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Industry Adjuncts: Lessons Learned

Abstract

Some have described adjunct instructors with significant industrial experience as “Professors of Practice.” These adjuncts can provide many benefits to both students and institutions. For example, students can see how theory is applied in actual practice and institutions can offer electives in subjects where the existing faculty may not have specific expertise. However, teaching part-time while working full-time can be challenging, especially given the increasingly global nature of many industrial organizations where frequent travel is often required. This paper describes an engineering equipment manufacturer that has partnered with two local universities to provide adjunct instructors. This paper will discuss the benefits and challenges along with some of the lessons learned when industry provides adjunct engineering instructors, including some recommendations on how to enhance this type of relationship for both the adjuncts and the institution.

Introduction

Part time university faculty are referred to by a number of terms including adjunct faculty, adjunct instructor, adjunct professor, contingent faculty, sessional faculty, associate faculty, and community faculty.¹ Here, the more commonly used term *adjunct* will be used. This paper specifically focuses on part-time engineering adjuncts who work full-time in industry, which are referred to here as industry adjuncts. It is assumed here that the adjuncts have the appropriate educational backgrounds and credentials to satisfy ABET requirements, as determined by the department chair.

There are many ways that industry practitioners can partner with universities to teach engineering courses. They can teach existing courses as adjuncts or visiting professors.^{2,3} McMasters and Komerath (2005) describe a program developed by Boeing called “Boeing Fellow on Campus Program.”⁴ In that program, Boeing employees acted as adjunct or visiting faculty at universities where Boeing recruited engineering graduates. They taught courses in technical areas of interest to Boeing so they could observe students firsthand in those classes. For those universities located at a distance, the Fellow actually lived temporarily on or near the campus during the course. However, that arrangement proved to be unsatisfactory for the employees and the program was eventually discontinued.

Adjunct instructors from industry can temporarily replace faculty on sabbatical or on leave,⁵ help handle temporary increases in student course enrollments,⁶ relieve full-time faculty so they can do research,⁷ or co-teach with full-time faculty to help bring professional practice into the classroom.⁸ For an example of the latter, Texas Instruments helped co-teach a heat transfer course with the University of North Texas and provided students with examples of electronic cooling problems and devices used to solve them.⁹ Those real-world applications were outside the scope of the typical heat transfer course and gave students a specific example of how the course materials were applied to actual

industrial problems. A study on engineering education commissioned by the Carnegie Foundation for the Advancement of Teaching, The Preparation for the Professions Program recommends that professional practice be brought into the classroom through, for example, industry adjuncts.¹⁰

Adjunct instructors can also teach specific topics in a course where faculty are less knowledgeable,^{11,12} teach entire courses outside the specific area of expertise of the faculty,^{6,13,14} and teach courses at off-campus locations.¹⁵ One example is using adjunct professors from industry to teach courses in a non-traditional, professional engineering and technology graduate (masters) program.¹⁶ Some universities have used industry to help teach senior design courses as part of capstone projects;¹⁷ Lehigh University refers to these adjuncts as “Professors of Practice.”¹⁸ Licensed industry engineers as adjuncts can supplement faculties, particularly in civil engineering where licensure is more important, because the number of full time faculty with engineering licenses is declining.¹⁹

John Zink Co. LLC (JZ) is a global manufacturer of industrial combustion equipment headquartered in Tulsa, Oklahoma. Oral Roberts University (ORU) and the University of Tulsa (TU) are private institutions in Tulsa that offer engineering programs. Both are located no more than 20 minutes from JZ. This paper discusses some of the lessons learned by industry adjuncts from JZ teaching mechanical and chemical engineering courses at ORU and TU. JZ industry adjuncts teach the mechanical engineering courses Applied Thermodynamics and Experimental Methods in the fall and spring, respectively at ORU.³ These required courses are each taught by a pair of JZ instructors. In this case the courses are being taught by adjuncts because there are not enough full time faculty to teach them. It is up to the department chair to ensure all accreditation issues are met.

