

Successful strategies and initiatives for increasing enrolment in an engineering college: a case study

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ABSTRACT: Many engineering programmes around the world are encountering declining student enrolments. The College of Engineering and Engineering Technology (CEET) at Northern Illinois University (NIU), DeKalb, USA, has been successful in tackling these problems and increasing student enrolments. The article describes how the CEET is meeting student needs through enrolment management, as well as the various recruitment initiatives that have been undertaken so far. These initiatives include programmes like Adopt A High School, facilitating College visits, building relationships with community colleges (including articulation agreements), the recruitment of under-represented students (including women), distance learning, advertising and promotional material, advice from the engineering faculty, and improvements to undergraduate programmes so as to indirectly and positively influence recruitment. These initiatives have proved to be successful and have attracted a diverse student body to the CEET. Such efforts are not only geared towards improving student recruitment, but also with leading them to the full completion of their degrees.

INTRODUCTION

Engineering programmes in many nations are experiencing a decline in student enrolments. This decline may be based on perceptions of being a difficult undertaking, lack of awareness, inadequate preparation in foundation courses, lack of role models/mentors, etc. It is possible to address these issues with high school students and make an impact on their determination and willingness to academically pursue programmes in engineering and technology disciplines.

The College of Engineering and Engineering Technology (CEET) at Northern Illinois University (NIU), DeKalb, USA, has been successful in addressing these issues and increasing its student population, despite negative national trends. The student population coming to the CEET includes freshmen students from high schools, as well as transfer students from community colleges. This article addresses enrolment management needs for both groups of students.

MEETING STUDENT NEEDS

The CEET has been able to launch some very effective initiatives and strategies in order to attract qualified students to its programmes. For the last three years, the College has reported an increase in the size of its freshman classes. Furthermore, the College has demonstrated significant success in increasing the minority student population, including women.

Without increasing its personnel resources, the College has been able to provide effective services to students resulting in retention and timely graduation. The College is very serious about meeting enrolment demands so as to maintain and improve the quality and profile of its engineering and technology programmes.

Even though the main focus of this article is to describe strategies that have been effective in increasing student enrolments at the CEET, enrolment management involves much more than that. Enrolment management covers issues related to meeting the needs of the increased student body, offering effective student services, maintaining optimum class sizes and faculty work loads, and providing a student-focused learning environment. Another aspect of enrolment management is to continuously improve programmes to maintain the increase in enrolments. Recruitment and retention must match in order to actually impact on student enrolments in academic programmes.

RECRUITMENT INITIATIVES

The recruitment of students and the improvement of programmes must go hand in hand. To recruit quality students, the projection of strong and student-friendly programmes is necessary. Therefore, a continuous effort to improve programmes in order to recruit and retain good students is one of the beliefs of the CEET. Based on the recommendations of the enrolment management taskforce, headed by the Associate Provost, the need to project NIU as an institution that provides accountability, quality, student friendliness, as well as the prestige of its academic programmes, is of utmost priority.

Having developed excellent engineering programmes and facilities, the CEET feels that it is in a position to offer these attributes to the student community and their parents in the northern Illinois region. Visitors not only go back with a positive impression about the College, but also about the University. Based on the positive impression that the CEET gives to parents and students, NIU has become a first choice institution over other *better-known* larger schools in the area.

Supplementing NIU's Office of Admissions in their recruitment efforts, the College has launched several far-reaching initiatives

independently (listed below). In addition, this article presents three initiatives that assist students to make proper professional decisions. During recent years in which the following initiatives were implemented, the freshman class size has surpassed all previous records and it is anticipated that the continuation of recruitment initiatives will enable the College, as well as the University, to improve student enrolments in engineering, technology and other programmes.

The data displayed in Table 1 authenticates the above claims. The CEET has world-class engineering facilities (the Website www.ceet.niu.edu provides a laboratory tour), including 29 engineering laboratories with over US\$15 million worth of equipment in its modern building. With its laboratory facilities, a positive attitude towards students, qualified faculty, and an emphasis on student-focused learning, the CEET has the potential to be one of the best undergraduate engineering institutions in the nation. Engineering colleges must grow, or at least replenish, the slots created by graduating students to sustain enrolment numbers. Because there is an acute shortage of qualified workforce in engineering areas, an increase in enrolments is a welcome trend; this is supported and applauded by the industrial sector.

