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Research Article

A Pedagogical Framework for Advanced Learners during COVID-19 for Engineering Students

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The COVID-19 pandemic has raised unprecedented challenges for the progressive education community universally. One crucial challenge is the engagement of advanced learners in pandemic times. Their academic interest is retained, their performance does not decline, and they get access to appropriate resources in time. This article will elaborate on the identification mechanism and the categorization of the students grounded on their comforts and performance. The pedagogical framework is developed for advanced learners by focused interventions such as providing exposure to industry-oriented problems, international virtual events, online courses and software, career counseling by industry leaders, and preparation for higher education. In this article, we are discussing obligatory interventions and their outcomes. Adopting blended learning is becoming a boon to learners by effectively using online resources. Working with these advanced learners, the teacher can directly converse the precise space where the scholar needs the support. In this research, student-centric methods are used. A pedagogical framework is proposed for aerospace engineering students. Advanced learners are categorized into specializations based on real-time data analysis such as aerodynamics, propulsion, space technology, and avionics. Analysis suggests that the categorization and targeted pedagogical intervention yields better student performance outcomes. Based on this study, we started offering specialization-based courses at the undergraduate level in coming batches.

1. Introduction

COVID-19 brings many challenges to the life of human beings. Since January 2020, the impact of coronavirus has gradually risen and brought a challenge to society. It encounters rapid fall in the economy for all the countries globally. All the nations are struggling to work on the impact of pandemics. Due to the rise in the COVID-19 cases, all educational institutions have to close their face-to-face interactions. COVID-19 brings enormous challenges for all educational professionals [1]. It impacts the teaching and learning process globally. It made us adopt online teaching as a traditional way of learning. Because of this high anxiety and negativity, it was a great challenge for students to cope with the new methodology.

A traditional engineering education emphasizes content, craft, and design while developing critical thinking and problem-solving skills [2]. Active learning [3], flip classes, and project-based learning are common pedagogical approaches to improving engineering education. Over the past decade, online education has become a viable component of higher education in technical fields such as electrical and computer engineering, computer science, and information technology, especially at the graduate level [4]. While online education is not a new concept for educators, the COVID-19 pandemic has presented an unprecedented global need to explore online teaching/learning opportunities online at various educational and professional levels. More than 1.5 billion students worldwide (90.1% of all enrolled students) have been affected by the closure of educational institutions and subsequent changes in education due to COVID-19 [5]. The sudden closure of most educational institutions worldwide has forced the transition from full-time education

to entirely online (or blended) in a short transition period [6]. As a result, institutions that focus primarily on traditional face-to-face education face several challenges during this transition period [7]. Mitigating the impact of the pandemic on technical education, especially for vulnerable, disadvantaged, and skilled students, requires urgent, careful, and evidence-based planning, symptoms, and underemployment [8]. Additional efforts are needed to ensure that online engineering courses meet stringent program accreditation requirements, such as the NAAC (National Assessment and Accreditation Council) and NBA (National Board of Accreditation) in India. While the available literature on online technical education is, to our knowledge, a comprehensive analysis (quantitative and qualitative) of the issues and factors influencing the pandemic, online engineering education in universities mainly offers immediate pandemic face-to-face training. The Sloan Online Learning Consortium has identified five pillars of high-quality online education: learning effectiveness, student satisfaction, teacher satisfaction, accessibility, size, and cost [2]. Mobile learning identified various advancement types [9, 10]. It impacts both (teachers and students) the stakeholders in the education industry [11]. UPES is one of the most diverse universities in India in terms of race/ethnicity, gender, finance, and culture (for example, with a large percentage of students from different states). It helps organizations with similar demographic groups improve their online engineering education during and after the pandemic, especially for advanced learners.

Experiential Learning (EL) and Deep Learning (DL) tactics are primarily proposed and developed. The following are the most recently promoted and discussed in teaching technology [12].

