contact with. Vacation, job security, and a flexible schedule were also factors that attracted people to education.[5] Given these and others factors, why is it that so little research has been done on educators' job satisfaction, and why does education have one of the highest turn-over rates of any occupation?[6] These were the questions that led to a review of the research literature related to educational areas and job satisfaction in engineering, technology, and technical education.

Educators in the field of vocational, technical, and technology education have a long history of examining teacher retention. Concerns about job satisfaction have spawned numerous studies, especially in the 1960's and 1980's.[7] As far back as 1974, Richard Olson studied vocational stability and job satisfaction characteristics of post-secondary technology instructors. Using the Smith's Job Descriptive Inventory (JDI) and Holland's Vocational Preference Inventory (VPI), Olson researched job satisfaction among post-secondary instructors in electrical/electronics and drafting/design. These inventories collected data on elements related to job satisfaction that included cultural influences, job environments, participants' attitudes and values, and personality

patterns. Although few correlations could be found in the study, Olson indicated that when hiring instructors that would be satisfied with their occupation, one should seek older professionals with graduate degrees that are homogeneous with the others in their chosen field.[8]

In 1978, Kaufman and Buffer assessed the job satisfaction of 350 industrial arts teacher educators across the United States. Their study focused on work facets in occupational areas that included professional role activities, supervision, and colleague relationships. The instrument they used was the National Job Satisfaction Study Instrument (NJSSI), developed by Kaufman in 1976. This study found that both intrinsic and extrinsic job dimensions affect the overall job satisfaction of educators, but academic freedom was the most significant source of job satisfaction for teacher educators. The data also revealed that time to improve teaching skills, opportunities for promotion, salary, with teaching and research equally important, influence job satisfaction.[9]

In 1990, the International Technology Education Association (ITEA) Professional Improvement Plan called for a study of technology teacher retention. This call lead Wright to send a Likert-style survey to technology education state supervisors and presidents of ITEA affiliates within the United States, Canadian Provinces, and U.S. Territories. His findings indicated that a lack of support from administration was the main reason teachers left the profession, but salaries were also consistently identified as a source of dissatisfaction. Other factors that affected teacher retention and job satisfaction included budget problems, student apathy, and lack of equipment and facilities.[10] Another study by Wright and Custer, in 1998, explored outstanding technology teachers' attitudes about the rewards and frustrations of teaching. Their hope was that information from the study would aid in future teacher recruitment and retention. Their survey instrument used open-ended questions based on a review of literature. The major findings of this study were that participants stayed in education for the excitement and stimulation involved in a learning environment as well as the ability to make a meaningful difference in society and people. Major frustrations were lack of funding and student attitudes.[7]

Educators in higher education have also look at job satisfaction related to teacher performance. In 1979, Indiresan researched the linkages between faculty backgrounds and job satisfaction for engineering teachers. He found that teachers who had greater research involvement and output were more likely to be satisfied with their jobs. His conclusions suggested that educators should be placed in environments conducive for research by providing good facilities and helping them through the stress of publishing their work.[4] To examine the stress caused by publishing requirements in higher education, Pelsma, Richard, Harrington, and Burry conducted a study measuring teacher stress and job satisfaction. In this 1989 study, the researchers used the Quality of Teachers Work Life Survey (QTWLS), the Maslach Burnout Inventory (MBI), and the Educational Values Scales (VAL-ED). They concluded that job satisfaction and job stress are strongly related, and the quality of work life for teachers seems to be multidimensional, rather than unidirectional, as indicated by previous research in this area. However, they also found that the quality of work life is not significantly related to demographic variables such as age, education, gender, and teaching level.[2]

