Effect of Using Adjunct Instructors in an Electronics Engineering Technology Program

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Abstract

Many universities and colleges make use of temporary or part-time instructors (commonly called "adjunct professors/instructors") to teach courses in various programs. The reasons are many and varied. The main reason is lack of full-time instructional faculty, cost savings as universities and avoidance of full-time salaries and other benefits. The use of adjuncts maybe a short-term solution to a shortage of full-time faculty but overuse of this resource may diminish the overall quality of the program as these part-time instructors do not have enough stake invested in the program to provide meaningful instruction and the rigorous academic participation needed to maintain a quality and accredited program. As academic institutions experience budget shortfalls and declining enrollment, the tendency is to hire fewer full-time faculty and "pad" the instructional staff with temporary instructors. This paper explores the effect adjunct faculty has had on an electronics engineering technology program base on the results of the exit examinations required of senior students' graduation; the analysis is based on data from 2010-2028.

1. Introduction

Colleges and universities are increasingly relying on non-tenure-track faculty (temporary instructors commonly referred to as adjunct instructors) as part of their instructional staff. The reason for the increased reliance on part-time instructors or adjuncts maybe attributed to a number of reasons, primarily cost-saving measures or lack of full-time instructors. By hiring adjuncts, universities avoid paying full-time salaries and offering other benefits. The overall cost is significantly reduced having an adjunct teaching a course section than a tenured or tenure-track faculty to teach that same course section [1].

The use of adjuncts provides a short-term solution to a shortage of full-time faculty but the overuse of this resource may, over time, diminish the overall quality of the program as these instructors may not have enough stake invested in the program to provide meaningful instruction and rigorous academic participation needed to maintain a quality and accredited program. As academic institutions experience budget shortfalls and declining enrollment, the tendency is to hire fewer full-time faculty and "pad" the instructional staff with temporary instructors.

Regarding the reduction of expenses, saving on instructional costs does not result in an increase in investment as it can do harm to the caliber of students produced, thus negatively impacting the university. Private four-year colleges that use large proportions of non-tenure-track faculty members spend 37 percent less on full-time faculty members of all kinds than do similar institutions with small shares of non-tenure-track faculty members. But looking at spending on all categories of full-time employees, these institutions are spending only 19 percent less than those with small shares of non-tenure-track faculty members. So more spending seems possible on the administrative side [1]. The same is true for public four-year colleges, although the spending gaps are 24 percent and 14 percent, respectively. Public four-year colleges are using the savings in instructional costs from relying on adjuncts to increase spending on other areas, namely maintenance, administrative and student-services staff. Most of this spending is in recruiting, admissions, counseling, student organizations, and athletics [1, 3].

The shift to non-tenure track faculty has affected the quality of education. It makes the process of hiring and retaining faculty more difficult; low wages and lack of job security that come with the contingent faculty (adjuncts) often lead to schools losing out on high-quality candidates. Poor salary and benefits are the proverbial tip of the iceberg. Unhappy, underpaid, overworked, and sometimes under-qualified instructors provide less-than-ideal instruction. Contingent faculty are often staffed at the last minute, a circumstance that directly prevents these instructors from properly preparing for the classes that they are assigned. In order to make enough money to make ends meet, many teach at multiple universities, often taking on far more than four classes, which is a more-than-full load. Non-tenure track faculty often have little choice in the classes they teach, meaning they often teach outside their areas of specific expertise. Many are limited in their freedom to develop new curricula and are forced to follow syllabi that may be outdated, ill-conceived, or inferior. In short, the combination of lack of time to prepare, lack of freedom, a heavy workload, and commuting between multiple schools leaves these faculty members with little time to bring their best work to the classroom [2].

The data presented was collected on a number of courses for the exit exam, administered to senior level students as their final comprehensive examination needed for graduation from an Electronic Engineering Technology program. The data is being used to draw inferences on the effect of non-tenure track faculty (adjuncts) on the performance (outcomes) of students on the examination and hence the effect on the program.

2. Data and Context

The data used in this research article cover the 2010-2018 academic years (fall and spring semesters). The exit examination given to students is divided into three parts, labeled exam 1 and exam 2, and the take-home portion, which is a written section that covers the ABET outcome of lifelong learning. The data is for the Electronics Engineering Technology (ELET) program. A list of the courses and description is given in Table 1.