JZ adjuncts teach Combustion Engineering in the chemical engineering department at TU in the fall.¹⁴ That elective course is taught by a dozen JZ instructors whose experience in combustion is overwhelmingly greater than any faculty member currently on the staff. Since the course is for advanced students, the material taught is advanced and well beyond the expertise of the current faculty. It is not material which could be learned quickly through consulting work or other faculty training because the adjuncts have many years of cutting-edge research work experience. Thus, the advanced expertise of the adjunct professors is what makes the course valuable, as they have taught the content for many years through the company’s training organization called the John Zink Institute.²⁰ Since this is an elective course, accreditation issues are easily met. If the course was required, then its content would have to be formally mapped into the student outcomes, and the student outcomes for the course would need to be assessed. The set of required classes make up the minimum requirements for accreditation, so for this elective class, the material needs only to be reviewed by the department chair and determined to be within the general educational objectives of the department. TU’s Educational Objectives are basically to prepare students for industrial jobs, so the combustion course fits in very well. The lesson learned here is that accreditation issues should be considered by the department chair, and only classes which can be set up to meet accreditation issues should be considered to turn over to adjuncts.

All three of the courses (two at ORU and one at TU) have aspects of fluid flow, heat transfer, thermodynamics, and chemistry which are specific strengths of JZ because of their importance in combustion. The students can see how these subjects, studied both in previous classes and in the classes taught by JZ instructors, can be applied to real world problems. This paper discusses some of the lessons learned teaching those courses at two different institutions.

Adjunct Motivation

Before considering some of the lessons learned, it is instructive to consider the motivation for many industry engineering adjuncts, which can help shed light on why certain issues may be of more interest to these adjuncts compared to full time faculty. Gappa and Leslie (1993) extensively studied adjunct instructors and developed a typology of four categories of adjuncts based largely on experience and motivation: 1) career enders, 2) aspiring academics, 3) freelancers, and 4) specialists, experts or professionals.²¹ Spoto (2006) believes that most engineering adjuncts fall into two of those categories: aspiring academics and specialists, experts or professionals.²² The latter category concerns highly skilled part-time instructors working full-time at a job in their field. They are looking for fulfillment by sharing their expertise.¹ This describes the type of adjunct considered here.

Most experienced engineers working in industry are earning a decent salary, so the money earned as an adjunct is usually relatively small compared to the pay from their full time job,²² especially given the additional time commitment required. Unlike consulting or expert witnessing as a side occupation which can be financially rewarding for experienced industry engineers, most industry engineering adjuncts are not teaching for the additional income. In fact, the actual take-home pay after taxes may barely offset the travel costs back and forth to the university.

There are usually other reasons that play an important role in why an experienced engineer, working full-time, would be willing to teach part-time at a university. One reason might be the prestige of teaching at a university and being called “professor”. Most engineering adjuncts have advanced degrees (many of the JZ adjuncts have Ph.D.s) and are quite familiar with the teaching side of academia and the elevated status of professors. Another might be the opportunity to give something back to the profession, particularly helping those preparing to enter the field. A third reason might be for recruiting purposes where industry can examine student performance more closely than reading a transcript or resume. For example, adjuncts can witness some of the intangibles such as motivation and passion, which can not be easily determined from a resume or an interview. This more intimate view of students can significantly enhance the hiring process for new engineering graduates.³ Another reason for teaching is that some engineers may teach to enhance and improve their technical skills in subjects they may use infrequently on the job. Intellectual stimulation, resume building, networking, and exploring a possible future career in academia are other reasons why engineers might teach part-time.^{22,23} Another reason may be technology and learning centers that are available to part-time faculty. The Eighth Floor in Tulsa is an example of such a center that focuses on the integration of technology in the classroom and promoting effective

instructional activities. Finally, some engineers enjoy teaching and sharing their knowledge and experience with those willing to learn. Many industry adjuncts teach for a combination of those reasons mentioned.

While a full-time worker may be willing to tolerate a certain amount of aggravation on the job in order to earn their paycheck, highly experienced engineers are less likely to put up with unnecessary roadblocks while teaching part-time as adjuncts. The purpose of this paper is to offer some suggestions based on the authors' personal experiences to both industry adjuncts and to the institutions using those adjuncts to make the process as smooth as possible. These adjuncts have a lot to offer the students and the institution. Since they are not likely teaching for the money, institutions should try to minimize the bureaucracy so the adjuncts can do what they enjoy doing which is teaching.

