

Statistical Exploratory Analysis Of The Factors Which Contribute To The Productivity Of The Academic Teachers With Respect To Scientific Research Output And Teaching Effectiveness

Christos C. Frangos

Technological Educational Institute of Athens
Department of Business Administration
e-mail: cfargos@teiath.gr

Stavros A. Chaniotis

Technological Educational Institute of Athens
Department of Business Administration
e-mail: s.chaniotis96@yahoo.com

Konstantinos C. Fragkos

University College London
Department of Medicine
e-mail: konstantinos.fragkos.09@ucl.ac.uk

Konstantinos Kyritsis

Technological Educational Institute of Epirus
Department of Accounting – Finance
e-mail: ckiritsi@teiep.gr

ABSTRACT

The investigation of productivity of Academic Teachers in terms of research and teaching effectiveness is a subject which has attracted considerable research and which determines the economic level and prospects of a country. In this paper we investigate the factors which influence the academic teachers' effectiveness in the Greek Academic Institutions, either Universities or Technological Educational Institutions, with respect to their research and teaching. We have carried out two sampling surveys. In the first one, a questionnaire has been sent to 128 Professors at Greek Academic Institutions. In the second one, a questionnaire has been sent to 374 students studying at Greek Institutions of Higher Education, either Universities or Technological Educational Institutions. The Statistical Methods employed were the following: Descriptive Statistics, Chi-Square Tests and T-Tests, Linear Models, Factor Analysis and Reliability Analysis. The results are the following: A) The productivity of an academic teacher, which is defined as research output and teaching effectiveness, depends on the following factors: A1) The number of publications in internationally recognized journals, Indexed in databases with impact factor. A2) The number of citations to his papers from other authors working on similar subjects. A3) His Teaching effectiveness measured by the annual reports of evaluation by his students, A4) The type of the Academic institution where he works, A5) His educational

background and his studies, A6) His work previous experience. Another important result is the following: According to the answers to the questionnaire by the Academic teachers, research productivity is the principal characteristic of a productive academic, but according to the students' answers to their questionnaire , the characteristic which is of paramount importance for an academic is his teaching effectiveness in terms of making clear the subject of his courses, his daily contact with the students, his readiness to answer questions to his students and his general attitude to improve the knowledge of his students with respect to the subject which he teaches. The Chi-Square Test has revealed a strong association between work previous experience and the following variables: research activity, rank, knowledge of foreign languages, type and principle schools affiliated to an academic institution and level of undergraduate curriculum subjects, which the professor teaches. A general conclusion is that the type of Institution, the existence of post-graduate programs and the previous work experience of the Professor determine his effectiveness as teacher and research worker.

Key-words: Evaluation of University Teachers, Productivity of Academics, Sampling survey, Factor Analysis, Logistic Regression

JEL Classification: C1, C8, I2, M1, M3

1. INTRODUCTION

In this paper we investigate, using statistical methods, the factors that contribute either in the academic teachers' or the student's point of view on the productivity of the academic staff that work in Universities, Technological Educational Institutes (TEI) or research Organizations with regard to research and teaching. Higher Education Institutions are important centers for promoting entrepreneurship either by way of teaching courses related to entrepreneurship or by exercising entrepreneurship with the help of academic services like EAKE, MOKE and Research workshops. The research activity of teachers is the prerequisite for receiving research grants by the universities safeguarding their financial independence and promoting their work prospects. In order to identify the factors that are the characteristics of a good teacher, we prepared two questionnaires. The first questionnaire was addressed to teachers and was distributed online to 128 academics. The second one was addressed to students and was distributed to 374 Greek students at Higher Education Institutions with core students from TEI of Athens. The statistical methods that were used are Factor Analysis, Reliability Analysis, Chi-Square Test and Logistic Regression Analysis. A significant result is that productivity -which is defined as the number of recognized research publications and the teaching effectiveness- depends on the

type of the Higher Education Institutions (AEI), the number of citations of papers of teachers by other researchers, the existence of index factor in the journals which are hosting their papers and the level of effective and clear teaching by an academic teacher.

