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STUDENT PROFESSIONAL DEVELOPMENT: FOSTERING CRITICAL THINKING AMONG STUDENTS

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Abstract— Student Professional Development is defined as the activities that enable to supplement andcomplement the curricular or main syllabi activities. These are the very important part and parcel of educational institutions to develop the students‟ personality as well as to strengthen theclassroom learning directly or indirectly. Professional development (PD) can be defined in diverse ways and can take many forms. Formal education is classroom education, with nonformal considered as “any organized, systematic, educational activity, carried on outside the framework of the formal system, to provide selected types of learning to a particular subgroup in the population. A problem higher education faculty face is the lack of a framework for holistic student professional development and assessment. Such a framework can serve as a bridge between academic and professional identity development This article presents the framework planned in the institute for professional development of students where the students learn by Informal education by association and affiliation, specifically, “the life-long process by which every person acquires and accumulates knowledge, skills, attitudes, and insights from daily experiences and exposure to the environment. The idea is to facilitate an academic mixed with co-curricular and extra co-curricular culture so that they can participate as effectively . Our mixed-methods study examined the impact of many activities leadership, classroom experiences, and sociocultural levels; the findings inspire new directions for program design with key insights for student PD program evaluation.

Keywords— Keywords: Educational change, impact evaluation, professional development,

I. INTRODUCTION

Student Professional Development is defined as the activities that enable to supplement and complement the curricular or main syllabi activities. These are the very important part and parcel of educational institutions to develop the students ‘personality as well as to strengthen the classroom learning directly or indirectly curricular activities are the true and practical experiences received by students. To a great extent, theoretical knowledge gets strengthened when a relevant co-curricular activity is organized related to the content taught in the classroom. Intellectual aspects of personality are solely accomplished by Classroom, while aesthetic development, character building, spiritualgrowth, physical growth, moral values, creativity, etc. Are supported by co-curricular activities. It helps to develop co-ordination, adjustment, speech fluency, extempore expressions, etc. among students. All these exercises are planned for students for their future successful career.

"The Knowledge, Skills, and Attributes of Effective Teachers" by The National Foundation for Educational Research (NFER) (2017) (*A guide to citation 2017)* – in this report , a detailed analysis of the knowledge, skills, and attributes needed for effective learning , including how these can be developed through teacher education programs and professional development opportunities. "The KSA Model and Student Learning Outcomes Assessment in Technical Education" by John Good lad and Keven Porter (2002) - This article provides a detailed examination of the KSA model and how it can be used in technical education to assess student learning outcomes and design effective assessment strategies. These references can provide valuable insights into the KSA model and how it can be applied in education to support student learning and success.

A. KSA model

The KSA model is often used in education to identify the specific knowledge, skills, and attributes for students to be successful in a particular field or to achieve certain learning outcomes. By identifying the KSA requirements, educators can design courses and programs that help students develop these skills and

attributes and prepare them for success in their chosen careers. The model comprises of three components

1.Knowledge which refers to factual or theoretical information required to perform a job, such as information about a particular subject or industry.
2.Skills refers to practical abilities required to perform a job, such as problem solving skills , communication skills, or technical skills.
3. Attributes refers to personal characteristics or traits that are necessary to perform a job, such as motivation, adaptability, or the ability to work well within time

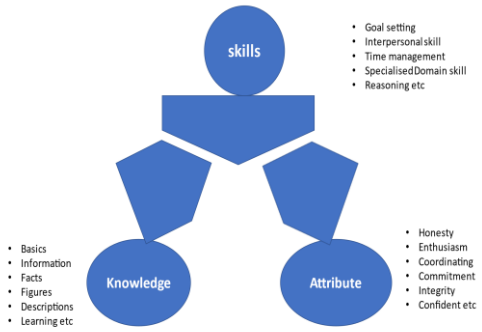

Fig. 1. KSA model

The KSA model can serve as a guide for educators and students to identify areas of strength or areas where they need improvement.
There are six levels of cognitive learning according to the revised version of Bloom's Taxonomy. Each level is conceptually different. The six levels are remembering, understanding, applying, analyzing, evaluating, and creating.
The skills have 4 levels as the improvement index goes up. In individual.
Attributes are gauged by decision maker, ready to adapt, problem solving, creative thinker .
Knowledge, skill, Attributes lead to competency (as per Kraiger, K., Ford J and Salas E. 1993).

Knowledge has 6 levels of learning given by Blooms Taxonomy.

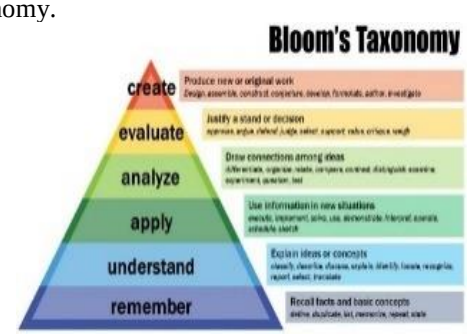

Fig 2: Levels of Knowledge source *https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/*

The combination of knowledge with skill, skill with attribute, and attribute with knowledge can result in a more well-rounded and effective individual in their respective field. Here's a breakdown of each combination:

1. Knowledge combined with skill: Better theoretical understanding of a concept and the ability to put that understanding into practice.
2. Skill combined with attribute: Students has better refined and specialized skill set which was quoted by Woaswi, W., Hamzah, N., & Azid, A. 2018 (page 179).
3. Attribute combined with knowledge: Student is able to apply their attribute in a more informed and effective way. For example, a person with the attribute of creativity and knowledge of design principles will likely be more successful in a design role.

