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Faculty Engagement and Performance Improvement in Engineering Students

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***ABSTRACT*-The concept of faculty engagement has become prominent in engineering education. The faculty members have to act as architects of effective engineering programs to implement efficient student engagement. Fifteen issues have been selected in the student engagement process based on prominent research works. 31 senior faculty members have been selected for this research work and questionnaires have been distributed to them to give feedback on the current status of faculty engagement. Based on their feedback a draft model of faculty engagement has been developed. There is a need for further field-specific validation by a large number of engineering faculty members. This is a current limitation of the model. There are many preconditions like strategic planning, availability of needed resources, and need-based faculty development for the implementation of the model.**

KEYWORDS: **Engineering faculty engagement, Factors that affect faculty engagement, Role of trained faculty members, Role of educational administrators**

1. INTRODUCTION

Faculty engagement is an important development and transformation process in all educational institutions. In the engineering industry, job shifts occur too often due to advances in manufacturing technologies. Many old technology-based jobs are to be transformed into digital technology-specific jobs. Many software companies recruit electrical, mechanical, and electronics engineers and provide them with six-month information-technology-based training and subsequently absorb them into their companies. Many obsolete diploma programs like Sugar Technology don't attract any industry-relevant jobs. In prosthetics and orthotics, robotics plays a great role in designing and manufacturing advanced orthotics and prosthetic appliances. The handicapped people need modern appliances but the curricula in many polytechnics, faculty members, and resources are not updated. The students don't get appropriate jobs. To effectively engage the students, we have to develop industry-specific curricula, train the faculty, and equip the labs. A State Directorate of Technical Education modernized the three-year diploma curricula after 30 years but the faculty members were not trained to implement the revised curricula. Finally, the faculty members were trained and additional resources were added to the polytechnics which consumed six years. One state trained the faculty members who were on transfer from other engineering departments to implement the revised curricula, but these faculty members left to serve their parent departments. The institute struggled to implement the revised curricula with ad hoc faculty members and fresh graduates. Many faculty members who were not updated in advanced engineering courses had to offer more advanced courses to meet the challenges of disruptive technologies but the students suffered. Many traditional teacher training institutes were elevated to national institutes and are expected to offer many advanced teachers' development programs in cutting-edge technologies without minimum accomplished faculty members. To solve many complex industrial problems in analysis, design, product development, testing, manufacturing, maintenance, and recycling, the curricula have to be continuously improved. This gives rise to the demand for up-to-date engineering faculty members who can plan industry-specific curricula/ cooperative-based courses. Such graduates are absorbed by the companies. If the existing faculty members are not continuously trained and developed, they lose their cognitive skills and become burnouts. Teacher engagement has become an important transformation process to train and develop existing students and executives. Otherwise, many low-profile faculty members were ousted for want of up-to-date cognitive skills.

There are many upcoming models in faculty engagement to update their cognitive skills, curriculum development, and undertaking many advanced research and development programs. Many faculty members have to be engaged in MOOCs, industrial training, an internship in the research universities, plan self-directed learning, and undergo sponsored research projects. Lifelong learning has been recommended in India for the last 2090 years. Many achievements motivated technical supporting staff who also

underwent part-time diploma, undergraduate degrees, postgraduate degrees, and doctoral programs over 15 years. Many outstanding senior faculty members are eligible for an extension of five years but the administrators never accept to re-employ them. Many faculty members also got awards for their excellent academic performance but they were not elevated to senior teaching/research jobs. Further, they were not fully engaged due to obsolete rules and regulations. Many institutes establish advanced educational video production centers but the administrators never approve to develop of video programs even by their outstanding faculty members.

Many middle-level faculty members need sabbatical leave to join global universities and undergo needed courses in new technologies. Only a few colleges with strategic planning offer funds and permissions for such programs. Many utilize the available programs under bilateral agreements and under ongoing institutional development programs that are offered by International Development Agencies like Asian Development Bank, DANIDA, GIZ, UNESCO, USAID, and the World Bank. Many directors of educational institutions and administrators are not having a strategic vision and they feel that it is not economical to sponsor faculty members to the relevant-development programs even though they are offered free of cost. Around 10-15% of the project funds are generally allocated the faculty development. Many states and deemed universities have established in-house faculty development programs and offer advanced courses. In many conferences, workshops are offered as a part of the conference to improve the cognitive skills of the participants.