2. LITERATURE REVIEW

The subject of research productivity and teaching effectiveness has been investigated extensively and is a quite sensitive research area. Researchers that have published their work on this field are: Noser T. C., Manakyan H. and Tanner J. R. (1996), Jacob, Reinmuth and Hamada (1987), Paul and Rubin (1984), Dyl (1991), Logue (1991) and Faia (1976). The above researchers support the opinion that the success of a teacher in class depends on his research productivity. Another school of researchers has the opinion that focusing too much on research can be harmful to teaching effectiveness. Especially Hoyt and Sprangler (1976), West (1991) and Sample (1972) believe that research can lead to hyper-specialization of the teacher, which doesn't really give any pros to the students. In contrary, the pressure to a teacher in order to publish his work can also lead to less effective teaching. Many researchers believe that the academic staff of a department should be active with regard to research and should succeed in surviving scientifically as well as working persons and be one step ahead of science on their field of study.

Another researcher, Faia (1976) suggests that teaching and research are mutually supportive activities. Another point is noted by West (1991), who believes that a doctoral student that emphasizes mainly on research is not educated well because he is not able to see his field of science spherically and test his teaching ability in the classroom. That means that sometimes scientific research can lead to hyper-specialization. **Hyper-specialization is the state of education when a scientist is specialized only on a really narrow field of his science and doesn't know in depth the principles of his field scientific discipline.**

3. RESEARCH METHODOLOGY

In this study two questionnaires are used that are addressed to academic teachers (PrQ) and students (StQ) respectively. PrQ was distributed online to 128 academic teachers from Universities and Technological Educational Institutes of Greece and StQ was distributed to 374 students with the majority of them being students at TEI of Athens and TEI of Piraeus. These questionnaires include questions on the respondents' demographics, the educational characteristics of their Institutions, the years of working experience and the number of publications with index factor, information from recent student evaluations and questions over the relative importance of research and teaching.

The investigation of the relationship between research productivity and teaching effectiveness needs an objective measure of each variable. The number of posts in various journals, the number of citations in journals with impact factor, the research presentations at international and regional Conferences and the number of books published, are used as variables of the investigation. The random sample of the teachers consisted of 128 academic teachers and 63% of them were men and 37% were women.