Mottaz looked at many different professions and aspects of job satisfaction, which has been the foundation of a number of current studies in education disciplines. His research in work alienation developed and classified the work situation into three categories. These categories include

interpersonal relations, task-related variables, and task characteristics.[1] This work led to his thematic research into job satisfaction that had a particular emphasis on intrinsic and extrinsic reward variables related to work (job) satisfaction.[11] He defined intrinsic rewards as the content of the task itself. In his view, intrinsic rewards included such factors as interesting and challenging work, self-direction and responsibility, variety, creativity, feedback, and opportunities to use one's skills and abilities. He further indicated that extrinsic rewards were provided for purposes of facilitating or motivating task performance. Mottaz defined extrinsic variables as being tangible and visible to others within the organization (i.e. pay, benefits, and security). An interest in extrinsic rewards and their ability to influence employee work satisfaction, and his previous research into job alienation, led Mottaz to begin a series of studies that analyzed the relationships between education and organizational commitment. These studies further involved him in additional studies related to job satisfaction.[11] During this period, he developed and validated an instrument to identify both intrinsic and extrinsic variables related to job satisfaction. Once completed, he then developed an instrument to look at organizational commitment. These two surveys were combined to produce the instrument for this study.[3, 13, 14]

Methodology

This study used the original job satisfaction survey instrument developed by Mottaz in 1981, and later revised in 1986 and 1987. The language in the instrument was modified by the researchers to make it appropriate for professionals in engineering/technical graphics education. A demographic section was designed, which also collected information related to the participants' previous and present employment situations. The instrument included 63 questions, broken down into ten categories, and used a four point Likert-type scale of strongly agree (4), agree (3), disagree (2), and strongly disagree (1).

The instrument included questions in five of the ten categories that identified extrinsic variables. These categories were the general working conditions in your school system, supervision, co-workers, promotion opportunities, and salary. General working conditions were defined as having adequate resources to support teaching and other work related issues (i.e. equipment, workload, and hours). Supervision was defined as the way supervisors were perceived to be supportive and helpful. Co-workers were defined by the degree each was considered helpful and supportive as well as competent and friendly. Promotional opportunities were defined as the extent to which opportunities for advancement were offered to faculty. The fifth category, for extrinsic variables, was defined as the extent educators believed their salary was fair and adequate for their current position.[3] Mottaz used Cronbach's alpha to establish and report the coefficients of reliability for these measures. His analyses obtained the following coefficients: 0.71 for general working conditions, 0.78 for supervision, 0.82 for co-workers, 0.82 for promotion, and 0.83 for salary.

Intrinsic related variables were identified and rated in three categories: autonomy related to practice, involvement, and significance of practice. The autonomy related to practice category was defined as the degree of self-direction. The involvement category was defined as the degree tasks were considered rewarding by themselves, and the category of significance of practice was defined as the amount of contribution educators felt they were giving to their work and teaching practices.[3] Based on Cronbach's alpha again, Mottaz reported the reliability of these measures as

0.92 for autonomy related to practice, 0.79 for the significance category of practice, and 0.88 for the category of involvement.[11]

Included in this instrument were questions from the Organizational Commitment Questionnaire (OCQ), which identifies variables related to organizational commitment.[15] These 15 questions were under the category of organizational commitment. The focus of these questions was to identify belief in the organizational goals, the willingness to extend effort to accomplish organizational goals, and the desire to belong to the organization. A final category in the questionnaire looked at overall work satisfaction.[3]

The survey was mailed in the Fall of 2001 to the members of the Engineering Design Graphics Division (EDGD) of the American Society for Engineering Education (ASEE) listed in the membership directory for 2000-2001. A total of 358 instruments were mailed to members in the United States of America and Canada, followed by a reminder letter two weeks later, and three reminders on the EDGD list-serv. After the data were collected, it was analyzed by looking at the relationship of the demographic data to each category, and its questions, using ANOVA tests for determining statistical significance.

Findings

Table 1 displays the demographic statistics gathered from the data. The demographic information found in the table indicates the majority of the respondents were male, over 50 years of age, obtained degrees in engineering, and had both education and industry experience. It also indicates that the educators mostly worked full time, had a master degree, and received mentoring when they first started teaching.

Question Responses:

Questions on the survey were placed into 10 categories. These categories were general working conditions, salary, promotional opportunities, supervision, co-workers, autonomy related to practice, significance of practice, involvement, overall work satisfaction, and organizational commitment. In examining the responses to these questions, some interesting results were found.