Adopt a High School

Feeder high schools in close geographical proximity have been identified by the CEET. Contact people at these schools have been recorded and every faculty member in the College, including administrators, was requested to adopt one or more feeder high schools. The faculty members have invited their high schools for a visit to the CEET's facilities. The reason behind this move was to provide a professional relationship between these high schools and the University. The relationship allowed counsellors at the high schools to get needed information about programmes by just making a telephone call or via e-mail.

The relationship has benefited prospective students, who gain information about the CEET and its services. On several occasions, faculty members were able to advise and guide students from various high schools to colleges at NIU other than the CEET. The College plans to continue and expand this initiative to impact student enrolment at NIU and the CEET.

Faculty members were able to get a first hand look at the needs of high school students and, in turn, take a closer look at their own courses and programmes. Schools were provided with posters and *reply back cards* to allow students to seek input from the CEET independently. This will continue yearly with each senior class of the adopted school.

The College also works with some high schools to develop 2+2+2 programmes, which start at the junior level in high school, continue through a 2-year stay at a community college, and end with a BS degree at the University. This enables the

formulation of dual admission agreements and provides effective advising for students pursuing 2-year degrees at community colleges. Detailed information about 2+2 programmes can be seen at www.ceet.niu.edu under the student services section, transfer guidelines.

Making the College Facilities Available for a Visit

The decision of many students, who choose to pursue their educational goals at NIU, has been impacted significantly by their visit to the campus. Based on these findings, the CEET has been involved in formally inviting high school counsellors, students and teachers to visit the College on a Friday between 11:00am and 12:00 noon. As an incentive to motivate high school principals to approve student visits, a financial compensation of up to US\$100.00 has also been provided to cover bus transportation costs. During these visits, the Dean, Associate Dean and all departmental chairs are available to provide details on careers and majors. Students are also given a 40-minute tour of the facility and the Office of Admissions is often invited to talk about admission procedures and other colleges at NIU. Feedback from such visits has been very positive and the College has tracked many student visitors as freshmen enrolled at NIU. The visits by high school officials have, in many cases, influenced their own attitude and teaching styles, thereby impacting the quality of their programmes and students coming to NIU.

Relationship with Community Colleges

Approximately 40% of the CEET's student population comes from community colleges. Therefore, it is extremely important to tap into this resource. A few years ago, deans of engineering, sciences and technology from community colleges were invited to spend a day at the CEET. The day was termed *Community College Day*. A total of 40 representatives from more than 20 colleges attended this event. After experiencing initial presentations and a College tour, visitors were provided with an opportunity to brainstorm with NIU faculty members regarding the articulation of courses and programmes. It was proposed that a *Community College Day* be organised every semester to renew ties with community college staff and provide current information on programmes so as to enable students to be effectively advised.

During the past two years, College staff have worked with select community colleges to develop a detailed 2+2 articulation agreement. These 2+2 agreements, approved by the CEET and community college officials, are posted on the Web at the CEET's homepage. A sample of 2+2 is given in Figure 1. Agreements are being prepared with additional colleges; these will result in an improved curriculum to achieve better school-to-school transition. NIU is also working with several community colleges to offer a dual admission opportunity to students. The dual admission agreement will permit students to have access to NIU's resources while still at community colleges.

Table 1: CEET enrolment statistics.