The National Education Policy 2020 prescribes Faculty Engagement as follows:

- All leadership positions in institutions must be offered to faculty members with academic qualifications and demonstrated administrative and leadership capabilities along with abilities to manage complex situations.
- Leaders of higher education institutes must demonstrate strong alignment to constitutional values and the overall visions of the institution, along with attributes such as strong commitment, belief in teamwork, pluralism, ability to work with diverse people, and a positive outlook.
- Outstanding leaders will be identified and developed early, working their way through a ladder of leadership positions.
- Higher education institutes shall display a commitment to institutional excellence, engagement with local communities, and the highest standards of financial probity and accountability.
- Create an institution development plan through initiatives, assessing the progress, and reaching the goals.
- All universities shall offer Masters' and Ph.D. programs in core areas as well as multidisciplinary fields.
- Faculty members will have to be trusted and empowered to maximize their motivation; they will have to be given the freedom to creatively design their curriculum and pedagogical approaches within the approved framework.
- Empowering the faculty to conduct innovative teaching, research, and service as they see best will be a key motivator and enabler for faculty to do truly outstanding creative work.
- Excellence will be further incentivized through appropriate rewards, promotions, recognition, and movement into institutional leadership.
- Increase the employability potential of higher education programs
- Provide socio-emotional and academic support for all such students through suitable counseling and mentoring programs

2. OBJECTIVES

1. To assess the existing faculty engagement practices in engineering colleges, state, and central institutions.
2. To propose a suitable faculty engagement model for creating high-performing faculty teams in engineering institutes in India.
3. To validate the model and suggest faster implementation in engineering colleges and universities

3. LITERATURE SURVEY

Significant research works in the area of faculty engagement are presented below:

Table 1 Significant Faculty Engagement Works

No.	Research on Engagement	Field	Outcome	Authors
1	Faculty & Student Engagement in Undergraduate Engineering	Behavioral and emotional forms of engagement	Faculty support is consistently, significantly, and positively linked to all forms of student engagement.	Denise Wilson, Lauren Summers, & Joanna Wright (2020)
2	Effective Industrial Engagement in Engineering Education	Engineering education has to ensure that undergraduate degrees are fit for the future, meeting the needs of industry and the expectations of students.	Practical, workable suggestions for universities, industry, and professional engineering institutions.	Oliver Broadbent & Ed McCann (2016) [Royal Academy of Engineering]
3	Conceptualizing Engagement	Contributions of faculty to student engagement	Developing, facilitating, and sustaining high levels of student engagement.	Helen L. Chen, Lisa R Lattuca, and Eric Hamilton (2008)
4	Factors Relating to Faculty Engagement in Cooperative Engineering Education	Cooperative Engineering Education [Sandwich Programs]	Positive relationships between the faculty co-op engagement score and the students' engineering work experience.	Friedrich, Bernadette J (2011) [Ph.D. Dissertation, Michigan State University]
5.	Curriculum and Faculty Engagement	Intercultural engagement throughout the curriculum and Increased faculty development to improve intercultural competence.	Improved dialogue increased: Understanding of human motivation, Understanding of resilience, Cultural elasticity, Self-awareness, Curiosity, Mindfulness, & Knowledge of campus resources.	Jose Villalba (2017).
6	Faculty Engagement Strategies for Career Services	Engagement of career topics, Promotion of career education, Integration of career readiness competence, Assessment of career-related additions, Lead training for faculty members	Recognize faculty for good work, Utilize the faculty member's expertise and connections, and inspire your faculty champions to inspire their peers	Kelly Dries, Kody Powell (2019)
7	Strategies for Faculty Engagement	Engagement of faculty members in fundraising, articulating the vision, making connections with potential donors, serving as a vital link between donor and university…	Understanding assigned work, demonstrating interest, knowing the donors' personality, building confidence, building a philanthropic relationship…	Advancement Resources. Org (2015)
8	Faculty Engagement and Curriculum Integration	Career readiness of students, faculty engagement, faculty-to-faculty dialogue about the moral obligation to help students…	Reflect, Articulate, Translate, and Evaluate (RATE): An integrated self-assessment instrument that guides students to develop a metacognitive habit of mind, and tracks their curricular and co-curricular experiences…	National Association of Colleges and Employers (2022)
9	Improving Faculty Development Plan	Professional Development and Student Learning	Overcoming the challenges to effective faculty development, Faculty Diversity Development, Mentoring, Teaching	Faculty Focus.Com [Magna Publication]

