

Exploratory Analysis of Factors Influencing Engineers to Teach at the Philippine State Universities in Ilocos Region

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Abstract This study is focus in determining the factors that influence the engineers to teach in state colleges and universities of Region I. The study is an exploratory analysis of the factors influencing engineers in Ilocos Region (Region I) to teach in state universities. The engineers were first described relating to their profile and work-related problems. After which, factor-analysis was performed to extract the underlying multiple and independent components out of eighteen (18) hypothesized influential variables to come up with a less explicit discussion in reduced dimension. A survey questionnaire developed by the researcher was used as the main data gathering instrument. Copies of the questionnaire were distributed to sixty-one (61) engineers teaching in the four major state universities in the provinces of Pangasinan, La Union, Ilocos Sur, and Ilocos Norte. They were selected using simple random sampling where results of descriptive statistical analysis revealed that they were of varying ages, mostly males, married and very few have earned a doctorate. Prior to teaching, most of the engineers have short industrial experience. A bulk of the faculty was new and old wherein the new faculty were occupying instructor positions on temporary or contractual status. The problems mostly encountered by them in their previous and present employment were moderately serious. The application of factor analysis resulted in the extraction of four components explaining 65% of the total variance. Such proportion explained the reasons why engineers opt to teach in a college where 35% of the total variance were shared by intrinsic factors.

Keywords Intrinsic Factors, Opportunity, Compensation, Engineers

1. Introduction

Engineers are the most in-demand and internationally sought-after profession. Engineers do various work from designing programs at a computer terminal to overseeing maintenance operations for major structures like aircraft, ships, heavy earth moving equipment, mobile cranes, offshore oil platforms, and many more. Job opportunities for engineers are lucrative and complex. As such, there are numerous large number of higher learning institutions offering various engineering degree programs[1].

Engineering has diverse fields i.e. aerospace, agricultural, automotive, biomedical, chemical, civil, sanitary, computer, electrical, geological, marine, and mechanical, petroleum, and software to name a few. Electrical, mechanical, civil, and agricultural engineering are mostly offered and in demand program courses in the Ilocos Region.

Instructors and professors with engineering degree programs and industry experience are considered assets in higher learning institutions. Their industry knowledge plays a major role in producing quality graduates conversant with engineering ethics, and link between technology and society. Compared to graduate of teacher education courses, opportunities for engineering instructors and professors are far wider outside the academe. Ideally, engineering schools should focus more on “real-world” engineering design and operations, including quality management; cover more material in frontier areas of engineering; offer more and better instruction in both oral and written communication skills and teamwork skills; provide training in critical and creative thinking skills and problem-solving methods [2].

Undeniably, opportunities for engineering graduates are far wider outside the academe. In some published tracer

studies for graduates of engineering degrees in the past ten years, the employability indicated high, 95.54% -Lyceum of the Philippines [3], 68% -La Salle University[4], and 99% -CSPC[5]. In the 2017 annual report by overseas job portal Workabroad.ph [6] the highest paying and most in-demand specializations other than healthcare and IT professionals are engineers. Land-based engineers are highly compensated in the Asia-Pacific while sea-based engineers receive the highest compensation in the USA.

Shortage of engineers is true in almost every sphere of engineering, and the greatest need is not in the design offices, test laboratories nor on the production floors, but in the corridors and classrooms of an academe [7]. The demand of engineers to teach in college has long been an issue to higher learning institutions for engineering studies. Engineers in the Philippines opt to teach in state universities with starting salary grade of SG-12. A salary grade of SG-12, based on the last four tranches of the salary standardization law [8], has an equivalent compensation of PHP 22, 938. Such compensation is not attractive compared to the compensation being offered for the engineers by the local or international industries. With this, the career of licensed engineers in the academe and the academe's institutional outcomes are at stake. However, according to Campbell "Many people say they're going into teaching because they want to make a difference and that their career in engineering wasn't as satisfying as they expected[13]." In addition, engineering and teaching seem like totally different profession, however science and maths knowledge that was polished throughout years in the industry is easily transferred to a school setting. In short, engineering course subjects should be taught by the licensed and experienced engineers for the application and development of new technology [7]. However, Limited researches related to the factors why engineers opt to work in the college or university exist. For an increasing number of engineers – hard hat-wearing civil engineers, chemical experts and everyone in between – that second career is teaching[13]. In addition, this research aids to understand the existing scarcity of the engineering instructors and professors in the Region 1; and recommend guidelines to ensure the engineering higher learning institutions to have sufficient faculty pool.