Table 1. ELET courses and course description (actual course names are not shown)

COURSES	COURSE DESCRIPTION
Course 1	Introduction to C++ Language programming
Course 2	DC Circuits Analysis
Course 3	AC Circuits Analysis
Course 4	Electronics 1: study of microelectronics components and uses (Diodes, Transistors; e.g. BJTs, MOSFET, JFET)
Course 5	Electronics 2: Operational Amplifier Analysis and System Design
Course 6	Digital Systems: Study of logic circuits, Boolean Algebra, etc.
Course 7	Communications Systems: Study of basic communications systems with emphasis on the applications of Fourier series, Fourier transforms, modulation techniques, and transmission lines
Course 8	Control Systems: Study of feedback control systems, Laplace transforms, and control modes and methods of implementation by analog and digital means
Course 9	Microprocessor Architecture: Introduction to microprocessor hardware and software, including microprocessor principles, organization, machine language programming, and input/output functions
Course 10	Advance C++ Language programming
Course 11	Computer Control Systems: Analysis and design of control systems with emphasis on control software, programmable controllers, and data acquisitions
Course 12	Microprocessor Interfacing: Study of interfacing with topics on bus timing, input/output timing, serial and parallel input/output methods, subroutine and control signals
Course 13	Micro-Computer Networking: Study of networking components and techniques for a microcomputer network, including the study of standards, protocols, LANs, and WANs

The ELET program is ABET-accredited and follows ABET standards. Therefore, the exit examination forms part of the assessment for evaluating the ABET outcomes for the program. Table 2 provides a list of ABET student outcomes for the courses taught in the program.

Table 2. Student Outcomes [7]

STUDENT OUTCOMES	DESCRIPTION OF OUTCOMES
A	an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly defined engineering technology activities
B	an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies

C	an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes
D	an ability to design systems, components, or processes for broadly defined engineering technology problems appropriate to program educational objectives
E	an ability to function effectively as a member or leader on a technical team
F	an ability to identify, analyze, and solve broadly defined engineering technology problems
G	an ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature
H	an understanding of the need for and an ability to engage in self-directed continuing professional development
I	an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity
J	a knowledge of the impact of engineering technology solutions in a societal and global context
K	a commitment to quality, timeliness, and continuous improvement

The student outcomes assessed by the questions on the exit examination (exam 1 and exam 2) are A, B, D, and F. In this study, the primary concern is with the outcomes assessed in part one of the examination since there is strong correlation between the data the hypothesis.

The exit exam comprises of 10 objective questions per course (see courses and description in Table 1). Each question is designed to evaluate at least one student outcome from the ABET student outcome list (Table 2). Students show mastery of any outcome by successfully attaining an average score of 70% and above.

The data collected over the 8-year period will be used to show that students' performance could be affected by the widespread use of part-time faculty. The department used few adjuncts in the ELET program from fall 2010-spring 2015; the ratio of full-time faculty to part-time was about 2.5 to 1. (i.e., 5 full-time and about 2 part-time). After spring 2015 (circa fall 2015) the department's record shows that there was a substantial increase in enrollment; therefore, more sections of courses were offered. To compound the matter, two more program tracks (electrical and computer engineering) were added without the additional faculty to carry the load. With no addition of full-time faculty, part-time faculty were hired. Each semester from fall 2015 to spring 2017, the department hired 5 to 6 adjuncts making the ratio of full-time faculty to temporary faculty 1:1. From fall 2017 the number of adjuncts started to decrease as a number full-time faculty were added to the department.

3. Data Analysis and Discussion

Outcomes A-F result of exit exam versus each semester

The summary of the outcomes a-f is shown in Table 1, which indicates the outcome a-f was not met during semester fall 2015 through spring 2017 due to the utilizing more adjunct faculty members to teach several ELET courses. There is some improvement in the result for fall 2017 and spring 2018. This could be attributed due to fact that the full-time faculty members were assigned to teach some ELET courses as overloads. It is important to note that the time interval between when students take the courses and take the exit exam is approximately 2-3 years.