			Effectiveness, Supporting program-level assessment, Strategic Plan, Removal of barriers…	
10	Faculty and Curriculum Development	Assessment of competency-based model during curriculum development and delivery, Flexible option model, Step-by-step process that begins and ends with outcomes, from broad to narrow…	Providing time for the cultural shift that requires on the part of faculty and support staff takes time and effort… Keep up with technology with the evolution of competency-based education…	The University of Wisconsin
11	Faculty Engagement with Learning Outcomes Assessment	Faculty engagement and the student's learning outcome	EFEA Model: Accountability within the higher education, alignment, faculty, and faculty engagement with learning outcomes assessment	1.library.net
12	3 Strategies to engage faculty in your student success initiatives	Faculty engagement and students' success initiatives	1. Elevating the quality of faculty advising and expanding their role, 2. Driving maximum adoption of in-class early alert systems, 3. Incentivizing and empowering departments to improve the success rates of students	Ed Vent (2017)
13	Student and Faculty Perceptions of Engagement in Engineering	Perceptions of engagement in engineering	Engagement is both a process and an outcome. Provide students with active learning experiences. Students show their engagement by participating in class discussions, doing research projects, and interacting with faculty & peers.	Rachelle S. Heller, Cheryl Beil, Kim Dam, and Belinda Haerum (2013)
14	Outstanding leadership	Higher Education Institutions	Prescription for Excellence	The (Indian) National Education Policy 2020

3.1 Synthesis of Faculty Engagement:

- Consistent faculty support linked to student engagement
- Suggestions for engagement with the industry
- Developing, facilitating, and high levels of student engagement
- A positive relationship between faculty co-op engagement scores and the students' engineering work experience
- Improving dialogue to increase human motivation, resilience, cultural elasticity, self-awareness, curiosity, mindfulness
- Recognizing faculty for outstanding work, utilizing their expertise to engage peers, and students
- Engaging faculty members for internal revenue generation to supplement the grants-in-aids
- An integrated self-assessment process to engage students
- Overcoming challenges to effective faculty development and engagement
- Providing time for a cultural shift
- Faculty engagement with learning outcomes assessment and the institutional conditions that reportedly elicit greater engagement
- Expand the role of the faculty members
- Drive maximum adoption of in-class early alert systems
- Incentivize and empower departments to improve the success rates of students

- Provide students with an active learning experience
- Prescription for Excellence

3.2 RESEARCH METHODOLOGY

It is based on Guba's social inquiry model. Questionnaires on shortcomings in faculty engagement have been developed, distributed to research participants, and feedback has been received. A four-point scale has been adapted.

3.3 POPULATION

Senior faculty members from various autonomous engineering colleges, state technical universities, and deemed universities in Tamil Nadu, Andhra Pradesh, Kerala, and Karnataka who have sufficient accomplishment and have many faculty-development programs.

3.4 SAMPLE:

Questionnaires have been sent to 189 senior faculty members but only 34 have responded. Three didn't complete the needed feedback. 31 faculty members, both male, and female, at the level of associate professors in various branches of engineering and 10 at the professors' cadre have been selected for this research. All of them have undergone many faculty development programs in planning curricula and instructional design courses. They are fully prepared to modernize the whole engineering courses and deliver them based on the advances.