Student Benefits

There are some potential benefits of using practicing engineers to teach engineering courses compared to full-time faculty. One is that students can learn specifically how the theory they are studying is applied in actual practice. One principle stressed in class is the importance of understanding the why behind the calculations. For example, calculating the adiabatic flame temperature (AFT) for an air/fuel mixture is a straightforward but tedious hand calculation. However, in actual practice, a computer program would be used to make the calculation quickly and accurately. The question then is so what – how is the AFT used since it is not a temperature reached in actual industrial combustors? (The answer is that it can be used to show trends when changes are made to operating conditions that can impact, for example, heat transfer and pollution emissions.)

Another benefit to students of using industry adjuncts is access to potential internships and permanent positions after graduation. The students can get a better idea about the company by listening to some of its top employees. They already have significant exposure to academia through their traditional full-time professors, but many have had little contact with practicing engineers. Our experience has been that students ask lots of questions throughout the semester about what it's like in the "real world." These discussions give students more information about what type of job they might want to pursue when they graduate. Full-time working engineers give the students another resource to answer their questions and discuss their future plans.

An important benefit for students may be access to world class facilities not available at the university. In the case of JZ, there are outstanding testing, computer modeling, and manufacturing facilities that are used as teaching resources for the classes. For example, when the subject of testing comes up, students are invited to visit the JZ R&D Test Center.²⁴⁻²⁶ When the subject of computer modeling is discussed, students are invited to see the JZ virtual reality visualization facility.²⁷ These facilities are not available at either institution.

Lessons Learned

While there are many benefits of using practicing engineers to teach, there are also some unique challenges, particularly related to engineers who are working full time in industry while teaching part time. One of the key challenges is scheduling. The best and most experienced engineers in industry are also usually the busiest. Both ORU and TU have made some important accommodations that make it easier for busy industry adjuncts to more effectively balance work and teaching. For example, both universities have adjusted the meeting times for courses (e.g., early morning, over lunch, late afternoon) to be more convenient for instructors working full time outside academia. Some of the courses that traditionally met three times per week have been adjusted to meet twice a week to reduce the number of trips to campus for the adjuncts. What is beneficial to the adjuncts can sometimes be a negative aspect for student learning, such as limited office hours and interaction with students outside of classes.

Another important aspect of the teaching arrangements with ORU and TU is that multiple instructors are used for each class to give the instructors more scheduling flexibility and to reduce the workload on any one instructor. In the Applied Thermodynamics and Experimental Methods courses, two industry adjuncts are used where one teaches the first half of the course and the other teaches the second half. In instances where the adjunct teaching at a given point in the course is unavailable (e.g., due to business travel), the other adjunct can usually fill in. In the Combustion Engineering course, a dozen instructors are used where each teaches for 1-2 weeks on their particular area of expertise.¹⁴ Since the topics in that course are somewhat independent, there is some flexibility in the order they are presented. This factor has been used to adjust the schedule according to business demands. The students get a first hand example of how the business world works, where last minute trips sometimes occur and adjustments must be made. While multiple instructors can add some complexity for the students, the benefits can be significant for both the students and the instructors.

The course content is an important consideration for industry adjuncts. There are two types of courses that are generally easier for industry adjuncts, both of which require less preparation time than developing new course content. The first type is where much of the content already exists. This usually means using a standard textbook with prepackaged materials such as PowerPoint slides, a solution manual, and sample exams that have been prepared by the textbook company and/or by previous full time faculty who have taught the course. The Applied Thermodynamics course falls into this category. The second type is where the topic is in the specific area of expertise of the adjunct where they already have much of the content developed. In the Experimental Methods course taught at ORU, that topic happens to be a core competency of JZ which has a world class combustion test facility.²⁴⁻²⁶ The adjuncts were given some flexibility in designing that course according to their specific expertise, where both instructors have authored or edited books related to experimental analysis and measurement techniques.^{28,29} The instructors used JZ's outstanding test facilities as a resource for the course. In the Combustion Engineering course taught at TU, the dozen instructors each taught in their particular area of expertise. The textbook used for that course, given at no charge to each student, was written by many of the instructors.³⁰ Since each adjunct is also a faculty