Under the area of general working conditions, the researchers found that respondents generally considered their working conditions good, particularly in the areas of working hours, work pressure, equipment, and facilities. However, over a third of the respondents (27 or 38%) indicated that their institutions did not provide them with sufficient resources to do their jobs. In another area of this category, 38 or 53.5% of the respondents either agreed or strongly agreed with the statement that their workload was too heavy.

In the area of salaries, over half of the respondents, 38 or 54.8%, were not satisfied with their current salary, although 60.3% (41) felt that their salaries had kept up with the cost of living. Slightly over half, 55.7% or 39 (n= 70), felt they were not underpaid for their position, but 57.5% or 37 (n=65) felt that they were not making a salary comparable to other institutions, and 44 or 63.7%, (n=69) felt they were underpaid for the amount of work they performed.

Table 1: Demographics of Respondents

Category	Value (n=71)
Mean Age	51.2
Mean Years of Education	18.85
Mean Years in Current Job	14.61
Mean Years in Industry	8.02
Males	85.9%
Females	14.1%
Industry Experience	85.9%*
Traditionally Trained in Tech. Graphics	80.3%*
Currently working in Tech. Graphics:	
Full-time	81.7%
Part-time	8.5%
Retired	7.0%
No Response	2.8%
Degree Areas:	
Engineering	54.9%
Education	21.1%
Technology	16.9%
Other	5.6%
No Response	1.4%
Highest Obtained Ed. Level:	
Associate	1.4%
Bachelors	4.2%
Masters	49.3%
Doctorate	43.7%
No Response	1.4%
Mentoring:	
Received Mentoring (Yes)	63.4%*
Did it help (Yes)	60.6%*

Note: *Category was equal to 100%

In the realm of promotion and tenure policies, the majority of the respondents, 73.8% or 48 (n=65), did not feel that the policies were fair, but somewhat over half, 58.2% or 39 (n=69), felt that there were good opportunities for promotion at their institutions. However, 64.2% or 43 (n=67), felt they had a slim chance of promotion without some type of "break." Only about half, 52.2% or 35 (n=64), were satisfied with the promotional opportunities at their institutions.

In the area of supervision, the respondents felt that their supervisors were difficult to work with, but they generally thought their supervisors were fair, competent, friendly, helpful, and praised their work. Of their co-workers, the respondents were more complimentary. Overwhelmingly, the respondents felt that their co-workers were helpful, cooperative, stimulating, and competent.

Interestingly, 63 (88.7%) indicated that they agreed or strongly agreed with the statement that their co-workers were not easy to get along with.

In the areas related to autonomy in practice, the respondents very strongly voiced the opinion that they had freedom and control, and 100% of the respondents indicated that they had the opportunity to exercise their own judgment. Only a slightly lower percentage of the respondents felt that they had control over daily activities and freedom from consulting supervisors when making decisions.

The respondents also overwhelmingly agreed that their work was significant to the department, important, and worthwhile; but 61 (85.9%) indicated that they were not sure they understood the purpose of their work. Sixty-eight (95.8%) also agreed or strongly agreed with the statement that they often wonder what the importance of their job really was. These responses could stem from the uncertainty caused by changes in the field.

Under the category of involvement, a majority of respondents overwhelming indicated that they sometimes did not feel a sense of accomplishment in the type of work they perform, and 100% (n=70) of the respondents agreed that salary was the most rewarding aspect of their job. However, 97.2% (69) agreed that their work provided a sense of fulfillment, and 95.8% (68) agreed that their work was self-rewarding, but felt their job could often involve routine and dull tasks. The same number also indicated that they felt their work was interesting and challenging.

The category of overall working satisfaction provided 67 responses (95.7%), which indicates that the respondents were satisfied with their work. A lower percentage, 77.2%, 54 (n=70), would still go into this career if they could start over again.