B. Activities

Following is the list of activities carried under the student professional development under KSA model.

1. ***Smart India Hackathon***
2. ***Exhibition of prototypes on Engineers day***
3. ***Activity based Learning***

Table 1 .

Combination	Result	Example	RBT
Knowledge +Skill	Theoretical understanding +practical application	Project Manager with knowledge of project management methodologies and the skill to effectively apply those methodologies	Remember , Understand , Apply
Skill Attribute	Refines and Specialised Skill set	Public speaking with strong communication skills and the attribute of being an effective public speaking	Apply , Analyse , Evaluate
Attribute Knowledge	Informed and Effective Application of Attribute	Designer with the attribute of creativity and knowledge of design principles.	Remember ,Understand , Analyse
Competency	Resultant of all Knowledge , Skill and Attribute	Overall confident , self reliant competent indidual	Understand, Remember, Apply, Analyse, Evaluate, Create.

Table 1: This table summarizes the combinations of knowledge, skills, and attributes, and the resulting benefits they can bring to an individual in their respective field. RBT level mapped with combined effects of KSA

Overall, combining different components of knowledge, skills, and abilities can lead to a more comprehensive and effective performance in a particular role or competency.

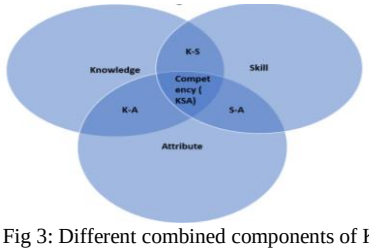

Fig 3: Different combined components of Knowledge, Skill and Attribute

4. E magazine, Bulletines

C. Need

Professional development (PD) in education or in a student's life is to how the student is exposed to a wide variety of advanced professional learning backed by specialized training, sometimes incorporating formal educational course that intends to help them in improving their skills, knowledge, and effectiveness. The Foundation for Critical Thinking offers customized webinars and 15-week customized courses, all tailored to institution's needs and goals for better creative outcome of students.

It can be delivered in person/ online or in hybrid mode , through 1-on-1 interactions, or group situations. This article will discuss the importance of professional development in education especially focussing on Activity based Learning and its impact on students' performance. Under KSA model these activities were carried out in order to polish the Knowledge, Skill set and Attributes of students as pointed out by Quiñones, Miguel A. (1997), page 154.

D. Motivation :

(i) To stimulate students on diverse domains of learning by participation in various seminars, workshops, professional body wings both intra and interdisciplinary helping in achieving overall completion of education.
(ii)To motivate the students to express them freely through planning, organizing and owning the program with a sense of belonging.
(iii)To guide students how to organize and present an activity, how to develop skills, how to co- operate and co-ordinate in different situations-all thereby helping the students to grow in leadership qualities and carry healthy competition.
(iv)To provide the avenues of socialization, self-identification and self-assessment when the student come in contact with organizers, fellow participants, faculty, people outside the campus during various activity.

E. Objectives

(i) The co-curriculum activities of an institute supplements the classroom teaching These out of class activities affecting all domains of life such as cognitive (intellectual), emotional, social, moral, cultural and aesthetic.
(ii) These activities are more focuses the students in area of intellectual development. Competitiveness, excellence, quality achievements, creativeness and enthusiasm.
(iii) It helps in developing the habits of constructive competition, brings efficiency in ideas, improves skill and competence thereby unearthing the hidden talent in a student.

D. Development and deployment of Best practice

Table 2: Event Response Since Inception (Data)

Year	No. of PS	Ministries	Finale participant teams	Response from Institute	Winnerstatus
2017	598	29	1150	1	1 software consolation prize
2018	408	38	1296 TEAMS	5 teams finalists outof 7 teams represented	1 hardware
2019	532	67	More than 1300	5 teams out of 11 teams represented	3 software prize
SIH 2020	532	67	1650 TEAMS	5 teams finalist out of 15 represented	1 prize software 1 lakh
SIH 2022	563	75	6535 TEAMS	8 teams finalist out of 33 teams represented	5 Software prize and 1 hardware

