

Coding Club's Impact on Engineering Education

Ujwala Bhoga¹, Vishnu Murthy G², and Durga Bhavani A³

^{1,2,3}Department of Computer Science and Engineering, Anurag University, Hyderabad, Telangana, 500088

¹ujwalacse@anurag.edu.in, ²deancse@anurag.edu.in, ³durgabhavanicse@anurag.edu.in

Abstract — In today's world, technology is advancing really fast, so the integration of coding skills into engineering education has become essential. This paper explores the impact of coding clubs as an innovative pedagogical tool within the context of engineering education. These clubs bridge the gap between theoretical learning and practical application by providing students with an organized platform on which they can engage in hands-on coding experiences. This paper illustrates the benefits of engaging in coding clubs by doing an in-depth analysis of the events organized and conducting interviews with stakeholders. Some of the events held are code-it-out, face-it-out and codewars coding challenges. These activities demonstrate the benefits of coding clubs in engineering education. Some of the benefits highlighted in this paper include improved problem-solving abilities, increased inter-disciplinary collaboration, and enhanced career readiness. In this, we have presented participant testimonials and empirical proof to demonstrate that coding clubs should be a regular element of engineering courses, helping to produce a new generation of engineers who are fluent in the latest technologies and prepared for careers in the field of engineering.

Keywords— Coding Club; Engineering Education; Pedagogical Tool

JEET Category—Practice

I. INTRODUCTION

Coding clubs are a supplement to standard teaching methods, and its purpose is to develop coding culture in the students. Furthermore, the club has the objective of enhancing the students' problem-solving skills, which will be of great assistance to them during the placements in reputed industries. Coding is a difficult activity, particularly for those who are just starting out in the field of programming. In order to be successful in this endeavor, it is necessary to possess certain cognitive abilities (Kappelman et al., 2016; Rajaravivarma, 2005; Giordano and Maiorana, 2014). (Psycharis and Kallia 2017) (Chao 2016). The research reveals that students who have superior cognitive abilities outperform better in solving the difficulties to find the solutions to the real-world problems, and that knowing how to programme enhances students' coding skills (Guzin, Akar, and Altun 2017) (Trumbull and Lash 2013). This is despite the fact that the outcomes of the research differ. Building the logic and putting the code into action is a challenge for the majority of

students who are just starting out in programming classes. In addition, students who aren't good at solving problems find it hard to use key programming ideas (Koulouri, Lauria, and Macredie 2014). Our contribution is unique in that it emphasizes self-directed learning while focusing on enhancing the problem-solving abilities of the students.

The objective of coding clubs is to provide students with a specialized group that brings them together for the purpose of learning and practicing programming skills. In order to help bridge the gap between theoretical understanding and real implementation, these groups provide a controlled environment in which hands-on coding experiences can take place. Through the establishment of coding clubs within the context of engineering education, students are provided with a structured environment in which they can learn and practice coding skills if they choose to do so. In today's technologically advanced world, the importance of these skills is only going to grow.

The ability to code well is an absolute requirement in the profession of engineering for a number of compelling reasons, including the following:

A. Expanded Career Opportunities

The practice of coding provides individuals with diverse opportunities for professional advancement, encompassing several career trajectories such as software development, web development, data analysis, artificial intelligence, as well as emerging industries like cyber security and block-chain technology.

B. Problem Solving

Coding gives engineers the ability to handle difficult problems by dividing them into phases that are more manageable and then using programming to build solutions that are both efficient and effective.

C. Innovation and Entrepreneurship

Coding empowers students to create their own products, apps, or startups. This entrepreneurial spirit can lead to self-employment, freelancing, or even founding a tech company.

D. Automation

Coding is essential for designing and regulating automated systems, streamlining processes, and minimizing human intervention in a world of increasing automation.

E. Data Analysis

Coding skills are essential for processing, analyzing, and visualizing data in order to make informed decisions when engineers work with large datasets.

This paper was submitted for review on December 05, 2023. It was accepted on December 15, 2023.

Ujwala Bhoga, Department of Computer Science and Engineering, Anurag University, Telangana, India.

Venkatapur, Ghatkesar, Medchal-Malkajgiri district, Hyderabad, Telangana, India. 500088(ujwalacse@anurag.edu.in)

Copyright © 2023 JEET.