Traditional face-to-face (f2f) publications supplemented with the virtual era and tools (e.g., PowerPoint or Prezi presentations, online tests, and quizzes). In practice, this method is very conservative, with a low degree of lively college students' dedication and nonconventional sports implementation for the duration of lectures and classes. Thai et al. [13] explained that blended learning includes online [14] and conventional getting-to-know environments, technology, and virtual media for getting-to-know content material delivery, considering numerous coaching and getting-to-know methods (each online and conventional).

In hybrid publications and blended learning, teacher and students combine exclusive online getting-to-know subjects and conventional publications, presenting a few digital periods and games accessed remotely via the student. That method allows the construction of many frameworks and systems for publications, with the excessive dedication to college students and lively mentoring positions of instructors and lecturers.

Flipped study room (FC) may be considered a type or a part of blended learning. Substances and technical contents are available for college students outside of the classroom via digital platforms, cloud sharing, and online Learning Management Systems (LMS) [15]. The study room conferences are planned instead of conventional lectures for brainstorming and problem-fixing discussions within the presence of the teacher/mentor.

With this in mind, we demonstrated the case study on aerospace engineering students. Identifying the advanced learner was the task of providing the proper intervention at this challenging time. Advanced learners are always the flag bearer of the institute. In engineering education, advanced learner identification is crucial. These industrial-oriented courses seem to have their direct importance in society. For the societal development of the country, we always need to work with this advanced learner

The term advanced learner in this article refers to the students that are involved in learning events faster than the other students in the course, achieve prodigious scores, and mark significant achievements in their life. They are more skilled with comprehension, retention, reminiscence, intellectual, creativity, and contextualization practices. These scholars can take up advanced level learning and academic tasks, and they can bring some new concepts and strategies and take leadership roles in the teaching-learning actions.

Engineering education requires practical expertise. Performance in the core subjects can help in the identification of advanced learners. Primarily when we cover the aspects of aerospace engineering, this stream requires diverse expertise per the industry requirements. In this article, our primary objectives are as follows:

(a) Identification of advanced learners.

(b) Providing the obligatory interventions required for advanced learners during COVID-19

(c) Accessing the outcomes of pedagogical interventions for aerospace engineering students

These pedagogical interventions are accessed for aerospace engineering students of the University of Petroleum and Energy Studies (UPES), Dehradun.

2. Significant Challenges with Advanced Learners

In any teaching, we tend to begin with what the students bring around the classroom: their level of ability and knowledge, skills and talents, deficits, learning styles, and interests. Advanced learners have several requirements. They can accelerate, so they will progress through the syllabus at their learning pace, which is considerably quicker than those at their grade level. They have a minimum of some inventive experiences to experiment, invent, and apply what they have learned. They have materials to work on their concepts and explore new lines of inquiry. Several conjointly want sensitive handling, as they might feel socially isolated due to their learning passion. Teachers cite numerous challenges to knowing and responding to the wants of advanced students. However, the subsequent are among the foremost common.

2.1. Time Spent on Testing. The high-stakes testing in several districts implies that teachers usually feel they cannot breathe a lot of till when administering the tests. Since advanced learners typically attain higher scores, they appear at an advantage over people who do not.

2.2. A Course of Study Restrictions. Academics add prescribed content with benchmarks already established for moving students through the curriculum. Most teachers are specialists at adjusting things as they go along. However, each teacher feels the pressure to bring students to the equivalent level of mastery altogether needed content areas. Hence, they enter successive grades with the abilities and information they want. This pressure usually restrains alternatives: artistic processes, freelance or small-group projects, and cluster groups.

2.3. Knowledge. Another challenge academics face is a lack of experience providing the quiet advanced students require. Providing opportunities for them to experience real challenges and advance at their ability level may be a matter of coming up with selections that yield much-accelerated learning, creative thinking, and interest-based comes. To some extent, several academics do this by identifying areas in their course of study where they can increase the number of problems for many advanced students..