	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000	1995-2000 Enrolment Change
Entering freshman class size	148	151	195	191	255	72%
Entering class size including transfer students	253	276	322	308	423	67%
Student enrolments in the College	932	937	1,022	1,045	1,268	36%

2 Years at the College of DuPage (COD)		
Courses at COD		Equivalent Courses at NIU
CHEMI 151+152	Principles of Chemistry	CHEM 210
CIS 241	C Language Programming	CSCI 240
ENGIN 201	Statics	MEE 210
ENGIN 202	Dynamics	MEE 211
ENGIN 210	Circuit Analysis and Theory	ELE 210
ENGLI 101+102	Composition	ENGL 103
ENGLI 102+103	Composition	ENGL 104
MATH 231+232	Calculus & Analytic Geometry I+II	MATH 229
MATH 223	Calculus & Analytic Geometry III	MATH 230
MATH 234	Calculus & Analytic Geometry IV	MATH 232
MATH 270	Differential Equations	MATH 336
PHYSI 251+252	Physics for Science and Engineering	PHYS 250A
PHYSI 252+253	Physics for Science and Engineering	PHYS 251A
SPEEC 100	Fundamentals of Speech	COMS 100
14 quarter hours in the humanities and social sciences. *Northern Illinois University permits students to transfer up to a maximum of 66 semester hours of community college credit. Only AA and AS degrees satisfy NIU's general education requirements.		

Figure 1: Sample 2+2 BS degree programme (community college).

Web-based advice has helped many students who have been able to take the right courses for transfer to NIU. Figures 1-3 demonstrate the course of study that transfer students from community colleges should take in order to earn a degree in engineering from NIU. Figure 3 shows a sample listing of the University's general education requirements.

Although transfer students with an AA or AS degree may already have completed the University's general education requirements, their course work must include sequences that fulfil the expectations of the Accreditation Board for Engineering and Technology (ABET). Indeed, for ABET purposes, 12 of the 18 semester hours of general education course work required by the University must include one sequence in humanities and arts and one sequence in social sciences. The CEET's homepage gives a complete list of the approved sequences (www.ceet.niu.edu under the student services section, transfer guidelines).

Recruitment of Minority Students (Including Women)

The CEET has been very successful in recruiting minority students to its programmes in engineering and technology. The number of students (primarily minority students) who were admitted through special programmes for under-prepared students has increased from about 20 to 116 over the past three years. The success of these students can be demonstrated by the fact that, out of 116 students, 17 are seniors, 16 are juniors and 43 are sophomores. The College has also been able to develop

good working relationships with the Chicago Public Schools and the City Colleges of Chicago to attract quality minority students into engineering and technology programmes and to develop 2+2 and 2+2+2 agreements with them.

2+ Years at NIU	
Remaining classes to be taken at NIU's College of Engineering and Engineering Technology to earn a BS degree in Electrical Engineering.	
ELE 211	Engineering Circuit Analysis II
ELE 315	Signals and Systems
ELE 330	Applications of Semiconductor Devices
ELE 335	Theory of Semiconductor Devices I
ELE 340	Electrodynamics
ELE 350	Engineering Logic Design
ELE 355	Engineering Logic Systems and Computer Circuits
ELE 356	Microprocessor I
ELE 360	Communication Systems I
ELE 370	Introduction to Engineering Electromagnetics
ELE 375	Transmission Line Media and Wave Propagation
ELE 380 or MEE 322	Control Systems I
ELE 490	Dynamic Systems and Control I
ELE 493	Senior Engineering Design Problem
IEET 100	Electrical Engineering Seminar
IENG 220	Introduction to Engineering
MATH 339 or PHYS 385 PHYS 360	Engineering Economy Engineering Mathematics I Methods of Mathematical Physics I Contemporary Physics
9 semester credit hours of Technical Electives. Choose three of the following with at least 6 semester hours of electrical engineering course work: ELE 364; ELE 431; ELE 432; ELE 433; ELE 435; ELE 436; ELE 437; ELE 438; ELE 451; ELE 452; ELE 457; ELE 458; ELE 461; ELE 470; ELE 475; ELE 477; ELE 480; ELE 481; MATH 434; PHYS 420; PHYS 421; PHYS 430; PHYS 434; PHYS 460; PHYS 467 or an approved math/science/engineering elective.	
Including the general education courses taken at the College of DuPage, the following maximum hours must be completed to earn a BS degree:	
<ul style="list-style-type: none"> • 9 semester credit hours of humanities and the arts; • 6 semester credit hours of social science; • 3 semester credit hours of interdisciplinary study. 	