member of the John Zink Institute,²⁰ they already had their teaching materials developed. The challenge was to reduce the content down to fit into the allotted time for the TU course! For either type of course, the content should be approved by either a full-time faculty member, knowledgeable in the subject area, or by the department chair to ensure it meets accreditation requirements. The Applied Thermodynamics course uses content previously developed by full-time faculty. The contents for the Experimental Methods and Combustion Engineering courses were approved by the department chairs.

An important lesson learned when using multiple instructors to teach a single course is the need for a coordinator who can schedule the instructors, prepare the syllabus, collect the grades during the course and determine the final grades, be a single-point-of-contact for both the students and the institution, and ensure consistency in the course. The first time the Combustion Engineering course was offered at TU, there was too much variation in the workloads assigned by the different instructors.¹⁴ This was adjusted in the second offering to make the load more uniform.

It is critical that ABET requirements are met for the individual engineering departments to satisfy their accreditation criteria. In this case, one of the instructors, who teaches in all of the courses at both ORU and TU, is also a Program Evaluator for the Engineering Accreditation Commission of ABET. That instructor is familiar with the requirements for accreditation and helps ensure course objectives are met and program outcomes are satisfied. In addition, the department chairs monitor these courses to ensure ABET requirements are satisfied. One instrument used to monitor course quality is anonymous student course surveys. Any complaints in particular are given very serious consideration, particular if a complaint is repeated by more than one student. While surveys are not a perfect tool, they can provide valuable information. For example, the Combustion Engineering course at TU was modified as a result of student feedback in course surveys.¹⁴

The question of quality in delivery methods and content is an important one. Being a subject matter expert does not automatically mean one is a good presenter. Adjuncts, as well as full time faculty, should go through presentation skills training. Nearly all of the JZ instructors have gone through at least one presentation skills course. All JZ instructors for the ORU and TU courses have considerable experience presenting papers at technical conferences. The JZ Institute, where all of the JZ instructors also teach, conducts seminars on a regular basis to improve instructor skills and course content. Anecdotal comments have been received from many students that JZ presentation materials often surpass the quality of those by the full time faculty. One of those comments came from a student who was also a full time faculty member in the department, who was taking the course for professional development hours to maintain engineering licensure. High quality course content should be a result of using industry experts with extensive experience in a given subject. Students should not experience any reduction in quality because a course is being taught by adjuncts instead of by full time faculty.

Another suggestion to reduce the workload for industry adjuncts is to assign them to teach smaller classes to minimize the time required for grading and meeting with students

outside of class. While full-time instructors would also appreciate smaller classes, it is particularly important for industry adjuncts because of time constraints. The use of students for grading of homework can be helpful to adjuncts as well as full-time faculty. The eight total classes taught by JZ at both ORU and TU have had no more than 11 students, where one class had only three students. This is particularly helpful since multiple instructors were used so each had a relatively short time with the students. Having a small number of students makes it easier to get to know them even in such a short time frame.

Other suggestions to help industry adjuncts include close proximity between the company and the university to minimize commuting time and access to university resources (e.g., copier, whiteboard markers, etc.) including outside normal working hours. In addition to scheduling flexibility, the institution should make logistics such as parking as simple and easy as possible. Some adjuncts like to bring in classroom demonstrations to show students and some of the demonstrations are large so the less distance the better. In one particular semester, one of the institutions was in the middle of a large building campaign, so parking all over the campus was difficult. The industry adjuncts had to buy a parking pass to park at the university, but because they were not full-time faculty, they did not get first choice of parking locations. The only lots available were a fairly long walk from the building they taught in. To make matters even worse, there were not enough spaces available during the time the class was taught due to all the construction. On one particular day, one of the instructors could not find a “regular” parking spot and so, along with many others, parked along a curb in one of the designated lots. Much to his dismay, he found out after class that he had received a ticket for parking in an unmarked spot! So besides not getting paid, having to pay for a parking sticker for a lot without adequate spaces, and having to walk a good distance to class, he then had to write a letter to the university’s parking authority that did eventually rescind the ticket. This parking arrangement made it more difficult for the industry adjuncts that term who had to arrive for class earlier than normal to find a parking place. Fortunately, this should only be temporary until the construction in the vicinity of the engineering buildings is completed.