2.4. Learners. Others prepare for college kids with specific talents to review an issue during a higher grade or find parents willing to figure out freelance study projects involving the curriculum with students.

2.5. Resources. The fabric and human resources are frequently lacking or appear to be so. High-ability learners would like completely different sorts and levels of the source to expand their imagination and hunger for knowledge. Human resources are equally important. Academics, parents, community members, artists, scientists, writers, and alternatives can give enrichment, project ideas, guidance, and sensible help in the classroom, benefiting advanced students.

2.6. Attitude. All students should learn, whoever they are, no matter their challenges or talents. Teachers who need to assist advanced students mostly face resistance from peers or directors due to a bias against advanced education. Advanced students spend plenty of time continuing what they have already learned or waiting for others to catch up, a state of affairs that may cause real hurt over time [3].

Many teachers can easily spot advanced learners through academic performance and test scores. One helpful way to expand our understanding of whom the advanced students are in our classrooms is to explore their thinking, learning, and behavior patterns in three broad categories.

Academically able children can absorb, synthesize, and analyze information quickly. They may be advanced readers with precise and detailed memories, able to digest new concepts quickly, comprehend meaning and application, and use logic and critical thinking in complex ways. Advanced intellectual ability also embraces a range of skills and thinking processes that some may consider less intellectual such as intuition, experimentation, instinct, or inspiration.

2.7. The High Degree of Creativity. Educators and parents have long seen creativity in their children. However, creative ability is difficult to measure. In schools that rely on standardized tests to identify advanced learners for special programs, the imaginative student with a quirky sense of humor may not qualify. Creative children apply logic to problems, explore solutions, and synthesize relevant information. The creative way they do all of these things is where they differ.

2.8. Heightened Sensibilities. When advanced students learn, they connect to the process profoundly, internally, absorbing the world through every pore [16]. Life provides them with multiple and complex sensations.

During this pandemic, advanced learners suffered due to a lack of unacquainted resources with online teaching, limited lab access, and negativity. So keeping their performance through various pedagogical interventions is the requirement of the present time.

3. Requirement of Pedagogical Intervention for Advanced Learners

The higher education sector requires the student to be skilled in the ever-changing industry requirements. The basic skill requirements are expertise in problem-solving, critical thinking, innovation, collaborative skills, digital literacy, and adaptability. We need to develop those skills by facilitating or enabling complex skills development in our teaching and learning pedagogy. This development requires additional mental and technical preparation from teachers and students. The COVID-19 lockdown announced in March 2020, with all its restrictions in f2f interactions [17], led to the need to transition to fully remote work with students in the learning process.

In contrast, it is possible to change the blended learning approach into the framework with online meetings and labs. Additionally, this condition was astonishing for both mentioned parties. At the same time, each was aware of the necessity to continue the courses and activities, especially the laboratory ones.

We keep the philosophy and the spirit of outcome-based education implemented by our university in the aerospace engineering program. The course curriculum for the program will remain the same as that approved by the Board of Studies (BoS) of the university and committees of the respective department and prescribed in the course booklets. Online classes and meetings are through UPES Learning Management Software "Blackboard."

Scheduled classes were conducted through virtual classrooms, and the students had to enter the virtual classrooms through their Blackboard IDs and passwords to attend the class. We had made provisions for recording all virtual sessions on Blackboard for future reference.

In order to minimize the impact on the predefined learning outcomes of a course due to the conversion of the actual classrooms to virtual classrooms, this action plan recommends having online discussions with the students

over Blackboard and focusing on take-home assignments and tutorial sheets a pedagogy. Students were provided with materials for observation, e.g., video recordings of activities in the identified field. This action plan was followed to minimize the impact on learning outcomes for all programs.