3.5 Research Questions on Faculty Engagement

1. Whether the faculty members are provided with consistent support that is linked to student engagement?
2. Whether the institutional mission enables students' engagement in the industry?
3. Whether the institute develop and facilitate the faculty members to provide high-level engagement?
4. Whether the institute established sufficient linkages with the industries to have the sufficient engagement of the students?
5. Whether the faculty members have been enriched to counsel, coach, and mentor the students to improve their performances?
6. Whether the faculty members have been recognized for their excellent accomplishments and high-level cognitive skills which can be utilized to engage the students to accomplish excellence in their programs?
7. Whether the faculty members have been trained and developed to bid for projects under various International Development Agencies?
8. Whether the faculty members have been exposed to the self-assessment process in improving their student engagement processes?
9. Whether the training needs of the faculty members have been assessed and the needed courses been provided to improve the student engagement?
10. Whether the faculty members have been given sufficient time to manage the cultural shift toward effective student engagement?
11. Whether the institute enlarged the support services for effective student engagement?
12. Whether the roles of the faculty have been expanded?
13. Whether in-class early warning system has been adopted for students' effective engagement?
14. Whether the departments have been incentivized and empowered with the success rates of engagement of the students?
15. Have your institutions provided active learning experiences to engineering students through effective engagement?

3.6 Feedback

Table 1. Feedback from the participants

No.	Issue/ Practice	Excellent	Very Good	Good	Fair
1	Providing consistent support to the faculty members	32.25%	22.58%	12.90%	32.25%
2	Institution's mission on students' engagement in an industry	25.81%	29.03%	32.26%	12.90%
3	Development and engagement for faculty	35.49%	19.35%	22.58%	22.58%
4	Established linkages with a set of industries	29.03%	22.57%	19.34%	29.03%
5	Enrichment of faculty members to counsel, coach, and mentor the students	38.71%	25.81%	19.35%	16.13%
6	Recognition of faculty members' excellent accomplishment	22.58%	29.03%	29.03%	19.36%

7	Development of faculty members to bid on consultancy projects under IDAs	9.68%	12.90%	22.58%	54.84%
8	Exposure to the self-assessment process	16.12%	19.36%	29.03%	35.49%
9	Assessment of training needs of the faculty and offer needed training programs	19.35%	22.58%	38.72%	19.35%
10	Time is given to meet the cultural shift.	12.90%	22.58%	32.26%	32.26%
11	Enlarged support services for effective students engagement	16.13%	19.35%	29.03%	22.58%
12	Expanded roles of the faculty members	29.03%	22.59%	19.36%	29.03%
13	In-class early warning system	12.90%	16.12%	29.03%	41.95%
14	Incentivized and empowered success rates of students' engagement	29.03%	25.81%	22.58%	22.58%
15	Effective engagement process	32.26%	22.58%	19.35%	25.81%

3.7 Synthesis

The presents were calculated for each issue.

Four excellent practices: 5. Enrichment of the faculty members to counsel, coach, and mentoring: 38.71%; 3. Development and engagement of the faculty members; 1. Providing consistent support to the faculty members-32.26% 15. Effective engagement process-32.26%,

The lowest ranked practice: 7. Development of faculty members to bid for consultancy projects under IDAs (9.68%)

4. A Draft Model on the Faculty Engagement Process:

The following 15-step model has been developed for the newly recruited faculty members. It is based on the contributions of various researchers cited in the literature review. **It is presented in Table 2.**

Priority	Description	Development Processes
1.	Create a mission for students' engagement	Develop a strategic plan for the institute. Involve all the faculty members Validate through the Board of Governors and the Ministry of Education
2.	Expand the faculty members' role	Develop a faculty handbook and list of desired roles: Teaching, Effective Student Engagement, Research, Publication, and Services.
3.	Expose the faculty members to the self-assessment process	Try to assist the faculty to conduct self-appraisal on the professional needs
4.	Assess the training needs of the faculty and offer needed training programs	Develop a questionnaire to get the training needs of every faculty member, Consult the Heads of departments.
5.	Develop and Engage faculty	Provide faculty training programs on curriculum design, instructional development, measurement, and evaluation
6.	Enrich faculty members to counsel, coach, and mentor the students	Introduce student psychology and train the faculty in counseling, coaching, and mentoring process.
7.	Provide consistent support to the faculty members	Provide resource materials, books, journals, internet facilities, LCD projectors, learning material production facilities, transport facilities for industrial visits, contingencies for purchasing consumables, etc.
8.	Standardize effective students' engagement process	Prepare video programs on the best student engagement process, assessment of special needs, trust in the students, and effective guidance in choosing courses, electives, projects, etc.
9.	Enlarge support services for effective students' engagement.	Get approval from the authorities, industrial training, industry-specific dissertation, projects, assessment of the effectiveness of the projects, etc.
10.	Give time to meet the cultural shift	Provide time for practice and accept the challenges and effective implementation.
11.	Create an in-class warning system	Conduct periodical tests to assess the progress, counsel for improvement, etc. Resolve the conflicts.
12.	Recognize faculty members' excellent accomplishment	Recognize the excellent contribution and encourage sharing process with the peer.