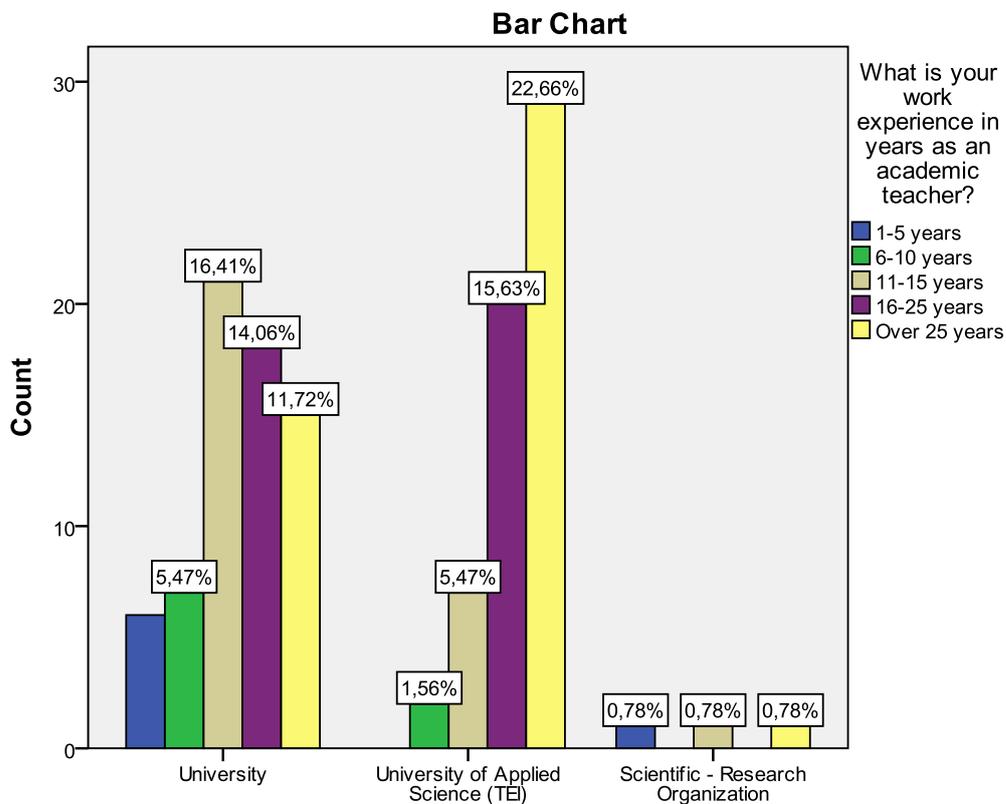
3.1 STATISTICAL METHODS

The average age of the respondents to the teacher's questionnaire was 46-50 years of age, while the standard deviation of their age was 10 years. In addition, 63% of the sample was teaching at a University of Greece and 34% of the sample was teaching at a TEI of Greece, whereas 3% of the sample was a member of a research organization. The random sample of the students consisted of 374 students at different Higher Education Institutions of Greece with the majority of them being students of TEI of Athens and TEI of Piraeus. The average age of the students was 21 years of age, while the standard deviation of their age is 3,37 years. Applying Chi-Square Test with the help of the Statistical package SPSS we find the following results:

There is a statistically significant relationship between the variables:

1. Work Experience and Research Activity, $\chi^2=27,2$, $df=16$, $p\text{-value}=0,039$.
2. Work Experience and Familiarization of the teacher with new technologies, $\chi^2=15,4$, $df=8$, $p\text{-value}=0,052$.
3. Work Experience and Knowledge of foreign languages, $\chi^2=26,99$, $df=12$, $p\text{-value}=0,008$.
4. Type of AEI and Experience with e-learning, $\chi^2=15,743$, $df=8$, $p\text{-value}=0,046$.
5. Type of AEI and being a Stressful Teacher, $\chi^2=16,14$, $df=8$, $p\text{-value}=0,040$.

The following graph shows that there is statistically significant relation between the type of academic institution and the work experience of an academic. Specifically, it shows that the majority of teachers at TEI are over 55 years of age, having more than 25 years of work experience, whereas the majority of teachers at Universities are 35-45 years of age, having 15 years of work experience. Hence, the Universities in Greece have younger academic personnel, whereas the Technological Educational Institutes have ageing education personnel. This fact has an influence on the research activity of the academics, because the younger academics are more keen on producing research publications than the older ones.

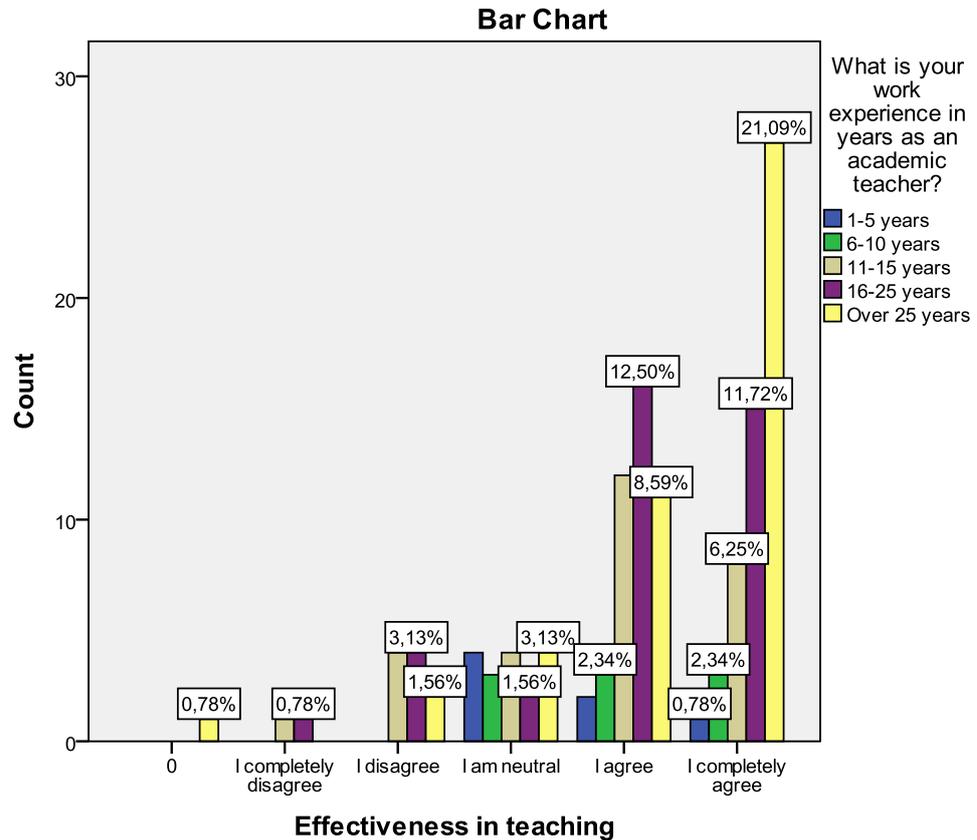


What is the nature of studies at the academic institution you are working?