During this crisis, and in keeping with global trends, UPES has collaborated with "Coursera" to offer a unique learning experience for students. It is a valuable addition to the regular core courses to augment learning outcomes, equipping students with the right skill sets to enhance their career prospects. It is an excellent opportunity for the students to acquire new-age skills, enhance subject knowledge, and build personal branding. There are about 3800+ courses available with nearly 400 specializations. Upon completion of each course, students acquire verified, university-branded certificates. During the COVID-19, Coursera has launched a global effort to assist universities and colleges by providing additional 5000 licenses for an uninterrupted learning experience.

In 2006, UPES started one of the bachelor's courses in aerospace engineering. This domain covers the studies related to aviation technology and space technology. We surveyed the four specializations for aerospace engineering students: aerodynamics, propulsion, flight mechanics, and structures. We had taken a few initiatives for our advanced learners to provide the right interventions during this crisis. We are going to discuss all these interventions in detail further. All the data for this analysis are considered from IQAC (Internal Quality Assurance Cell) of UPES.

4. Best Practices for Advanced Learners

Higher education plays a vital role in nation-building. Higher education contributes to advancing civic conduct, nation-building, and social cohesion by transmitting democratic values and cultural norms. NAAC is the council in India that looks after teaching-learning requirements for various institutions. NAAC always motivates institutions to support their advanced learners by offering various scholarships, placements, lab support, etc. NAAC (https://naac.gov.in/docs) has suggested various best practices.

Choice-Based Credit System

To make higher education student-focused and promote academic excellence in student-centered areas, CBCS is a boon to students. It provides suitable flexibility in the selection of subjects for students. CBCS allows students to choose interdisciplinary, intradisciplinary courses and skill-oriented papers. We have adopted core courses, program elective courses, and ability enhancement courses. We have been following this system from 2016 onwards in our institution with the help of experts in various committees.

Curriculum for Experimental Learning

We have developed the curriculum to cater to allied industries' requirements. It brought horizontal mobility into practice and introduced job-oriented and skill-based courses. Interdisciplinary courses help students to widen their areas of learning. At our university, we have introduced skill courses to cater to the diverse need of the nation.

Curriculum to Cater to Diverse Needs

We have introduced the flagship projects for all the teachers and students. These flagship projects cater to a vast area of expertise, namely, flying cars, rural technologies, smart cities, and disaster management. It helps the student support the country in attaining its vision. It develops the research ability that helps them to achieve their life goals. Young minds can continuously innovate new things [18]. We support our students by providing various financial grants to pursue innovation [19].

Research: Integral Part of Curriculum

5. Methodology

5.1. Pedagogical Framework Development. We have developed the framework by characterizing the students' areas of interest. In aerospace engineering, four areas are more prominent: aerodynamics, propulsion, flight mechanics, and structures. We floated this request to all the students and collected their choices. We have provided the right interventions to them as per their choice. It was found that the performance of these students increased by 15% from the previous batch, even in COVID-19 pandemics [20]. This modified pedagogical framework is divided into five steps. We are going to analyze each of them further.

5.2. Identification. Identification of advanced learners was conducted in the following criteria.

5.2.1. Creativity in Aeromodelling. In our curriculum, the aeromodelling lab is introduced as a regular subject. Students prepare their aircraft models by applying the basic principles of aerodynamics, propulsion, flight mechanics, and structures. In this lab, it was observed that few students had shown their creativity in all the respective specializations. Few students have done the modification in wings by showing their creativity and interest in aerodynamics. Some students develop new concepts for aircraft engines that can carry more load. Many students modified their model's aircraft systems and controlled them efficiently and economically. Few of them identified the load distribution and strength of the aircraft efficiently. This Aeromodelling lab helped us identify these students in their respective areas of specialization, and we provided them with the proper intervention.

5.2.2. Performance in Core Subjects. The Aerospace Engineering Program is a four-year course segregated into eight semesters. In aerospace, we have four core specializations and subjects. In Table 1, we have shown the core subjects with their respective specialization. The performance of all the students in their respective subjects is identified.

Table 1: Semester-wise specialization for aerospace engineering.