Hence, this study was made to analyze the factors influencing the engineers to pursue teaching profession in the Ilocos Region

1.1. Objectives

This study aimed to determine the factors that influence the engineers to teach in state colleges and universities of Region I.

Specifically , it sought the following objectives:

1. to characterize the engineers in terms of their personal and employment profiles;
2. to determine the work-related problems encountered by the engineers in their previous employment and present job as teachers;
3. to determine factors that encourage young engineers to teach in state universities; and
4. to measure the level of influence of the factors as multiple and independent components

2. Methods

This study utilized descriptive research technique. It described the characteristics of the population represented by the faculty engineers as respondents. The respondents were randomly selected from major state universities in the Ilocos region offering undergraduate engineering degree programs.

The questionnaire as research instrument is composed of three parts. Part I used to describe the profile of the respondents as to their age, sex, years in service and highest education. Part II used to determine the encountered problems of the engineers in their previous and current employment. Lastly, Part III identified variables that could explain why engineers teach in state universities and colleges.

Factor analysis was utilized in reducing the number of variables that describe the reasons why engineers choose to teach in state colleges or universities . This analysis explored the underlying theoretical structures of the phenomena in reduced dimension [9]. Although the number of samples used in the study was small (<100), the use of factor analysis despite this size is warranted by the discussion of Shao [10], wherein conclusion, he stated that the general rule of thumb of the minimum sample size is not valid and useful and one can proceed with FA as long as his recommended rules concerning the overall KMO, smallest communalities, eigenvalues, and cut-off values of loading size were carefully observed.

3. Results and Discussion

3.1. Profile of the Engineers Teaching in State Universities

Table 1 shows the personal profile of the respondents. Age was nearly uniformly distributed over the different categories. As expected more males than females. The majority of the respondents were married. Few earned doctoral degree.

Table 1. Personal profile of the respondents teaching in state universities in the region (n=61)

Variable	Category	Frequency	Percent
Age (in years)	<30	14	22.95
	30 to 39	17	27.87
	40 to 49	13	21.31
	50 >	17	27.87
Sex	Male	40	65.57
	Female	21	34.43
Civil Status	Single	19	31.15
	Married	42	68.85
Education	BS	19	31.15
	Earned MS units	14	22.95
	MS	17	27.87
	Earned PhD units	5	8.20
	Ph.D.	6	9.84

Table 2. Employment's profile of the respondents engineer teachers in state universities and colleges in the region

Variable	Category	Frequency	Percent
Previous employment	none	21	34.43
	industry/non-academics	26	42.62
	teaching	14	22.95
Years in the previous employment	< 5 years	44	72.13
	5 to 10 years	11	18.03
	10 years >	6	9.84
Academic rank in the current employment	Instructor	31	50.82
	Assistant professor	18	29.51
	Associate professor	10	16.39
	Professor	2	3.28
Years in the present employment	< 5	24	39.34
	5 to 10	10	16.39
	10 >	27	44.26
Status of employment	contractual	25	40.98
	temporary	16	26.23
	permanent	20	32.79

Table 2 shows the employment profile of the respondents in the region. Experience like actual exposure to facilities and equipment in the industry is important for an engineer. Experience is one of the most important

qualification to become a good engineering teacher. Professor Magruder, mentioned that in order for a teacher has something to impart, he/she should have an appropriate education, training, experience, travel and observation, qualifications for a good teacher. In addition, an engineer should have rubbed elbows with workingmen of the artisan type and have measured himself/herself by the standards of knowledge and skill [12]. Ironically, many of the engineer teachers didn't have previous experiences in the industry prior to their entry in the college. They taught in other colleges or universities or first job was teaching in the state university. Majority of the engineer teacher have less than five years before teaching in a state university. In terms of Engineer teachers academic ranks are mostly instructors, very few of them are full-pledged professors. The data shows, a concave distribution of teacher engineers based on their experience in teaching in state university as a permanent, temporary or contractual status.