Figure 2: Sample 2+2 BS Degree Programme (NIU).

The College has constituted an effective student support structure to provide advising, tutoring and learning assistance to minority students to help them succeed in engineering and technology careers. The College hires three student tutors for a total of 60 hours to provide tutoring services in mathematics, physics and English to students of the College. The CEET is working on an innovative programme to provide peer tutoring and advice assistance for its technical courses. The College also supports student chapters of 16 professional organisations, which will be included in this endeavour. It is very important for the College to engage minority students, along with others, in meaningful real-life activities based on interdisciplinary projects to improve their motivation to complete careers in engineering and technology. These students will also serve as

(COD Equivalent)	(COD Equivalent)	(COD Equivalent)
1. ANTH 120 (Take at NIU) ANTH 210 (ANTHR 120) ANTH 220 (ANTHR 100) (ANTHR 105) ANTH 230 (Take at NIU)	2. ECON 260T (ECONO 202) and ECON 261T (ECONO 201)	3. GEOG 202 (GEOGR 100) (GEOGR 105) and GEOG 253 (Take at NIU)
4. POLS 100 (POLS 101) or POLS 181 (Take at NIU) and one of the following: POLS 260 (POLS 203) POLS 350 (Take at NIU)	5. SOCI 250 (Take at NIU) and one of the following: SOCI 170 (SOCIO 100) SOCI 260 (PSYCH 240)	6. FCNS 230 (CHILD 101) and one of the following: PSYC 102 (PSYCH 100) SOCI 170 (SOCIO 100) SOCI 260 (PSYCH 240)
7. ANTH 101 (Take at NIU) and one of the following: ANTH 210 (ANTHR 120) ANTH 220 (ANTHR 100) (ANTHR 105) ANTH 230 (Take at NIU)	8. EPSE 200 (Take at NIU) or FCNS 280 (PSYCH 237) or ILAS 230 (Take at NIU) and one of the following: PSYC 102 (PSYCH 100) SOCI 170 (SOCIO 100) SOCI 250 (Take at NIU) SOCI 260 (PSYCH 240)	9. FCNS 207 (Take at NIU) and one of the following: ECON 260T (ECONO 202) ECON 261T (ECONO 201)
10. ILAS 123 (Take at NIU) or LEFE 201 (Take at NIU) and one of the following: ANTH 220 (ANTHR 100) (ANTHR 105) SOCI 250 (Take at NIU)		

Figure 3: Approved sequences in social sciences; students are asked to *select two courses from a box of courses listed below, do not choose classes from two different boxes. Of the two course selected, no more than one course may be a 100 level course or contain the Introduction in its title.*

potential role models to attract minority high school students to the College and NIU.

Distance Learning via ISDN

The CEET is very much in step with current technological innovations in instructional delivery systems. The CEET was the first college at NIU to utilise distance learning to offer a degree programme (in electrical engineering technology and nuclear engineering technology at the nuclear power plants in Illinois). Based on the success of its experience, the College has invested resources to develop a fully operational distance learning room capable of linking multiple sites via ISDN connections. The College looks at this as an effective medium to transport education to off-campus sites, enabling non-traditional working students to continue their educational pursuits.

The College plans to establish partnerships with community colleges, high schools, industries and distance learning consortiums to recruit students in engineering and technology programmes. The technique will also be used to improve the quality of traditional off-site programmes by adding a laboratory component to theoretical courses. This will enable the College to offer better programmes for non-traditional students seeking an off-campus mode of delivery. The College offers classes linking more than one site and plans to add a video camera to the interactive video system to attach a clinical component to the theory. The distance learning facility is fully

operational and the College has been approached by industries to offer courses, certificate programmes and degree programmes using teleconferencing facilities. The distance learning facility can also be used to present seminars, courses and/or workshops to interested clientele in the community.

Distance Learning via the Internet

The CEET has been a leader at NIU in distance learning via the Internet. The CEET is the first college on campus to offer an Internet course and considers that this technology will cater to the needs of full-time working individuals who do not have access to teleconferencing facilities and do not have the time to drive to campus. The CEET is not yet convinced about offering complete degree programmes using the Web, but a certain percentage of the programmes can definitely be offered to a mature audience.