Semester	Specializations			
	Aerodynamics	Propulsion	Flight mechanics	Structures
III	Fluid mechanics	Thermodynamics and heat transfer	Engineering mechanics	Strength of materials
V	Aerodynamics	Aircraft propulsion	Flight mechanics	Aircraft manufacturing and materials
VII	Supersonic aerodynamics	Gas dynamics	Aircraft systems and control	Aircraft structures
VIII	Hypersonic aerodynamics	Rocket propulsion	Orbital mechanics and space dynamics	Aeroelasticity/Aeroacoustics
	Major projects			

Students scoring 70% and above are considered advanced learners in their respective specializations. In this broad classification, each student has the equal opportunity to be an advanced learner and be provided with the proper intervention.

5.2.3. Major Projects. A faculty mentor was provided based on their performance in their respective specialization. Specialization of faculty mentor matches with mentee's interest. Both will plan for a project to help us identify their interest. They spend time with their faculty mentor in the domain discussion for a year of work in their respective specialization. These projects help an advanced learner participate in external events like competitions and conferences. These interventions are planned in virtual mode during this pandemic, and advanced learners are guided to avoid losing interest.

5.3. Student-Centered Classification. In engineering education, the student-centered approach is essential. We always have to conduct one-to-one interactions with our students. In these discussions, we will learn about their area of interest. Later, we need to provide the right interventions that improve their performance in life. In our university, recently, we have adopted for school for life. In this, all the students are prepared to face life's challenges and make the world beautiful for society. A student-centered approach helps students choose their specialization and perform best in the domain. Advanced learners are identified after they have chosen their area for their starting of graduation. Student clubs are where these ordinary students transform themselves into advanced learners. Students make these clubs, and they also felicitate various activities. In aerospace engineering, we have always offered the proper intervention based on student interest. We have two student technical clubs, Infinity Space Club and Aerospace Club. These clubs help students develop leadership and communication skills away from the class. Based on the identification mechanism mentioned above, Table 2 represents students' classification in the respective domain.

5.4. Design of Framework. We have followed the framework for each specialization in aerospace engineering. These pedagogical interventions by most faculties help the advanced learners grow in their respective domains. Pedagogical framework development for advanced learners is the present-day requirement. The following interventions were proposed for advanced learners.

5.4.1. Case Studies. Aerospace Engineering is the domain of engineering that evolves every day. In this volatile domain, it is mandatory to adopt the pedagogy of case studies in our teaching and learning practices. These case-based studies help advanced learners adopt the techniques that prepare them for industry and research jobs. We have adopted the industry-based problems in our classrooms.

We adopted the case base study for our Rocket Propulsion class [21]. It is a high-level core subject, and most advanced learners choose this subject in their final semester. We used our industrial experience with Vikram Sarabhai Space Centre (VSSC), ISRO, to frame the problem based on the propulsion systems of the satellite.

The response was overwhelming from most of the students during our f2f interactions before the pandemic. However, we were challenged to conduct a similar exercise during the pandemic. We modified our case using open-source software online. This time we had 25% more participants in the process. We will have positive results if we provide the right interventions during the pandemic. Later, few students have adopted similar case studies in their major projects [22, 23]. They virtually developed the thrust stand for testing the rockets in labs. This work got international recognition and was presented at various forums. COVID-19 does not affect the performance of our advanced learners, but it helps them explore more possibilities in open source.

Similarly, we have various case studies related to aerodynamics, propulsion, flight mechanics, and structures. Significant improvement is observed by adopting the case-based study, especially for the advanced learner. We have observed this while interacting with other teachers in the department.

5.4.2. Technical Competitions. Technical competitions are framed based on the problem statement of the industry or society. Advanced learners from aerospace engineering regularly participate in various technical competitions. SAE Aero Design Challenge, NASA Design Challenge, and UAS Challenge are a few in the domain. We participate in these events and regularly bring laurels to the university along

Table 2: Classification of advanced learners.