(i) Smart India Hackathon: 2017-2022

AICTE under the aegis of MHRD and in collaboration with i4C, Persistent Systems Ltd., Rambhau Prabhodini Mhalgi, NIC, and My Gov launched Smart India Hackathon 2018 on October 16, 2017 at the hands of Shri. Prakash Javadekar, Hon'ble Minister of HRD, Government of India and Chief Patron, Smart India Hackathon 2018. The Smart India Hackathon 2018 focuses to develop innovative solutions for the various set of problems and challenges not only from various central ministries but also from state governments and some extent from industries and society as well. Registration is done by Team leader on portal of SIH . The deadline for registration date is announced every year.
Students are asked to form the team of six students , out of which one students should be mandatorily a girl student.
Two mentors are assigned from faculties / industry to each team of Hackathon participants.
Internal Hackathon is carried out at Institute level to select the best projects as asked in numbers by SIH . These projects are submitted on portal and verified by SPOC (Single point of Contact , SIH)Then further the projects are evaluated by SIH and shortlisted projects are selected for competition at different nodal centers.More than 378 students participated in SIH 2022. After shortlisting 48 students competed in 8 teams at various nodal centers in SIH 2022
Winners announcement was done on last day of Grand Finale with 6 teams , the highest number winning in SIH 2022 . Five Software and One Hardware projects were declared at National Level 1st prize.
About 27 Central Government Ministries and 18 State Governments have come together and posted 408 problem statements to the students participating in this grand initiative. More than 105234 students registered. With 17539 ideas are received from technical institutions in India, this surely has been a fantastic response www.sih.gov.in 2022

ii) Exhibition of Prototypes on Engineer's day

The Engineering Community across India celebrates Engineers Day on 15th September every year as a tribute to the greatest Indian Engineer Bharat Ratna Moksha Gundam Visvesvaraya. "Role of Engineers in a developing India" is the theme of Engineers Day. We therefore on the line of theme celebrate its Engineer's Innovation Exhibition on Engineering day every year. True Learning can only be achieved when knowledge is put into practical action to create a remarkable experience.

And therefore, the day is celebrated with an exhibition of innovative products from various companies to substantiate the Theoretical learning. Engineers day has been celebrated since 2017 till date with an Exhibition of innovative products of companies, entrepreneurs or start ups . The students interact with the the displaying personals and a knowledge exchange is seen as affair on Engineers Day.

Initially in 2017 to 2018 the Companies were Invited to display the USP products they wanted to share in exhibition. Innovative products of Companies are displayed. A formal inaugby the chief guest always opened the exhibition. Nearly 22 companies all over Maharashtra would be the players on Exhibition floor. A proper timetable with a slot mandatory for the entire college would be prepared so that every student could interact with company people with a learning outcome. Nearly 3000 students would benefit from the exhibits. The program would end with a vote of thanks and memento distribution to Company participants as a token of love.

In 2020 Due to pandemic , an online lecture on Cybersecurity was delivered by a cyber cell expert . In 2021 , an Online lecture by eminent scientist from BARC gave lecture on Non proliferation of Nuclear weapons which was an eye opener for engineering students on Nuclear defense topic which is a frontline discussive topics at International level. In 2022 , the legacy of exhibition was brought back by displaying the 22 innovative projects either won at National level SIH/ other competitions or entrepreneurs prototypes or the the start ups projects .The students for interaction were from SE to BE. FE students were not there as the admissions were late in 2022. The feedback was very intense that such exhibition held a very high motivation to budding Engineers to give their best to Institute.

iii) Activity Based Learning

The vision of ABL is that students become independent investigators who start a n independent inquiry into a topic of interest in a self-directed manner. Facilitating, motivating, enabling and coaching are therefore key skills-sets for an instructor which was taken as training sessions with faculties involved prior to ABL exercise with students which agrees with Radhika et al 2022(page 176) and Fizza Answer (2019)

The types of activities could be exploratory (gathering knowledge), constructive (creative output) or expressional (presentations) . Later the responsibility was taken by students for their learning and develop solutions for complex problems when their research paper becomes a PBL(Project based Learning) in same semester but an enhanced Activity Course

The course is a credit based and is a part of the Institute's continuing effort to expose young scholars to the work of international engineering fields. The course was offered to entire Second year students in a class of 60-70 students. One full week is allotted in academic calendar with 40 hours plan in total. Altogether, each student received around 15 hours of instruction and 25 hours were devoted to complete the topic investigation, survey design, writing article etc. It's worth noting that the teaching time was prolonged owing to additional one-on-one training during office hours, which allowed participants to share their experiences, debate research methodology challenges, and brainstorm possible solutions with continual strategies.

The major Activity ABL covers most of the practices like Quiz, Debates, Literature survey on technical theme based topics aligned with domains. It also covers survey designing and creative writing to bring a holistic development in student in totality. For ABL innovative solution to burning problems picked from TV -2035 the following steps are followed.

Ideate.

With a diverse mix of students from different core branches, age groups, and abilities, the mix and collaboration enabled them to have rich conversations. Ideation platform is offered under Activity Based Learning carried out in both semesters with different technical themes. In 2020 the Technology Vision was introduced to second year SEM III students . The topics under TV-2035 were aligned with core branches of engineering and domains of specialization . Each Class was given 10 topics making a team of 6 students to work on the topics . This enhanced the technical skills of students and was extended in higher semester for Project based learning so that the students could develop a prototype. The TV 2035 roots itself into the collective aspirations, ambitions, and expectations of Indians to get themselves experience the evolution of technology vision for the country. Thakur College of Engineering and Technology has always been in the forefront to initiate and align with the government ingenuities.

The major aim of TECHNOLOGY VISION - 2035 is to capture deeply the domestic market which will likely make India the world's third largest economy by 2035 after China and the United States measured by market exchange rates. It is already the third largest economy measured by purchasing power parity. This agrees with Quiñones, Miguel A. (1997),that today the training for a rapidly changing workplace is must.