Lessons learned from this pilot course are being utilised to develop additional courses to attract more students to take engineering and technology classes through the Internet. The College feels that the Internet, combined with interactive video, will be a potential instructional medium that will enable additional students, who would not have come to NIU, to take classes from NIU utilising communication technologies. Supported by research, this medium will also improve student learning. The CEET is discussing plans to offer courses using the above media to international clientele.

Online Advice

The CEET is aware that NIU has established dual admission agreements with over 20 community colleges. In order to advise students under the State of Illinois-sponsored Illinois Articulation Initiative (IAI), the College provides online advice to interested students. The Associate Dean of the College reviews advice requests and routes them to appropriate people to facilitate advice. All faculty members are available online through the electronic mail on the CEET's homepage to allow students to ask technical questions in specific areas of engineering and technology. The CEET proposes to develop chat lines and message boards to permit students to exchange information on a shared platform. The College takes pride in its homepage; all prospective students can visit laboratories, access any faculty member through e-mail and get information on courses and events.

Advertising and Promotional Material

Lack of information and awareness is often a detrimental factor in students not pursuing higher education. The CEET has developed several brochures, posters and information sheets to provide information on engineering and technology programmes to prospective students. All visitors to the building are sent a thank you letter along with pertinent information. Visitors to the building are also given a souvenir to take along with them as a reminder of NIU and the CEET. Additionally, all students who have shown interest in the College are sent an informational package from the College office.

Advice from Engineering Faculty

As required by ABET, advising students is one of the primary responsibilities of faculty members. The College employs no additional staff to perform student advice. Despite high workloads, CEET staff engage in student advice, which provides students with an opportunity to obtain accurate advising schedules. Each faculty member is allotted a group of students who must be advised before signing up for classes. The student file must have an advice form for every semester that must be co-signed by the advisor as well as the student. Because of the sequential nature of engineering courses, this approach of informed advising by staff has resulted in an effective use of student time. In many cases, staff were able to advise their Department on the need to offer additional courses.

Improvement of Undergraduate Programmes to Indirectly Influence Recruitment

Improvement of undergraduate programmes is an ongoing process at the CEET, which attracts academically talented students to its programmes. These initiatives are necessary to obtain industrial support for the programmes, maintain accreditation, remain competitive, offer professional in-demand programmes and continuously improve the process of learning using new technological tools. Some of the unique initiatives undertaken are described below.

EOGENES: The CEET has developed an innovative programme entitled EOGENES to educate non-engineering students on engineering concepts. The classes for EOGENES are held in the new engineering facilities, exposing non-engineering students to some of the engineering laboratories. Non-engineering students who take EOGENES classes walk away with a better and diverse impression of the CEET, and may

choose to declare engineering and technology as their major. In any case, these students will be the CEET's *goodwill ambassadors*, influencing the decision of prospective students to come to the CEET and other colleges at NIU. The College plans to offer a residential section of EOGENES as well, to recruit students into courses that form the core of EOGENES. The College expects that, after taking some of the courses in the EOGENES package, some students may decide to pursue engineering and technology degrees. EOGENES is responsible for almost 20% of the total credit hours generated by the College. It is an important initiative for the College and a unique endeavour in which CEET faculty are involved in educating non-engineering majors on issues and topics related to engineering and technology. This is a response to the need of community and industry to educate non-technical personnel on important technical issues to transform them into a more productive workforce and informed citizens.

BS/MS Programme: As a recruitment tool to bring academically talented high school students (26 or higher ACT score) into engineering, an accelerated BS/MS programme has been approved in industrial engineering. These students will earn a BS as well as an MS degree in five years. It must be noted that the national average to complete a BS programme from an accredited institution takes about 4.7 years. The students enrolled in this programme will represent the top 10% of their class and will certainly bring higher prestige and quality to NIU and the CEET. Additional resources to provide scholarships and special services to these students will be located to implement the programme successfully and effectively.