Batch	Total students	Identified advanced learners			
		Aerodynamics	Propulsion	Flight mechanics	Structures
2015–2019	100	20	15	10	15
2016–2020	120	15	20	10	20
2017–2021	100	15	15	15	15

The 2015–2019 batch is before the pandemic, and from the 2016–2020 batch onwards, we have a pandemic effect on our education sector. We had planned all identification and interventions in online mode.

with our students. These competitions help the student to build their design for the desired application. These challenges help them apply their engineering knowledge practically and complete the problem statement. While participating in these events, they learn various design software and concepts. Our Aeromodelling lab helps them to develop their aircraft model.

We want to share our student's experience, Ms. Ishika Jain, winner of the SAE Aero Design competition 2021. We are part of Team Aztec from the Department of Aerospace, who participated in the AeroTHON, Air Vehicle Design Contest, organized by SAE India. This time the competition was organized virtually because of a pandemic. In this competition, we have to design an aircraft that can carry a maximum load under a given constrain, so we have formed a team from all the specializations in our department. The contest started in April and ended in June 2021 and comprised two rounds. Students were given a problem statement for developing the aircraft that carried the maximum payload for one month in the preliminary round. They had to develop an innovative and original UAV design, satisfying all the design requirements. We are qualified for the final round and stood in the top 5 teams. The final round was successfully held in June problem statement was handed over and had to finish within 24 hours through a presentation. This competition taught us more about team building, working under pressure, and applying our technical specialization. During this pandemic, also we learned a lot and participated with full enthusiasm.

5.4.3. Job-Oriented Training. All the students at university need to go for industrial visits and industrial training during their summer break. We in the Department of Aerospace Engineering always focus on our advanced learners by providing them an internship in the organization that works in their specialization area. Our advanced learners from aerodynamics specialization joins industry like Airbus, National Aerospace Laboratory, Birla Institute of Technology (BIT), and Indian Air Force (IAF), to name a few. These organizations work on an industrial project related to aerodynamics with an additional mentor from university. Advanced learners emphasize propulsion, provided by companies like Axiom Research Labs, ISRO, and Rolls Royce. A similar pattern is followed for other specializations, and these advanced learners reach the proper organization from the 3rd year onwards. It helps the university showcase its best students to the industry, positively impacting our placement scenario.

5.4.4. Motivation and Guidance. Motivation is the fuel for students and teachers, which makes them feel excited during this pandemic. Motivation comes when we listen to or read about industry leaders. Each advanced learner has a mentor, but sometimes it is vital to know the skills and mindset required for the industry and research jobs. We used to conduct various invited lectures from industry leaders and wellness coaches. This pandemic brings a lot of anxiety and negativity to advanced learners. So, we have increased the intensity of these motivational and technical talks for our students. Along with this, we have a few international collaborations where our advanced learners pursue their research. It helps them to plan for higher studies and jobs overseas.

5.5. Applying Pedagogical Interventions. We applied this pedagogical framework to our students. The response is very promising for employability. In most of the top aerospace companies, we have our alumni working in good positions. We have analyzed the data from the National Institutional Ranking Framework (NIRF), the Ministry of Education (MoE), Government of India (GoI).

The strength of the department lies in our students and facilities. We used to guide them from 2nd year onwards for technical competitions and later they directly participate in these events at the international level. During this COVID-19 era, we won more technical challenges than f2f. Table 3 presents the interventions for technical competitions showing promising results.

We have arranged an online internship for all our students during this pandemic, mainly focusing on our advanced learners. We have provided them with a domain-specific organization where they can work on their specialization. Table 4 presents the data of recent years for all of our students.

Table 5 shows the continued increment in our students' guest lectures and other motivational activities. It shows that we have invited most of the prime leaders of the aerospace industry to motivate our students. During the pandemic, we have conducted master classes by these experts in our regular teaching sessions. These sessions help our advanced learners to pursue research in their respective verticals.