Institutions should not assume that industry adjuncts are familiar with the policies and procedures in academia. While those adjuncts attended institutions to get their engineering degrees, that may have been many years ago and at different institutions. For example, getting employee IDs, parking passes, computer access, and room keys often requires going to different locations on the campus at specific times of the day. It is best if this can all be done in one visit to save time for busy professionals who are typically only on campus to teach at their designated times which could be outside the normal hours of operation of, for example, the HR and security departments of the institution. Extra trips to campus should be minimized wherever possible. Both ORU and TU have excellent administrative assistants who know how to get things done and have been good resources to avoid unnecessary problems.

A handbook created especially for adjuncts can address many of their policy and procedure questions. This book or binder can also contain calendars (grade due dates, school breaks, faculty in service dates, etc), technology instructions (interactive video courses, Smart Board summaries, campus grade entry software, etc.), maps, important

contacts and phone numbers in administration, and any other information that would be useful to the adjunct. Sometimes this information is given through different individuals or via emails; however, a single repository of pertinent information makes it easier for the adjunct instructor to access when they need it.

There may be other resources required depending on the course being taught. For example, there are some labs in the Experimental Methods course that must be set up and run using specific software to collect data. Fortunately, a full-time faculty member familiar with the labs and a technician in the department help run those labs to minimize the preparation time for the adjuncts. Computers and projectors should be easily available in the classroom for presenting course content. A short orientation in the use of Smart Boards or specialized projectors should be given to industry adjuncts during one of their campus visits. Having support personnel available by phone on the first day or evening of class is also advisable in the event of technology issues.

While many of the lessons learned may seem obvious to full-time faculty, they are not always obvious to part-time faculty, particularly if they have not taught at the particular institution before. Besides wasting unnecessary time, not knowing institutional policies and procedures can be a source of frustration that could ultimately cause an experienced industry adjunct to stop teaching. This would be unfortunate for both the adjunct and the institution. Fortunately, it is preventable given adequate preparation and communication.

Conclusions and Recommendations

This section includes some Do's and Don'ts related to industry engineering adjuncts.

Do's:

- Do provide industry adjuncts with the resources they need such as room keys, parking stickers, employee IDs, computer login information, learning resource management system (e.g., Blackboard, Desire2Learn, or WebCT) instructions, classroom technology instructions, passwords for the copy machine, phone numbers, etc.
- Do provide industry adjuncts with relevant schedule information such as dates for breaks, final exams, school holidays, when grades are due, etc.
- Do help industry adjuncts prepare course syllabi by providing appropriate institution and department policies and any specific formatting requirements.
- Depending on the course, do give industry adjuncts some flexibility in developing the content where their specific expertise can be put to best use.
- Do include industry adjuncts on department distribution lists for relevant emails and memos so they are aware of what is happening, especially when the information could pertain to them and their students.

Do invite industry adjuncts to relevant department and institutional professional and social events to make them feel part of the team.

Don'ts:

Don't assume industry adjuncts know their way around the campus physically and electronically. Make sure they know where their classrooms are and how to access the information they need (e.g., how to enter grades electronically).

Don't make it difficult for industry adjuncts with logistics such as scheduling and parking.

Don't make industry adjuncts have to come to the institution too often outside of their normal class times. Schedule as much of the administrative paperwork and processes as possible when they are already on campus.

Using industry engineering adjuncts can be very beneficial for both the students and the institution. Making it as easy as possible for the adjuncts helps them focus on teaching which is often their primary motivation. This can help build a long-lasting and satisfying relationship that is fulfilling and rewarding for the adjuncts and beneficial to the institution.

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