3.2. Problems in Previous and Present Employment

Table 3 shows the reasons why engineers shifted and left their previous workplaces. Some possible problems were identified and rated as to their degree of seriousness. As seen in Table 3, "stressful work" revealed the highest mean of 2.43 with low stress description. Other problems such as low salary, slow career advancement, uncomfortable workplace were all described as less serious. The respondents who considered the abovementioned problems as moderately serious to very serious should not be discounted nor neglected.

Problems encountered by engineers while in teaching were identified to shed light on leaving their teaching post issues. As shown in Table 4, this study identified overloading, slow promotion, rare opportunities, poor management, and low salary as problems. However, all these problems were generally considered less serious. This determines their mobility which is hardly predictable. In one study in the UK regarding teacher retention, solutions to teacher retention is challenging. Former teachers hardly provide practical suggestions in resolving retention issues they themselves faced with multilayered reasons [11].

Table 3. Problems in previous employment

Problem	NS	LS	MS	S	VS	Mean	Desc
Stressful work	27	3	14	12	5	2.43	LS
Low salary	28	4	13	13	3	2.33	LS
Slow career advancement/promotion.	27	10	12	8	4	2.21	LS
Uncomfortable workplace	28	9	14	10	0	2.10	LS
Poor management	35	9	8	9	0	1.85	LS
Lack of moral or motivational support from the supervisor.	34	11	10	6	0	1.8	LS
Conflicts with superiors/officemates	40	8	8	5	0	1.64	LS

*LS- less serious

Table 4. Problems in present employment

	NS	LS	MS	S	VS	Mean	Desc
Work Overloading	44	1	7	6	3	1.74	LS
Slow promotion	45	1	8	4	3	1.67	LS
Few opportunities compared to industry	44	2	9	3	3	1.67	LS
Poor management	45	2	8	3	3	1.64	LS
Slow professional advancement	46	1	9	3	2	1.59	LS
Low salary	45	2	9	5	0	1.57	LS
Lack of hands-on application and more of theories	45	3	8	5	0	1.56	LS

3.3. Extracted Latent Structures

Reasons why engineers choose to teach in a state university were sought. Factor analysis was conducted if the reason can be understood as a single factor or as comprising of multiple and independent components. To determine if factorability is possible, some measures of sampling adequacy were used such as the Kaiser-Meyer-Olkins and Bartlett’s sphericity test. As Table 5 shows, the KMO coefficient exceeds 0.50 and Bartlett’s test is significant. This is a good indication that factor analysis is possible.

Table 5. Results of the Sampling adequacy and sphericity tests

Kaiser-Meyer-Olkin test		0.74
Bartlett's Test of Sphericity	Approx. Chi-Square	612.87
	Sig.	0.00

Results of factor analysis revealed that 4 multiple independent components are extractable thus the success to reduce the dimensionality of the components from eighteen (18) to only four (4). By applying varimax rotation, the variances of the components have been maximized allowing eight variables to load on the first dimension, five variables to load on the second dimension, three variables on the third dimension and one to load on the last dimension. One variable did not successfully load on any of the four dimensions, and thus a candidate for exclusion.

Each of the four components explains a corresponding amount on the total variance. The component explaining the highest variance at close to 35% is the first component where the eight variables significantly loaded. With the addition of three more components, the total variance is a value above 65%. This means that the four components

explains 65% of the variation as seen in Table 6.

Table 6. Rotated Component Matrix

	Component			
	1	2	3	4
Sufficiency of the salary	-.08	.13	.78	-.11
Workload is just enough to handle.	.09	.10	.71	.20
Persuasion of family to teach in college	.05	.80	.19	.03
Distance of the school from home	.03	.57	.18	-.13
A friend convinced me to enter teaching.	-.14	.58	.04	.34
My family has a connection to where I work.	-.19	.65	-.43	.15
Teaching is the first opportunity that was offered to me.	.06	.16	.05	.88
I have a good working relation with my colleague	.40	-.09	.42	0.48
Supportive administration	.31	.24	.63	.09
Teaching job suits to my health concern.	.29	.64	.14	.07
It is my eager interest to teach students.	.81	.02	.07	.00
Teaching profession is my passion.	.84	.15	-.08	.18
I find satisfaction in my work.	.91	.01	-.07	.17
I want to be part of the students’ academic progress/achievement.	.89	-.10	.22	.00
I have a good rapport with students	.87	.09	.16	.02
I can exercise autonomy in delivering instruction.	.82	.09	.16	-.04
I find teaching a calling not a job.	.81	-.02	-.02	.17
I feel fulfilled whenever appreciated by students	.76	-.06	.19	-.15