5.6. Accessing the Pedagogical Interventions. Advanced learners are the flag raiser of the institute. We have to plan and analyze the interventions that we took for them. The proper intervention increases their performance and employability. In Figure 1, it is clear that involving more

Table 3: Technical competitions.

Year	National/international completion	Club activities	Awards	No. of the students involved
2016	2	5	Team ASTRAL participated in the CanSAT-2016 award by NASA, Winner of the Singapore Space Challenge	16
2017	1	4	Team ASTRAL won the CanSAT-2017 award from NASA	17
2018	2	13	2nd position in SAE Aero Design Challenge, National Aerospace Conceptual Design Competition	25
2019	2	10	AIAA Engine Design Competition	28
2020	2	10	NASA Design & Build Challenge	30
2021	3	10	Winner of UAS Challenge 2021 VIRTUAL Award and SAE Aero Design	37

Table 4: Internship data.

Year	No. of organizations	Name of a few renowned organizations	No. of the students involved in the internship
2016	5	NAL, HAL, IAF	80
2017	7	Mahindra Aerospace, Axiom Labs	80
2018	8	ISRO, Genesor	100
2019	14	CII, BIT, IISc, DRDL	130
2020	15	Wingbotics, IAF	120
2021	18	Airbus, Rolls Royce	117

Table 5: Industry guest speakers.

Year	Industry expert lectures	Alumni talks	Renowned speaker/organization
2016	3	1	Director DRDO
2017	3	3	Member Niti Aayog
2018	1	1	ASL, DRDO
2019	2	7	CEO, Geneser Aerospace
2020	18	8	Scientist, NASA
2021	15	9	Chairman ISRO

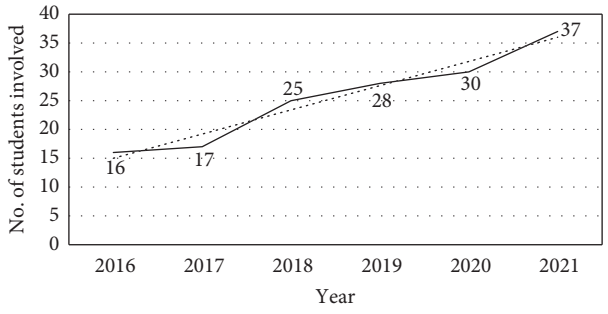

Figure 1: Impact of technical competition.

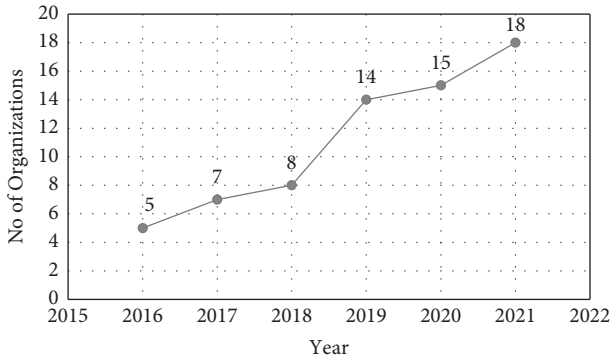

Figure 2: Analysis of industrial involvement.

students in technical competition brings more awards to advanced learners.

These competitions are organized regularly by various organizations like NASA and SAE. During the pandemic, our advanced learners in all specializations came together and participated in SAE Aero Design and UAS challenges. It helps them to develop their communication skills while presenting their concepts. These competitions prepare them to face challenges in the coming future. They bring laurels through their performance.