Graph 1: Association between work experience as an academic teacher and the nature of studied the academic institution has

We note that the effectiveness in teaching has a statistically significant relationship with the work experience as the following graph shows. GraphThe academic personnel of the Universities are 16,4% with 11-15 years of work experience, whereas at Universities of Applied Science only 5,4% have 11-15 years of work experience as academic teachers. Also, the academic teachers with over 25 years of experience constitute 11,7% of the academic personnel at the Universities, whereas at Universities of Applied Science the same category of teachers is 22,6%. This fact means that Universities have younger academic teachers than

Universities of Applied Science, who occupy junior academic positions (Lecturer, Associate Professor). These academic teachers need to produce many more publications than the academic teachers at Universities of Applied Science in order to be promoted. So this is a reason why in the Universities the volume research which is produced is much more than the research which is produced at Universities of Applied Science.



Graph 2: Association between teaching effectiveness and work experience as an academic teacher.

From the above investigations, we reach the following conclusions:

- a. There is a statistically significant relation between the work experience of an academic and his research output, his familiarization with the new technologies and knowledge of foreign languages
- b. The type of Higher Education Institution plays an important role in the familiarization with e-learning and pressure for writing of a research publications.
- c. If we apply the Chi-Square Test to the variables of students' questionnaire we find that there is statistically significant relationship between the level of maturity of the student with respect to his studies and the academic year his study, with the senior students having greater experience and being more inquisitive about their prospects from their studies than the junior ones

Applying the χ^2 test we found following:

A relationship exists between the variables:

1. Age of the teacher , with the variable: minimum content of the curriculum based on the student's level of knowledge,
 $\chi^2=120,2$, $df=80$, $p\text{-value}=0,002$
2. The variable: The teacher informs his students about the skills they will acquire and the variable: whether the student is working or not,
 $\chi^2=10,4$, $df=4$, $p\text{-value}=0,033$.

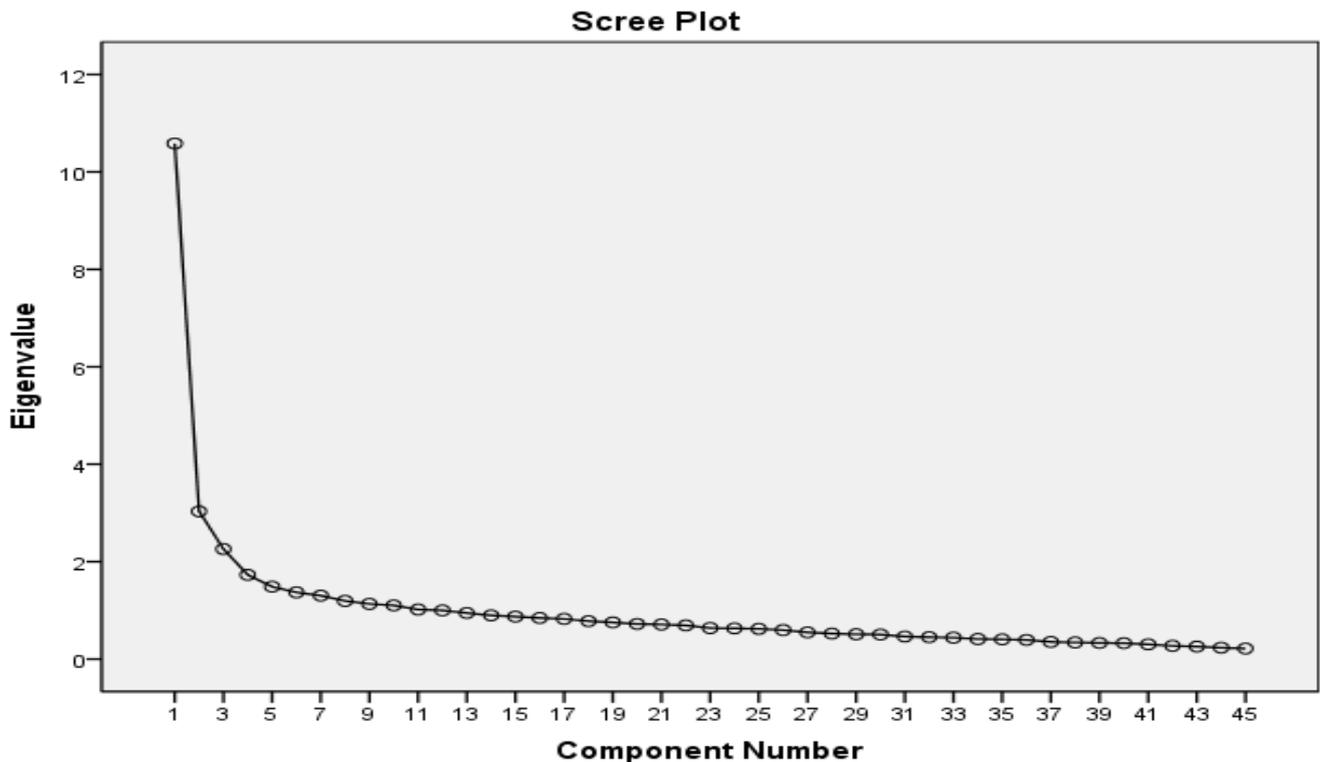
We found that there is a statistically significant relationship between the opportunity of the student to acquire significant learning outcomes from the course he follows and the possibility of working or not. When the student is working, he has the opportunity to acquire important work experience.