Prototypes

Team essence plays a major role while developing a protype. Prototypes allow for user testing, which provides designers with valuable feedback about their product. With their insights, the design team can make changes early on. Creating any product requires a team of designers that can effectively communicate their ideas and concepts with one

another.[9]

iv) E- magazines, Bulletins

Every semester each Department under the ages of Professional body releases its magazine, bulletins. The magazine covers the best technical articles by students and staff. The Bulletins give an overview of the activities carried out in department, achievements and feedback of activities for improvements. Magazine publishing has been transferred now to innovate in digital media . It is released as E magazine and bulletins from each department.[10]

E. Monitoring of the Best Practice

(i) Smart India Hackathon

Smart India Hackathons are judged at 4 stages.

a) Initially all the projects are assessed at Department level by the internal judges. Each department then selects the best number of projects to the Institute. Separate Rubrics is designed for Department level.

b) The best projects evaluated at Department level are then assessed for the best Institute level 15 projects. This involves the internal senor faculty as judges and a few industry personals as external judges. The Rubrics designed is more stringent than department level evaluating parameters.

c) The best 15 projects are then uploaded on portal by SPOC for evaluation by SIH judges.

d) Out of 15 projects then a name of selected projects are displayed by Govt of India on SIH portal as shortlisted teams for Grand Finale . The nodal centers are announced where the team of students travel and compete for National Level.

In Grand finale three to 4 level of evaluation are done after giving the hints for further solution, counselling etc. The pitching given by students is then evaluated in continuous mode of working for 36 hours competition if it is software and 72 hrs. if hardware competition.

f) Last day of grand finale finally announces two teams winners one at 1st prize and other 2nd prize for each problem statement given by SIH.

(ii) Activity Based Learning *:*

The Activity Based Learning is a credit course and one credit is offered separately in both semesters . The students have to complete the evaluation stages of all 6 modules given in a semester . Finally a report submitted by student on all modules covered with an inference of topic studied in detail given to teams. In addition a presentation is being given by students and are assessed by a common rubrics for all teams. Some of the modules are designed in such a way that it brings a individual evaluation of student participation and performance eg. Creative writing etc. Both report and presentation carry 25 marks each for report and presentation which accounts for one credit .

iii) Exhibition of prototypes on Engineer's Day

Evaluation of Engineers Day is assessed by the direct feedback from visitor students of Institute in Exhibition.

iv) E magazine, Bulletins

The quality of articles is gauged for continual improvement of magazines. The creativity of students is checked by the meaningful content check and its authenticity. Ever since magazines are released the count has seen an continuous uprise so far. S Das et al. https://www.taylorfrancis.com/chapters/edit/10.4324/9780429321368-2/magazine-publishing-innovation.

Similar exercise was done like Singar &N peddar et al .https://www.gov.uk/research-2016 using a multi-methods approach, examines the perceptions and practices of students,

A general overview of the attributes that could be seen for each activity under KSA model and assessment tools is given in Table 3. The aim of the assessment is to determine the candidate's qualifications for a particular role, and the appropriate tools will depend on the skills and abilities required for that role.

Table 3:

Activity	Attributes	Assessment tools
Hackathon:	Technical skills, such as programming and software development Ability to work in a team Ability to think creatively and outside the box Knowledge of relevant technologies and tools Problem-solving skills Effective communication skills	Code review, product demonstration, peer evaluations Judgment by industry experts
Exhibition of Prototypes on Engineer's Day	Strong problem solving skills for solutions ro real world issues Critically think to improve the prototype effectiveness Innovate solutions with unique design, features and functionalities Possess technical expertise for refining model Strong communication skills with team work and project management skills.	Prototype model status Cost effective model Multifunction Can it give a future start up or entrepreneurship Can it convert to project for fund application
Activity-based learning:	Knowledge of the subject matter Ability to work in a team Effective communication skills Ability to research and gather information Ability to articulate arguments and counter arguments Critical thinking and analytical skills and innovation Presentation skills	Group projects, role-playing exercises, case studies Creative prototypes Technical write ups Effective Presentation
Magazine & Bulletins Writing:	A deep know how about the topic Gather information and research Excellent writing skills with creative acumen, engaging readers in a concise manner Attention to detail, with a good presentation	Creative Articles Content creation Number of articles converting into publications

F. Obstacles faced / Problems encountered.

i) Smart India Hackathon:

Since there are many rounds of evaluation, sometimes the students get impatient and drop out of competition, in such case a strong counselling is done to Student and make him/her comfortable for finding a solution. The second mentor from industry in same domain with at least minimum 3-year experience is sometimes difficult to arrange. Alternately its left on SIH event organizers to assign at nodal center the same.

Booking the tickets by train in a short span after the shortlisted names are announced is really very challenging.

Amenities at Nodal Centers are sometimes very bad. Students and mentors from the Institute have to put up for the same.