Team building and collaborative work help students advance in life. Tremendous possibilities help our advanced learners to work smartly even during the pandemic. Figure 2 suggests the continued improvement in the industrial involvement training for our students. Few of our advanced learners secured an internship in companies like Airbus during this pandemic. Receiving such a response from the big giant companies in this challenging time is excellent

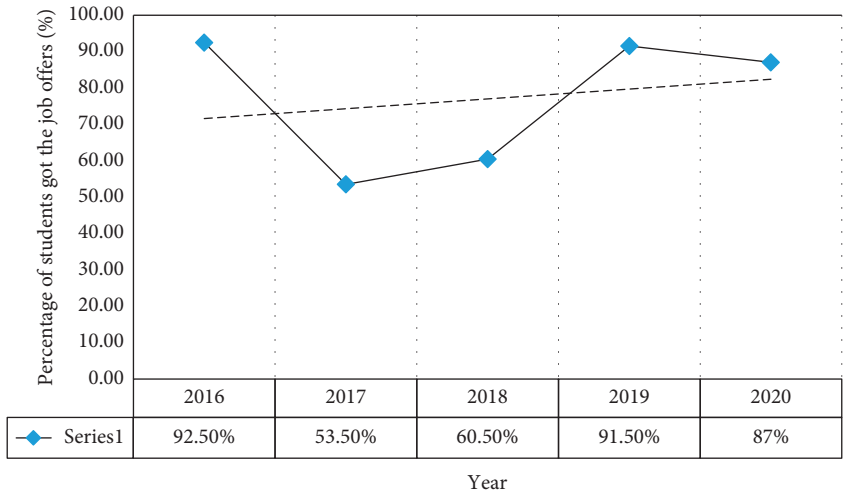

Figure 3: Placement scenario for advanced learners.

Table 6: Summary of pedagogical interventions concerning the academic year.

Batch (academic year)	Total No. of students	Percentage of advanced learners (%)
2015–2019	73	34
2016–2020	78	39
2017–2021	72	41
2018–2022	76	48

support for our students. It is possible only by providing the right interventions from the beginning of their course.

We analyzed the performance of prepandemic and during the pandemic of advanced learners. We found that our advanced learner participation and performance increased during a pandemic.

We used to prepare our advanced learners for industry requirements by getting exposure from various organizations during industrial visits and internships. A large number of companies visit our campus regularly and recruit our students. In Figure 3, consistent growth in the jobs is observed for our advanced learners. It is the outcome of our various interventions in the framework. During the pandemic, various companies conducted the online recruitment process, and we achieved the mark of 87% of our advanced learners receiving job offers. It suggests that consistently our right interventions were positively affecting their employability.

Authors may summarize the assessment of pedagogical interventions from Table 6. It is clear that providing job-oriented training, exposure to real-world technical issues, and bringing industry to the classroom transform more students into advanced learners. In this crucial challenging time of COVID-19, we have significantly increased the number of advanced learners.

6. Conclusion and Future Work

Engineering education requires various pedagogical implementations. In this article, we have emphasized the new framework for advanced learners. We have analyzed the interventions for aerospace engineering students and found that providing the right interventions to advanced learners improves performance even in a pandemic. Identifying the advanced learner based on specialization and performance helps provide the proper intervention. We followed a student-centered approach by involving students in technical competitions, internships, industrial visits, and projects. The framework discussed in this article for advanced learners provided around 90% employability during the pandemic. All the pedagogical changes we adopted during this pandemic improved employability for our advanced learners. Students receive a specialization-oriented job profile that helps them to grow further. This article justifies providing a specialization-based pedagogical approach to the advanced learner to make them more productive in their career. We accessed the impact of participation in technical competitions and industrial involvement during their engineering education. We propose the idea of a specialization-based approach in higher education. We had accessed the pedagogical interventions for a short duration during students' course of study in the institution.

With these pedagogical interventions, at the university, we started offering specialization to students from 1st year onwards to be a part of the advanced learner community. Critical analysis of suggested pedagogical interventions will be accessed in the coming years. Shortly, we will assess the long-term impact of our interventions on our advanced learners through the various survey.

6.1. Limitations. All the pedagogical interventions suggested in this article were confined to batches of the Aerospace Engineering Program from UPES. The article is restricted to the technical education system.

Data Availability

The data used to support the findings of the study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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