3. The variable : Age and the variable: “Encouraging the students to participate in the teaching process
 $\chi^2=17,5$, $df=4$, $p\text{-value}=0,002$. About 42% of the women and 25% of the men believe that an important characteristic of a good teacher is to encourage students to participate in the lesson and ask questions about it..
4. The variable: Age and the variable: “Promoting team-based projects,
 $\chi^2=110,4$, $df=80$, $p\text{-value}=0,014$. Younger students appreciate the importance of team-based projects. This is because younger students have a greater desire to work productively on a subject.
5. The variable: “The teacher provides to the students accurate explanations and answers students' questions” and the variable: “The student is employed or not”, $\chi^2=16,2$, $df=4$, $p\text{-value}=0,003$.
6. The variable: “The teacher checks the assigned projects and exercises given in class” and the variable: “The student is employed or not”, $\chi^2=9,8$, $df=4$, $p\text{-value}=0,044$.
7. The variable: “The teacher has an objective personality” and the variable “opinion of men and female students on teacher's effectiveness, $\chi^2= 12,7$ $df=5$, $p\text{-value}= 0,026$.
8. The variable: “The variable: “Teacher's research activity”, and the variable: “opinion of men and female students on teacher's effectiveness”
 $\chi^2= 2,23$, $df= 4$, $p\text{-value}= 0,692$.

In contrary to the teachers, the students do not believe that it is an important qualification for a teacher to be active on a research level, while they believe it is more important when a teacher is effective in his teaching, encourages students to participate in class and assigns projects. This is one of the most important findings of our research.

Subsequently, we apply the statistical method: Factor Analysis, in order to find the factors that affect the good opinion of the students with respect to a teacher . The KMO Test (Kaiser-Meyer-Olkin Test) is equal to 0,890 and the Barlett’s Test is statistically significant. With regard to the above we can confirm that the Factor Analysis is valid. A scree plot is given belowas follows:

Graph 3: Scree Plot



The scree plot reveals 3 factors that represent 60% of the variation of the answers to the questions. Factor (1) is defined as “The teacher’s classroom activities” and contains the variables: Teacher’s clarity, Teacher’s encouraging activities to students, Teacher’s adequate knowledge of subject, Communication, Promotion of team-based projects.

The Factor (2) is defined as “Exams” and contains the variables: Exam subject and Grades.

The Factor (3) is defined as “Studies – Work experience” and contains the variables: Undergraduate/Graduate studies, Experience in Research.

The Reliability Analysis involves finding Cronbach’s Alpha coefficient for the questions which are included in Factor Analysis. Cronbach’s coefficient measures the degree of internal consistency of questions, meaning the level at which the variables of the questionnaire are measuring the characteristics that

the researcher is expected to measure. In our case, the Cronbach's Alpha coefficient is equal to 0,91 which is considered as satisfactory.