Under organizational commitment, the respondents largely agreed that they were willing to exert a great deal of effort beyond their job, talked positively about their institution to friends, were willing to accept almost any job assignment, felt their values matched their organizations', were proud to tell others that they are part of the organization, cared about the fate of the organization, thought that it was the best of all possible organizations, were inspired by the school, and were glad that they chose this school as the place of their employment. However, the majority also agreed that they felt little loyalty to their school, could be satisfied working at another institution, did not always agree with the institution's policies, and felt that not much would be gained by working for their institution indefinitely. Over half (52.8%, n=70) agreed or strongly agreed with the statement that deciding to work for their college or university system was a mistake.

As part of the survey, the respondents were asked to rank several categories by importance to their job satisfaction. These categories included freedom and responsibility in work, salary, friendly and helpful supervisors, meaningful worthwhile work, promotions, friendly and helpful co-workers, interesting and challenging work, and general working conditions. Their rankings indicated the following order of importance of these categories for job satisfaction. The respondents' top ranked category was meaningful and worthwhile work. Twenty-six respondents (36.6 %) gave this their top ranking, with 15 or 21.1 % ranking it second. The second overall highest ranking was interesting and challenging work, with 20 (28.2%) ranking it as their first choice, but 29.6% (21) ranked it as their second choice. The second highest ranked category was

freedom and responsibility in work. Twenty respondents (28.2%) ranked it first, 17 or 23.9% ranked it second, and the same number ranked it third. The category of friendly and helpful co-workers was ranked in fourth place. Fifteen (21.1%) selected this category as their fourth choice. General working conditions was ranked fifth overall, and friendly and helpful supervisors sixth. The category of promotions was ranked seventh, with 16 respondents (22.9%) selecting it as their seventh ranked category, and 35 respondents (50%) selecting it as their eighth ranked category. The lowest ranked category was salary. The rankings in this category varied more than any other, but overall it was given the lowest rankings.

Analysis of variance procedures (ANOVA) and t-tests were conducted on each of the ten categories based on their sum scores and the means of questions asked in each category. These scores were compared to the sum scores and means gathered in the demographic section asked at the beginning of the survey instrument. The ANOVA tests used an Alpha of $p \leq .05$ to determine statistical difference between the mean sum scores for each category as compared to the demographic information. Table 2 displays the comparisons that provided a statistical difference, and the results of the ANOVA test for these categories.

Conclusions

In reviewing the results of the data analysis, it is evident that generally educators in the field of technical/engineering graphics are satisfied with the type of work they perform. They mostly feel free to make decisions, feel they are adequately paid, their work is important, and challenging. Areas that are not so satisfying relate to resources, promotional policies at their institutions, and their workloads. Although they feel that they are well paid, they did not think that their salaries matched other institutions or was adequate for the amount of work they perform. They demonstrate a pride in their institutions and organizations, but do not feel a great deal of loyalty or desire to stay there for extended periods of time. This demonstrates that the respondents to this survey are not so much dedicated to their institutions, but to their profession. One of the most interesting aspects of the data was the number of times that "not applicable" was selected for questions under the category of organizational commitment. This was the only category that allowed respondents to select this response because the questions in this category were adapted from a different instrument than the others. This response was selected particularly often for statements about participants' willingness to work beyond normal expectations, their willingness to "talk-up" their institution to others, and their concerns about the fate of the institution. This could imply that the respondents already felt that they worked well beyond expectations, that it was inappropriate for them to advocate for their institution, and they personally had no direct effect on the fate of their institution. It could also imply that the respondents did not feel the questions were appropriate.

Table 2: ANOVA tests showing statistical difference between job satisfaction survey categories and demographic information for engineering/technical graphics educators.