(ii) Activity Based Learning: Since the entire week students face the exercise of different modules and be prepared well on domain related topic assigned to team. Therefore, the presentation is kept 15 days after the last module conduct of ABL. Also due to late lateral admissions few students are the ABL is conducted again on working Saturdays and assessed for credit. Every year some new faculties join the duty of ABL therefore orientation is done daily by Activity Head for same scale of conduct and evaluation.

(iii) Engineers' day:

The space crunch of keeping the exhibited project with visitors' movement was felt on Engineers day 2022. However, a new location has been identified for next year to avoid crowded space and crowd management.

(iv) E magazines, Bulletins: The Magazine release date is always towards the last week of semester, students are therefore extremely busy completing term work, exams etc. Also, the articles have to be carefully judges on content and plagiarism so the process is quite engaging. Despite this student take great interest in releasing/unveiling their magazines

G. Resources

Two types of resources are the minimum requirement in every program. Faculty and venue, other than that few are listed in Table 5.

Activity	Resources
Smart India Hackathon	SPOC , a mediator between Institute and Govt of India . Faculties as mentors and judges volunteers for maintaining law and order during Department level and Institute level Hackathon . Space for offline competitions Budget for travel and other expenses.
Exhibition on Engineers Day	Planning and Information to Depts. Professional body Faculties with volunteer students for monitoring hospitality and other requirements of the exhibitors to take care Exhibition space with accessories like electrical connections , LAN , WIFI etc . Team of Judges to select best projects.
Activity Based Learning	Academic Calender. The faculties and venue identified by HOD of the department for smooth coduct of this credit based Course. Ppt and videos for orientation of faculties on each modules and later to teach students Space to conduct
E-Magazine , Bulletines	Zoom licence to launch online, Faculties , volunteers Anchors
	Budget for printing magazines.

Table 5: Activities and Resources.

3. Results of Best Practice and outcomes

Students are able to step into diverse application based creative zones by the exercise oof ABL, Hackathons which definitely helps them for placements in companies. It offers a common platform for students and faculty is provided by the institute to strengthen TCET student f interaction on innovative product to bring and realize real time solution for different problems. Fruitful interactions with faculty and staff, inputs were provided by Experts of domains, mentors and students regarding their understanding on products. This is an opportunity for the institute to speak about its achievements and Innovative practice as it's a part of national drive taken by Government to motivate students to come up with unique products. A habit of constructive competition unearthing the hidden talent in a student. Improving capacity of organizing events enabling managerial and leadership activities improvement year after year. An opportunity to solve a social issue at national level. This has opened the doors for entrepreneurship and competition platforms across country at higherlevel of giving solutions at country level. This will also bring opportunities for student 's talent above a edge for placement opportunities

Creating avenues to meet with various people thereby helping in socialization, self-identification and self-assessment. Debates Quiz exercise takes them to the world of expressing their views with technical know-how on topic. Abid el Majidi a,* , Daniel Janssen b & Rick de Graaff c a at el (2021) .

H. Why is it a Best Practice?

The above designed activities are behaviors or policies by faculty, staff, and administrators that result in positive changes in student attitudes or academic behaviors. These programs were initiated five years back and now they are continued which are composed of a carefully coordinated collection of individual best practice activities. Also, it has been accepted as superiorto any alternatives because it produces results that are superior to those achieved by other means orbecause it has become a standard way of doing things, e.g., a standard way of complying with academic and technical requirements.

II. Results and Discussion:

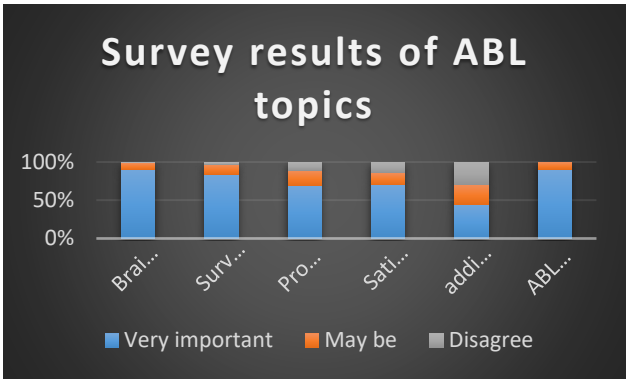

Fig5: Feedback on each module

Finally, a questionnaire was used to collect students' expectations for the course.

For feedback on each module, a survey was conducted. A total of 500 students answered a set of 15 questions.[6]