Table 3. Average variation in outcomes A through F versus each semester

Semester	Outcome A	Outcome B	Outcome D	Outcome F
Fall 2010	82%	84%	86%	81%
Spring 2011	83%	84%	85%	81%
Fall 2011	82%	82%	83%	81%
Spring 2012	79%	79%	80%	78%
Fall 2012	80%	80%	82%	78%
Spring 2013	79%	80%	79%	76%
Fall 2013	76%	76%	77%	75%
Spring 2014	75%	74%	77%	74%
Fall 2014	72%	74%	78%	70%
Spring 2015	82%	81%	82%	79%
Fall 2015	66%	68%	64%	67%
Spring 2016	69%	69%	72%	69%
Fall 2016	64%	63%	69%	64%
Spring 2017	66%	70%	71%	69%
Fall 2017	78%	67%	84%	79%
Spring 2018	78%	75%	91%	80%

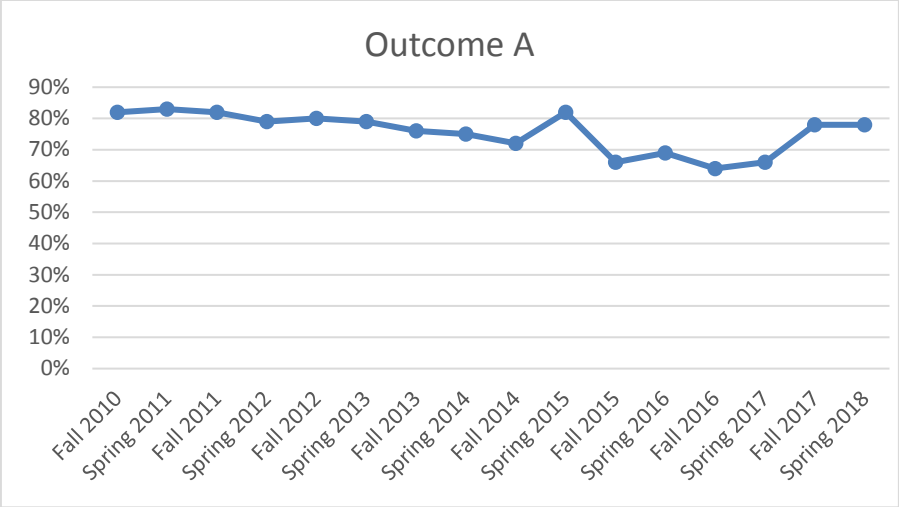

Figure 1. Percentage of students showing mastery of outcome A from fall 2010 through spring 2018

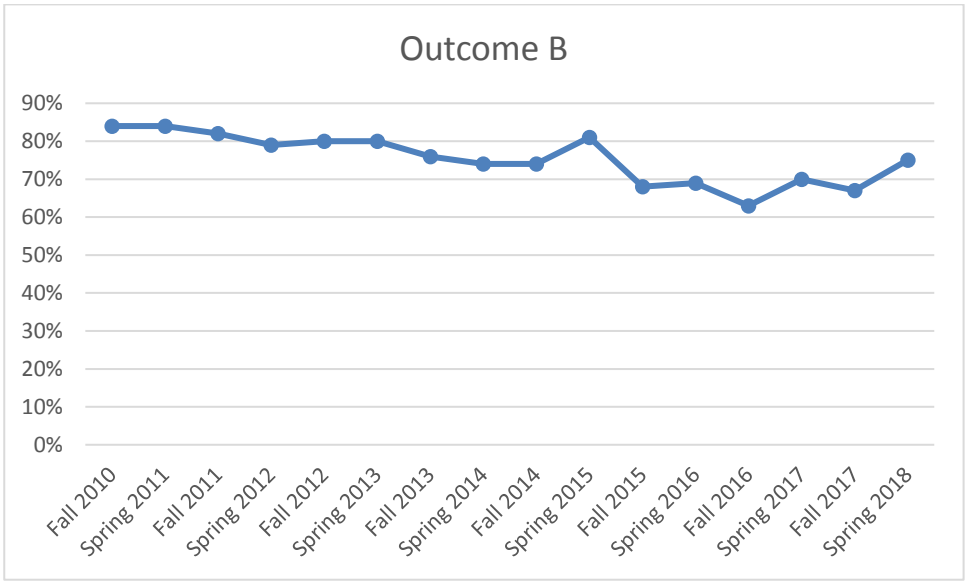

Figure 2. Percentage of students showing mastery of outcome B from fall 2010 through spring 2018