13.	Establish linkages with a set of industries	The Institute authorities have to take steps in creating active linkages with the industries in the state and region.
14.	Develop faculty member's cognitive abilities to bid for consultancy projects under International Development Agencies [IDAs]	Now develop the faculty to focus their expertise to bid for consultancy projects from local companies. Involve interdisciplinary teams. Encourage to development skills and cognitive abilities to bid for projects under International Development Agencies.
15.	Incentivize and empower success rates of students' engagement	The trained and dedicated faculty members can develop an educational ecosystem with effective cooperation with companies.

4.1 Validation of the Model: The 31 faculty members reviewed based on their experiences. They suggested offering sufficient time to practice and come up with more authentic suggestions.

4.2 Discussion: This model needs the support of educational administrators in funding faculty development, creating needed resources, establishing effective learning aids development centers, transportation facilities for industrial visits, etc. If the strategic plan incorporates students' engagement, then accreditation of the programs will follow. The model when it is validated will provide effective student engagement and excellent academic achievement for the students. Accountability of the faculty will also increase. The desired attributes of the students will be ensured. Further, the return on investments made in engineering education will be large, if this model is implemented through effective training and development of the faculty members. The students' dropouts will be reduced. They can get better placements in well-paying companies.

Success Rate of this Model

- Encouraging the faculty to undergo technology-specific courses
- Engaging them to offer advanced courses to meet the job requirements of fast-developing companies
- Providing needed resources, software, equipment, tools, and trained technical support staff.
- Incorporating the advanced courses periodically in the curricula through the Academic Council of the University
- Offering state-of-the-art training courses in analysis, product design, testing the performance of the product through simulation, field-testing, and identifying the defects for low performance.
- Rectifying the defects, assembling the product, and retesting for performance.
- Plan for mass production, marketing, and getting feedback from the users.
- Checking the feedback and rectification of defects.
- Periodical training of the maintenance personnel
- Ensuring the components for replacements
- Assess the changes due to market competition and plan for the upgraded product with high quality, easy maintenance, and added innovation.
- Availability of Mentors for the faculty members
- Offering needed counseling of the students and arranging campus placement

Reasons for Failures of this Model

- College management is not able to recruit well-accomplished faculty members
- Too much shortage of faculty members
- Colleges are located in far-off rural places
- Trained faculty members may leave the institution and join companies or well-paying universities or migrate to overseas universities
- Continue to offer old curricula where the institute could not initiate modernization
- Not offering needed industrial training to the students due to want of linkages with the companies in the state
- Laboratories and workshops are not modernized to offer the prescribed testing and product development
- State Technical Universities and Autonomous Colleges attracted motivated students.
- Couldn't offer co-operative/sandwich programs due to a shortage in the companies
- Could not recruit adjunct faculty from the companies due to shortage of course-specific experts
- Could not get additional grants-in-aid from the government

- Absence of donors or alumni funding
- Too frequent job shifts and unstable employment potential
- Closure of multinational companies like Ford, General Motors, etc.
- Faculty members are not able to win consultancy projects from the companies

5. CONCLUSION

Engineering faculty engagement has become an essential step in the transformation process. Without effective faculty engagement, there will be a big loss in the return on investment in engineering education, shortage of industry-specific attributes in the graduates, low pay jobs, difficulty to get accreditation of the engineering programs, etc. Based on the literature survey and the feedback from 31 highly qualified and well-accomplished senior faculty members, a draft model has been developed for faculty engagement that will ensure effective and efficient student engagement. This model has to be field-tried and has to be modified, if necessary. The administrators have to develop a strategic plan for the institution, train the faculty members, provide needed resources, and develop active linkages with state and regional companies. If an academic ecosystem has been established, the students can be effectively engaged in all professional transformation processes.

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