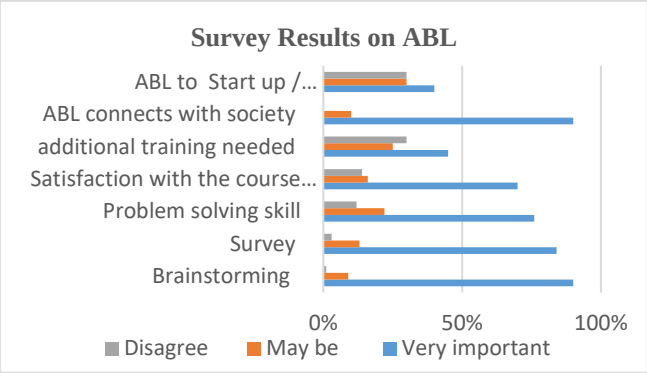

Fig 6: Survey result of ABL

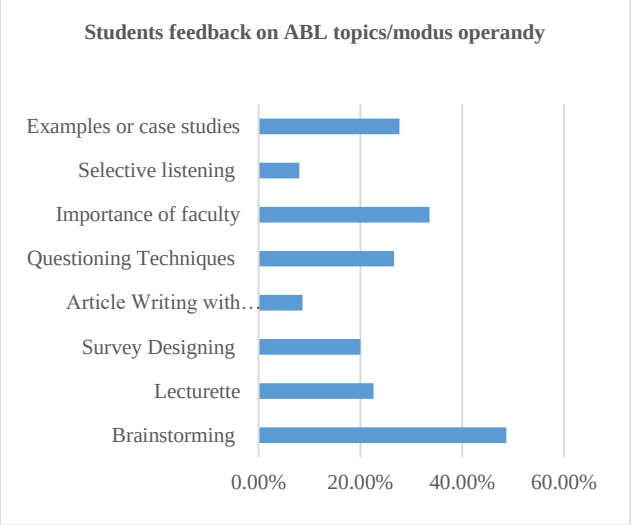

Fig 7: Student feedback on ABL topics

(i) Smart India Hackathon

The SIH participation has seen a long journey among students from 2017 to 2022 . Every year students have creatively given solutions to ministry either in software / hardware or both . Fig 1. Shows the participation status of Institute in SIH 2017-SIH 2022 .The summary of the acclodes won at different SIH is as given in Fig 2. [8]

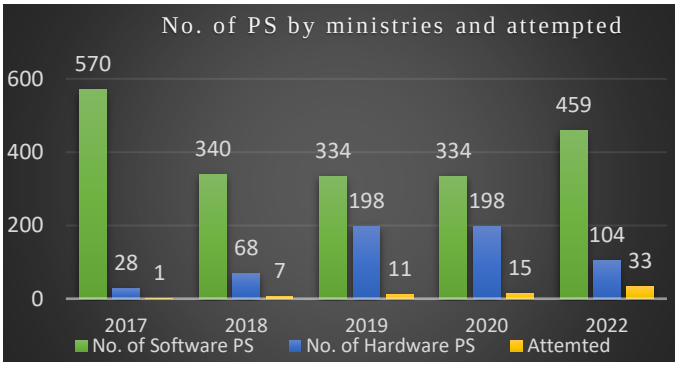

Fig8 : 2017-2022 projects attempted

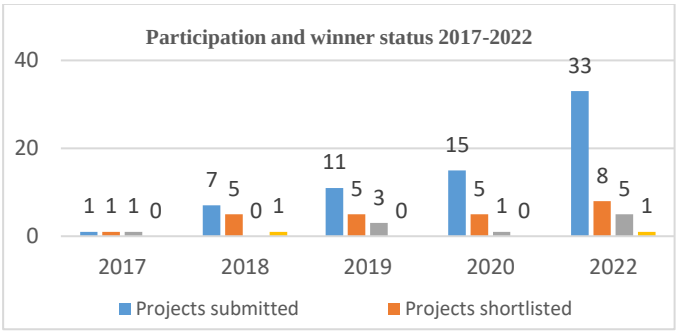

Fig 9 : 2017-2022 projects won at National level and winners status respectively .

(ii) Activity Based Learning :

Based on the findings and discussion, this study indicated that Activity Based Learning boosts student motivation and academic accomplishment in undergraduate engineering college students. Teaching styles attract students and play a favorable role in student motivation and academic accomplishment for improved learning outcomes which is also stated by Ahmed Albadi*& Solomon Arulraj David , 2019.

The purpose of the study to foster ABL in students with the use of active learning technique was fulfilled as observed by the positive feedback given by students. Overall, students liked this method as a useful and interesting tool for learning.

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Year	Status of ABL	ABL activities
2017	ABL non credit course Structured syllabus missing	Debates Survey Designing Projects after Literature Survey
2018	ABL non credit course Structured syllabus missing	Technical Quiz, & games added with presentation and report A link to society was introduced for ABL in relation to domain linked topics
2019 Auto nomy	ABL became credit course under autonomy	Renewal energies projects were given under ABL to continue to PBL.

Status	A structured syllabus of 30 hrs	Domain linked topics given Team/ individual assessment
2020	ABL, credit course and theme based TQM introduced	Theme Technology Vision 2035 Brainstorming Blog writing
2021	ABL, theme based with introduction of new modules. Agile methodology	TV- 2035, Zero carbon emission, and Hackathons domain based topic. A link to society was continued. Creative writing, drama, role play added to syllabus.
2022	ABL, theme based with introduction of new modules. Personality Development theme	TV- 2035, Hackathons domain based topic. A link to society was continued. Lecturette and Blog witing with drama, role play added to syllabus.