Peer-Assisted Tutoring, Advising and Learning (PATAL): Active networking among students promotes successful completion of the educational track. The College has conceptualised and implemented Peer-Assisted Tutoring, Advising and Learning (PATAL), which will be implemented through 15 professional student organisations supported by the College. The infrastructure and plan is in place to offer mentoring, tutoring and advising at the micro (course) as well as macro (career) level. Students are involved in providing general, as well as focus, tutoring for classes that need special preparation and are perceived as being difficult. A recent intervention through focus tutoring in the engineering statics class resulted in a 20% improvement in student grades. Additional faculty members will have to be assigned to this activity to expand the scope of the project.

SUMMARY

The CEET is committed to recruiting quality students to its programmes. Its efforts are not only geared towards improving student recruitment, but also with leading them to the full completion of their degrees. The College has undertaken several initiatives to attract students to its programmes, the College and the University. They have proved to be successful and have attracted a diverse student body. Its pride in being one of the best undergraduate engineering facilities in the country is reflected by the openness and accessibility of faculty members.

Every visitor and student is treated with professional respect and is taken through an experience that reflects the best at NIU and the CEET. The mutual respect and professional consideration of others, maintaining the quality of programmes supplemented with support and help, accessibility, small class sizes, accountability to the community, etc, are key success factors at NIU and the CEET.



World Transactions on Engineering and Technology Education

A Call for Papers

Current events have impacted upon the arena of international conferences and academic travel, impinging on the freedom of intellectual movement to conferences and the like that are so important for the advancement of engineering education internationally and regionally and, indeed, the development of humankind now and into the future. Wars, threats and diseases affect the physical presentation of ideas at conferences, fora and seminars; however, the liberty of thought and the exchange of educational ideas cannot be bordered, blasted and subdued. To this end, the UNESCO International Centre for Engineering Education (UICEE) has established the *World Transactions on Engineering and Technology Education* (WTE&TE), which is open to everyone around the world who is interested in the progression of engineering and technology education. Current unfortunate circumstances have meant that the *World Transactions* offers a safer and cost-effective alternative to conference participation.

The first volume of the WTE&TE presented a range of papers from across the spectrum of engineering education and from around the world, including over 50 very interesting and insightful representations from many countries worldwide. From this, it can be seen that the WTE&TE contribute strongly to the publication of engineering and technology education papers globally, which is essential for academic life and the continued growth and evolution in humanity's store of knowledge and understanding across nations, cultures and continents. Work is underway on Vol.2, No.2 of the WTE&TE, with the objective to release the issue in early August.

Therefore, a call for papers is made for the next issue of the WTE&TE, **Vol.2, No.3**. The very nature of the *World Transactions* is open to every facet of engineering and technology education and is not confined to traditional views about science, engineering and technology. As such, there are no overriding engineering or technology themes, but rather the overarching principle of the globalised expansion of engineering and technology education that is not confined to borders or regions; instead the WTE&TE seeks to benefit all those involved in the engineering and technology through the wider dissemination of knowledge.

The deadline for this issue is **30 September 2003**. Authors should indicate their interest as soon as possible. Additional information can be found at the UICEE's homepage under *World Transactions* at <http://www.eng.monash.edu.au/uicee/>

Interested persons should submit their original, previously unpublished papers to the UICEE for consideration to be included in the WTE&TE. Authors should be aware of the standard formatting structure, which will essentially be the same as for other UICEE publications. Papers are to be submitted in MS Word format in 10pt font, single-spaced, double column, and a **maximum of 4 pages** in total, including abstract and figures (additional fees will apply for extra pages). Fees are based on cost recovery for editorial and publishing work, and every submitted paper will cost \$A450. Also, within the cost structure is the delivery of one copy of the WTE&TE per paper submission by airmail postage to anywhere in the world.

The electronic kit for authors, incorporating standard formatting details and submission forms, covering copyright, will be supplied on request. Potential authors should notify their intention of submitting a paper at their earliest convenience and earlier submissions than **30 September 2003** will be particularly welcome. Further correspondence via e-mail should be directed to Mr Marc Riemer on marc.riemer@eng.monash.edu.au