Table 7. Results of grouping into the different dimensions

Component	Loaded items	Eigenvalue	Variance	%variance
I	It is my eager interest to teach students.	6.40	35.55	35.55
	Teaching profession is my passion.			
	I find satisfaction in my work.			
	I want to be part of the students' academic progress/achievement.			
	I have a good rapport with the students			
	I can exercise autonomy in delivering instruction.			
	I find teaching a calling not a job.			
II	I feel fulfilled when students appreciate the way I teach them.	2.55	14.15	49.70
	Encouragement of family			
	Encouragement of friends			
	Presence of relatives connected in the school			
	Distance of the school from home			
III	Teaching job suited to health concern.	1.72	9.56	59.26
	Sufficiency of the salary			
	Favorable workload			
IV	Good support of the administration to their faculty	1.13	6.29	65.55
	Teaching is the first opportunity that was offered to me.			

By careful breakdown, each extracted component was given a name with consideration of the underlying factors that each item represents. The most important component that highly influences engineers to teach in the university is considered intrinsic factors such as passion, satisfaction, fulfillment and individuality. The influence of other factors such as peer influences and physical comfort, compensation, workload and administrative support, and instant opportunity are moderate.

3.4. Level of Influence of the Factor-Analyzed Component

Table 8. Factor-Analyzed Results

Factors	Mean
Intrinsic factors (Fulfillment and individuality)	
It is my eager interest to teach students.	4.11
Teaching profession is my passion.	3.85
I find satisfaction in my work.	4.00
I want to be part of the students' academic progress/achievement.	4.15
I have a good rapport with the students	4.05
I can exercise autonomy in delivering instruction.	3.85
I find teaching a calling not a job.	3.89
I feel fulfilled when students appreciate the way I teach them.	4.15
Mean	4.01 (High)
Peer influences and physical comfort	
Encouragement of family	2.62
Encouragement of friends	2.21
Presence of relatives connected in the school	1.77
Distance of the school from home	3.26
Teaching job suited to health concern.	3.26
Mean	2.62 (moderate)
Compensation, workload and administrative support	
Sufficiency of the salary	3.21
Favorable workload	3.38
Good support of administration to their faculty	3.66
Mean	3.42 (moderate)
Instant Opportunity	
Teaching is the first opportunity that was offered to me.	2.38
Overall Mean	3.14 (moderate)

4. Conclusions and Recommendations

On the basis of the findings of this study, it is concluded that engineers teach in state universities are predominantly males, young, and have a minimum industry experience of less than 5 years. The results revealed that stressful work is one reason they shift into teaching. Furthermore, most engineers teach in state universities out of their passion for teaching. The feelings of fulfillment, satisfaction and freedom they can experience in teaching, motivate them to enter the academic profession are considered intrinsic factors which should be given utmost importance. It's by these that school administrator should find ways to provide opportunities to enrich learning particularly of those in the engineering programs. Engineers can become successful as a teacher if they produce successful students. This can be achieved if the teachers deliver instruction in an excellent learning environment for the students. The autonomy or academic freedom of the teachers to exercise their teaching ability should be considered. As engineers were not trained as teachers, school administrators should conduct seminars and professional development programs for engineers or other teachers of technical programs to be trained in terms of teaching pedagogy. Although no single reason can be isolated to answer issue on faculty mobility, school administration should still look into other key considerations for better communication in answering less serious problems our engineers experience on workload reduction, promotion or recognition, and salary compensation. It is also recommended that the administrations will push the engineers to pursue their masteral and doctoral degree to develop their understanding in teaching techniques. For future researchers, it is recommended to add additional parameters on how to motivate engineers to teach in college and factors that will encourage them to stay in the academe.

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