Table 7: Represents the journey of ABL from 2017-2022 with various developments to enhance the students knowledge, skills and attributes

(iii) Engineers day :

Year	Projects by companies	Projects by Internal students	Projects by Entrepreneurs	Attended by Internal students	Attended by External Students
2017	15	2	5	2500 approx.	-
2018	16	1	5	3000 approx.	-
2019	5	1	7	3500 approx.	200 school students
2020	-	-	-	3000 workshop on Cybersecurity	-
2021	-	-	-	3800 workshop on Nuclear Non Proliferation	-
2022	-	22	-	4000	600 outside students during roadmap to engineering

Table 6 represents the projects displayed year wise 2017-2022

iv E Magazines and Bulletins

Creating a technical article requires a rigorous research, analyses and critical thinking. Young individuals must identify problems, explore potential solutions, and present their findings in a coherent manner. This process nurtures their problem-solving abilities and encourages them to think creatively fostering a culture of innovation. When asked the feedback on Magazine, more than 50% students felt that they could convert their article into publications.

III Conclusion:

ii) Smart India Hackathon

The goal of a hackathon is to create functioning software or hardware by the end of the event. Hackathons tend to have a specific focus, which can include the programming language used, the operating system, an application, an API, or the subject and the demographic group of the programmers. Tcet has offered total 12 solutions to country so far with its journey from 2017-2022 and will continue to do so. Jeanette Falk, & Alexander Nolte et al .(2022)

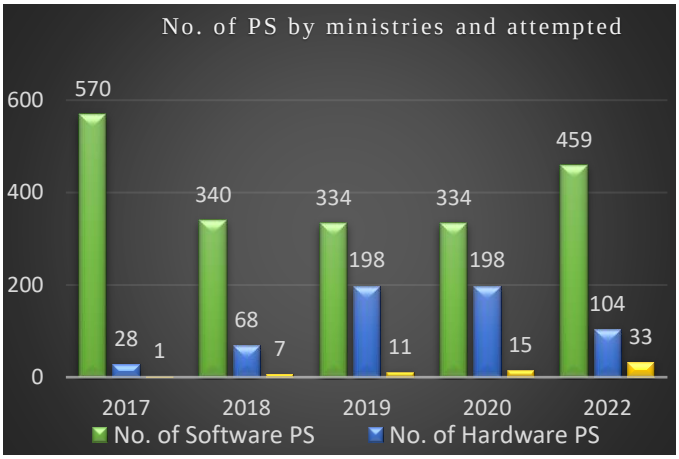

Fig 10: The number of PS floated by ministries and attempted by institute students

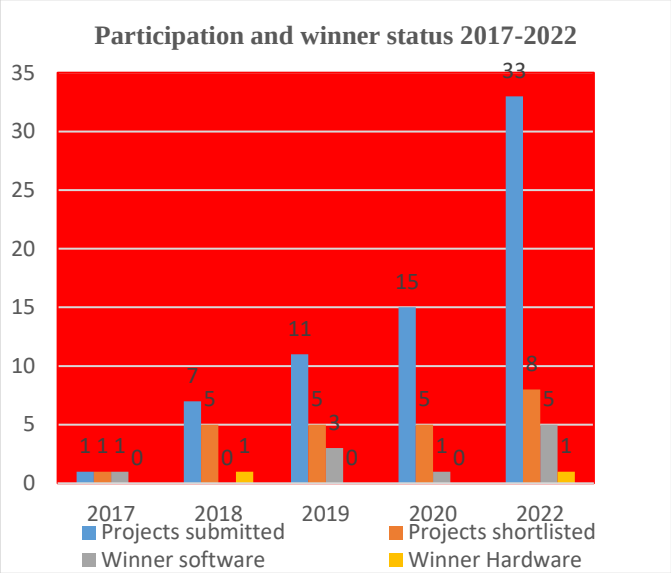

Fig 11: Projects submitted and wo projects summary.

Institute celebrates Engineering Day on 15th September with display of unique products for technical interaction of students. This year the displayed items were Idea/prototypes by students who won at different competitions at State, National or International Level. It was an overwhelming response both by exhibitors and participants as well as faculties. 4 projects of Smart India Hackathon winners at National level along with other winners at different competitions showcased their talents. TSDW, NSS and EWT worked along with professional body as well as R&D faculties gave a technical worked at the backhand of entire event.
The participants were so much so motivated that they wish to come with their exhibits nest year.

E Magazine , bulletins :
Magazine writing requires a specific set of skills including research, interviewing editing , writing and fact checking . Every semester students take a great interest in articles writing over a range of topics , they work in team collaboratively, manage time and meet the deadlines which fetches tan agility quality in them . This year total 247 articles were written .

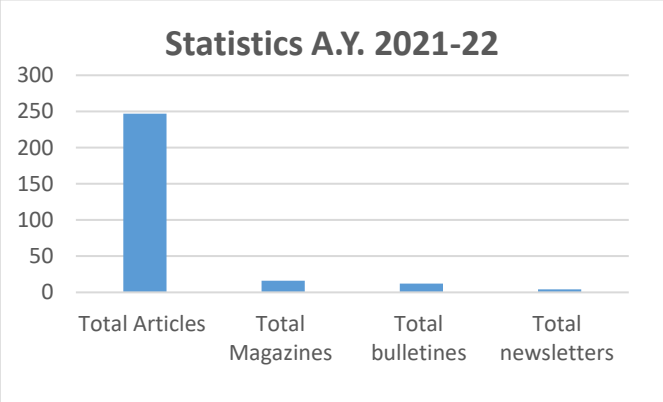

Fig12: Total articles in year 2021-2022

Table 8: Total magazines, newsletters and articles published from 2017-2022.