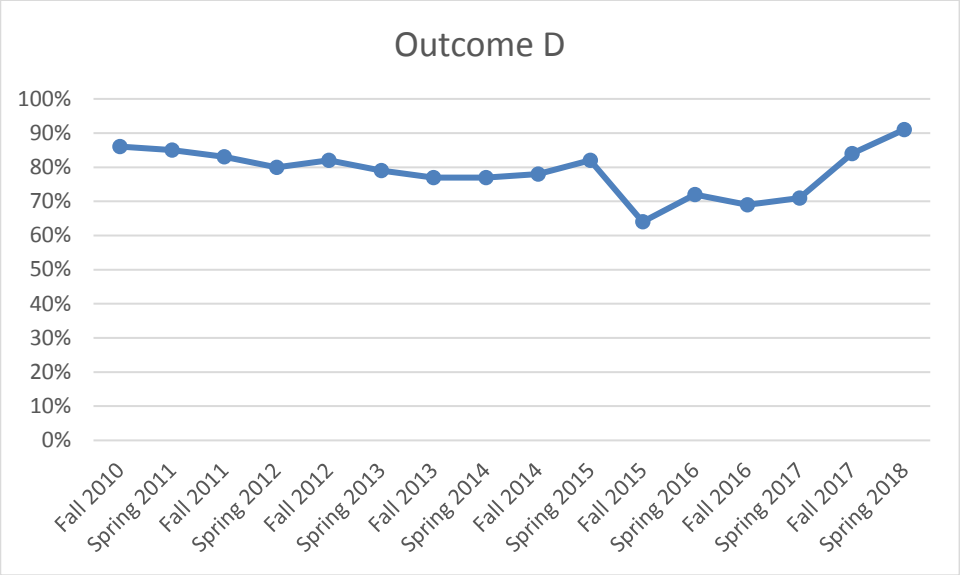

Figure 3. Percentage of students showing mastery of outcome D from fall 2010 through spring 2018

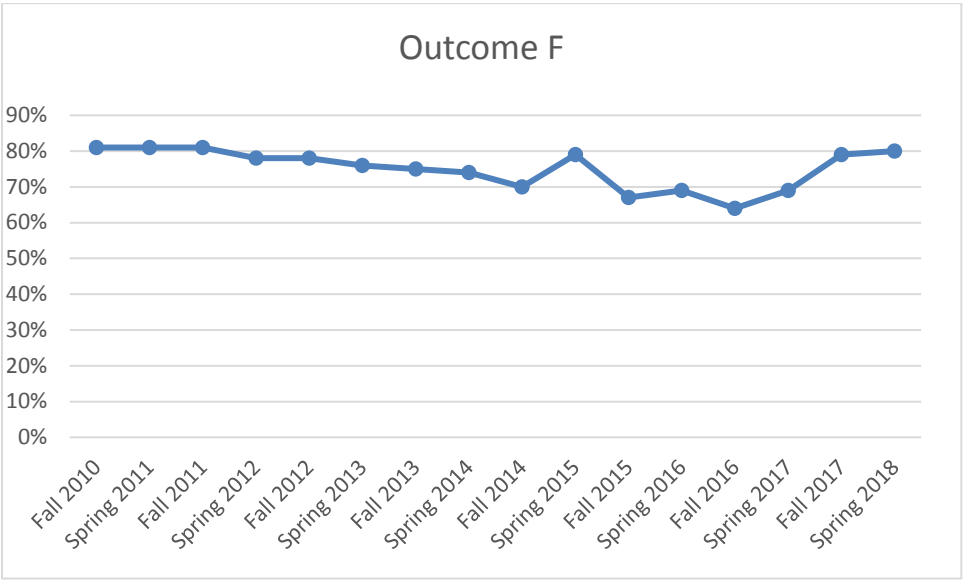

Figure 4. Percentage of students showing mastery of outcome F from fall 2010 through spring 2018

The data and the graphs show that from fall 2010 to spring 2015 percentage students meeting minimum outcome performance on the exit exam was satisfactory (70% plus). From fall 2015 a noticeable drop in students' performance, as shown in Table 3 and Figures 1, 2, 3 and 4. The ability of students not being able to master the outcomes from the dates given is attributed to the number of part-time instructors being used to teach classes. A word of caution: this does not mean that the instructors are not qualified to teach these courses; the poor performance could

be the instructors having little time to prepare for the course which they are given and also the lack of continuity of these instructors, since most of the instructors seldom return for successive semesters.

4. Conclusion

The data and analysis help support the conclusion that the use of adjuncts can have negative effects on a program if not managed properly. This is evident by the decreased performance in the student outcomes from the results of the exit examination. A proper mix of full-time and part-time instructors will make for a strong program as seen in the results from fall 2010 to spring 2015 and from fall 2017 to spring 2018.

This paper is not an indictment of part-time instructors or adjuncts. They are a valuable part of the academic system and their contribution must be recognized as such. If they are managed efficiently and are provided with better working conditions, such as semester-to-semester employment, decent pay, and other benefits, they can be as effective as full-time tenured or tenure-track faculty.

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