4. CONCLUSIONS

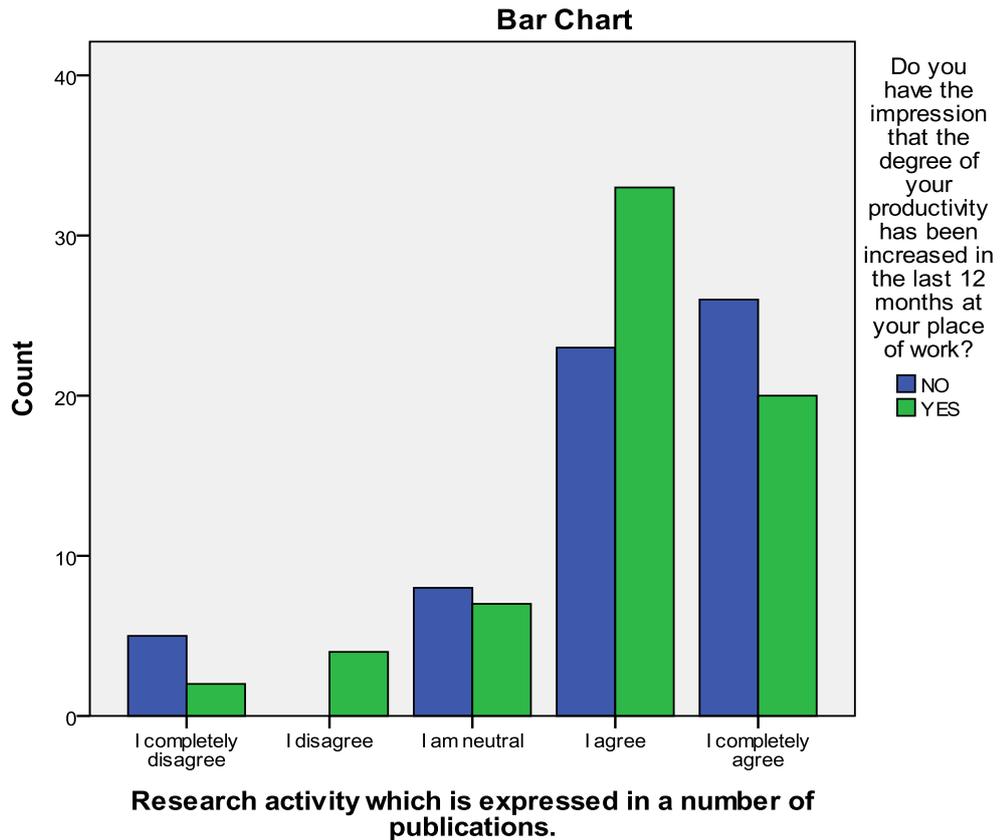
The 128 teachers have answered a questionnaire regarding the factors influencing their productivity activity. The results of this questionnaire are as follows:

1. There is a statistically significant relationship between Research activity and the increase of a teacher's productivity", $\chi^2=7,803$, $df=4$, $p\text{-value}=0,072$.
2. There is a statistically significant relationship between teaching at Graduate level and the increase of a teacher's productivity, $\chi^2=7,803$, $df=4$, $p\text{-value}=0,09$.
3. There is a statistically significant relationship between the type of the Higher Education Institution where the teacher is teaching (AEI or TEI) , the existence of graduate students and the teacher's educational activity, $\chi^2=11,646$, $df=6$, $p\text{-value}=0,070$.

5. GENERAL CONCLUSIONS

The first conclusion is that teacher's productivity is measured by the research activity, meaning the number of publications in journals with impact factor and the effectiveness of the academic with respect to the degree of satisfaction of his teaching by the students. We note the interesting contrast between the opinions of academics and the opinion of students regarding the characteristics of a remarkable teacher.

On the one hand, academics believe that the number of publications and citations with impact factor are important elements which show how productive the teacher is. On the other hand, students believe that the factors that determine the teacher's productivity are his effectiveness in communication and his abilities in teaching. In addition, the survey among teachers has shown (with the use of the Chi-Square Test) that the type of the Higher Education Institution, meaning University or TEI and the existence of graduate students affects the level of research activity by academics.



Graph 4: Association of teachers' productivity with research activity.

The message of this paper is that the productive academic teacher has the following characteristics:

1. He is an author of academic books
2. He is the author of internationally recognized publications
 - 2.1 His publications are published in scientific journals with impact factor
 - 2.2. His publications attract a considerable number of citations
3. His students have a high opinion about his teaching and communication abilities.

Graph 4 shows clearly that there is an association between the characteristic of a productive teacher and his efforts to increase his number of scientific publications.

6. ACKNOWLEDGEMENTS

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