Sr.No.	No. of Articles	No. of Students attended	No. of Magazines	No. of Newsletters	Social Bodies	Faculty articles
2017	90	129	7	3	-	4
2018	135	205	7	3	-	6
2019	110	167	7	7	-	4
2020	126	190	10	6	2	3
2021	190	300	12	4	6	5
2022	247	356	12	3	7	9

Therefore KSA model is verified with various activities for improvement in innovative capabilities or proficiencies developed through training or hands-on experience along with polishing of their innate traits or talents that a student brings to a task or situation.

Hence Table 9 shows that under KSA model the result of all activities combined develops the attributes with competency in students to handle projects with creative thinking .
Table 10 shows that along with creativity the other parameters too are mapped well foe 12 graduate Attributes.

Table 9: Results of activities under KSA model.

Activity	Knowledge, Skill and Attributes development	Assessment tools
Hackathon :	Technical skills, such as programming and software development Ability to work in a team Ability to think creatively and outside the box Knowledge of relevant technologies and tools Problem-solving skills Effective communication skills	Code review, product demonstration, peer evaluations Judgment by industry experts
Exhibition of Prototypes on Engineer's Day	Strong problem solving skills for solutions ro real world issues Critically think to improve the prototype effectiveness Innovate solutions with unique design, features and functionalities Possess technical expertise for refining model Strong communication skills with team work and project management skills.	Prototype model status Cost effective model Multifunction Can it give a future start up or entrepreneurship Can it convert to project for fund application

Activity-based learning:	Knowledge of the subject matter Ability to work in a team Effective communication skills Ability to research and gather information Ability to articulate arguments and counter arguments Critical thinking and analytical skills and innovation Presentation skills	Group projects, role-playing exercises, case studies Creative prototypes Technical write ups Effective Presentation
Magazine & Bulletins Writing:	A deep know how about the topic Gather information and research Excellent writing skills with creative acumen, engaging readers in a concise manner Attention to detail, with a good presentation	Creative Articles Content creation Number of articles converting into publications

Table 10 : Depicts the mapping of all 4 activities with Graduate Attributes .
Attributes matching with Activities in the range of 8-10 are H (High)
Attributes matching with Activities in the range of 5-7 are M (Medium)
Attributes matching with Activities in the range of 4-6 are L(Low)
Jacqkeline n Zeeman et al. (2019)

Graduate Attributes	GAs	Smart India Hackathon	Exhibition on Engineers Day	Activity Based Learning	E Magazine and Bulletines
Graduate Attribute 1	A knowledge base for engineering	H	H	H	H
Graduate Attribute 2	Problem analysis	H	H	M	L
Graduate Attribute 3	Design Development of solution	H	H	L	L
Graduate Attribute 4	Conduct Investigation	H	H	H	L
Graduate Attribute 5	Modern use of tools	H	H	M	H
Graduate Attribute 6	Engineer and Society	H	H	H	H
Graduate Attribute 7	Environment and sustainability	H	H	H	M
Graduate Attribute 8	Ehics and professionalism	M	M	M	H
Graduate Attribute 9	Individual and team work	H	M	H	M
Graduate Attribute 10	Communication	H	H	H	H
Graduate Attribute 11	Project management and Finance	H	M	L	L
Graduate Attribute 12	Lifelong Learning	H	M	M	H

For overall development of students a list of attributes and the interest of individual were mapped as a result of 4 holistic student developing activities as given in Table

Table 11: Depicts the 20 parameters shows a correlation between the attained goal and skills attributes gathered during the graduation through various Co-Curricular activities.[14]
I. Academics , II Competitions, III. Activity, Project and Research based learning, IV. Club activities, V. Professional bodies, VI. Energy &Environment , VII. Entrepreneurship , VIII Service to Society.

Parameters	I	II	III	IV	V	VI	VII	VIII
Critical thinking	✓	✓	✓	✓		✓	✓	✓
Creativity	✓	✓	✓	✓	✓	✓	✓	
Problem solving	✓	✓	✓	✓	✓	✓	✓	✓
Strategy		✓		✓			✓	✓
Organisational management			✓	✓				✓
Networking		✓	✓	✓	✓	✓	✓	✓
Interpersonal communication		✓	✓	✓	✓	✓	✓	✓
Team work		✓	✓	✓	✓		✓	✓
Memory	✓	✓	✓					
Time management		✓	✓					✓
Public Speaking	✓	✓	✓	✓				✓
Self confidence	✓	✓	✓	✓	✓	✓	✓	✓
Self Direction	✓	✓	✓		✓	✓	✓	✓
Written Communication	✓	✓	✓		✓	✓	✓	✓

Disciplinary knowledge	✓	✓	✓		✓	✓	✓	✓
Ethics	✓	✓	✓	✓	✓	✓	✓	✓
Global awareness	✓	✓	✓	✓	✓	✓		✓
Cross cultural skills		✓		✓				✓
Humanitarianism		✓				✓		✓
Civic responsibility	✓	✓	✓	✓	✓	✓	✓	✓

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