Category/Demographics	DF	Sum of Squares	Mean Square	F Value	Pr > F
General Working Conditions					
Industry experience	2	62.58	31.29	3.33	0.0418
Mentor	1	81.75	81.75	9.10	0.0036
Salary					
2yr. vs. 4yr. institutions	1	2.47	2.47	6.05	0.0166
Promotional Opportunities					
Under 50 vs. over 50 yrs. age	1	2.37	2.37	4.51	0.0375
Co-Workers					
Industry experience	1	71.16	71.16	9.60	0.0029
Mentor	1	37.04	37.04	4.62	0.0351
Involvement					
2yr. vs. 4yr. institutions	1	25.73	25.73	3.89	0.0528
Industry experience	1	24.62	24.62	4.04	0.0485
Overall Work Satisfaction					
Mentor	1	1.51	1.51	5.19	0.0258
Significance of Practice					
2yr. vs. 4yr. institutions	1	23.25	23.25	4.00	0.0496
Industry experience	1	32.88	32.88	5.91	0.0178
Under 50 vs. over 50 yrs. age	1	22.60	22.60	3.79	0.0555
Supervision					
Industry experience	1	91.14	91.14	4.97	0.0292
Organizational Commitment					
2yr. vs. 4yr. institutions	1	0.74	0.74	4.02	0.0491
Industry experience	1	1.18	1.18	6.80	0.0113

 After carefully reviewing the findings made by the ANOVA tests conducted on the data, the following conclusions can also be made from this study. First, in the category of significance of practice, participants gave a wider range of responses than in any of the other categories. The number of ANOVA tests that were statistically significant within the category indicates the diversity of the responses. The diversity may be due to the questions asked in this category that dealt with the individualistic intrinsic variables of why we do what we do. This diversity of responses lets the profession of engineering/technical graphics know that members in the EDGD have individual ideas about what they want to achieve in the profession. This diversity is an asset

to the profession in that it tells other disciplines in education that, although professionals in engineering/technical graphics have common goals, there is autonomy in what one believes or stands for in education. It also demonstrates that individualism is still an attractive commodity that draws people into education as a career and keeps them there.

The most significant findings from all of the statistical analyses conducted in this study is that certain populations stand out when looking for statistical significance among the respondents. As seen in Table 2, from the demographic information examined, only four was consistently found to be statistically significant for each of the ten categories. These four areas were: the age of the respondents, whether or not they had industry experience, whether or not they had a mentor at the beginning of their career, and whether they taught in a two-year or four-year institutions.

The data indicated that a difference existed in the responses to questions between those participants that were under 50 years of age, when compared to the responses given by those over 50 years of age. This does not bode well for the profession because everyone, regardless of his or her age, needs to be satisfied with their job. One explanation could be that older participants (over 50) are more satisfied with their jobs because they have stayed in education as a career and do not see the need to seek another career based on lack of job satisfaction. A second explanation could be that there is a difference between instructors who have predominately taught in the computer age and instructors who taught with manual equipment for most of their careers. As for the differences between those participants with industry experience as compared to those that did not have industry experience, a noticeable difference was observed between these two groups, especially on those questions and categories that looked at intrinsic variables. This indicated to the researchers that job experiences outside of education affected the way they saw their careers and made them less satisfied with the culture in education. Whether or not participants had a mentor when starting their career in education was also a major factor in how the survey participants responded to questions. Given the responses made by participants, those that had a mentor seemed to have more job satisfaction then those that were left on their own to figure out the educational environment. This tells the profession that more emphasis needs to be placed on providing mentors to new faculty so that their initial experiences in education are successful and improves their job satisfaction. The last demographic area that demonstrated a statistical significance was the differences in responses provided by instructors from two-year (i.e. community college) institutions and four-year universities. This indicated to the researchers that environmental and organizational cultures exist between these two types of institutions. The researchers also feel that more study is needed into why these differences exist and what effects they may have on content and pedagogical strategies used in the classroom.

Overall, additional research is needed in areas of job satisfaction for engineering/technical graphics instructors. Once we know more about how instructors feel about their careers, changes can be made to retain current instructors and also provide more satisfying environments for individuals entering the profession in the future. As the profession of engineering/technical graphics grows into the 21st century, let's not forget who got us there. It is the teacher, researcher, and service agents that will carry the profession into the "visual age."

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