F. Simulation and Modeling

Coding enables engineers to generate simulations and models that replicate real-world scenarios, thereby facilitating testing, optimization, and the creation of innovative solutions.

G. Interdisciplinary Collaboration

Coding acts as a common language that facilitates collaboration among engineers from diverse backgrounds, enabling them to work together effectively on multidisciplinary projects.

H. Adaptability

In a constantly changing technological environment, engineers with coding skills can quickly adapt to new tools, languages, and platforms, ensuring their continued relevance and versatility.

In a nutshell, students who are looking for employment prospects in today's technology-driven work market should consider acquiring coding abilities, as they have become an essential asset. Not only do they improve employability, but they also provide access to a wide variety of job opportunities and the possibility of long-term success and expansion in a variety of fields. In addition, the ability to code is essential for modern engineering since it enables engineers to discover solutions to difficult issues, automate processes, analyze data, create simulations, and propel creativity. It is necessary for engineers to possess skills such as these in order for them to be effective and to compete in the technological landscape of today, which is constantly growing. These abilities are not merely useful; rather, they are absolutely necessary.

II. DESCRIPTION

In today's rapidly changing environment, programming skills are essential tools that can be utilized and incorporated into various fields and domains. Hence, it becomes absolutely essential to equip young minds with such skills. In order to meet the aforementioned goals, we have started a coding club at our organization, called "APJ Abdul Kalam Hacker's Academy," in the year 2021 to help students learn and improve their coding skills so they can excel in coding competitions with the aid of well-known coding platforms. The primary objective of the club is to introduce students to the world of coding through the completion of challenging activities. Students who take part in these activities gain valuable insight into the types of skill sets they should develop if they want to succeed in the programming industry, which in turn benefits their placements. The employment of students is the short-term objective of the coding club, while progressing towards product-based firms with greater packages is the long-term objective, which increases the employability skills of students further. The url of the APJ Hacker's Academy club is <https://apjhackersacademy.anuragweb.club/>. The screenshot of the club website is depicted in the Fig.1.

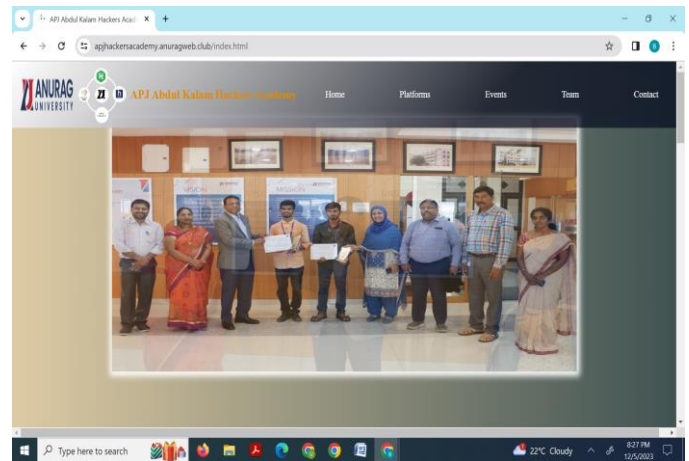


Fig.1. APJ Abdul Kalam Hacker's Academy Website

To organize coding competitions/events under the club the following four popular coding platforms are used:

A. Codechef

It is established to support programmer success in algorithms, computer programming, and contests. It conducts three monthly challenges (Long Challenge, CookOff, LunchTime & Starters) and rewards victors with prizes and treats. In addition, the platform allows the programming community, including academic institutions and student groups, to hold contests.

B. HackeRank

It is a technology hiring platform that is the standard for assessing developer skills for over 3,000+ companies around the world. It is a coding platform which not just focuses on giving challenges, but it also focuses on preparing students for the challenges through the tutorials that they provide in the platform.

C. HackerEarth

It is an online technical-recruitment tool that enables you to create tests and evaluate candidates. It saves the time taken to go through hundreds of resumes by automating the process thus helping you to filter the candidates quickly. Currently, more than 750 customers worldwide use technical coding assessments platform, including Amazon, HP, VMware, Wipro, Intel etc.

D. Topcoder

It is an international coding platform with a bit higher level than the other three. It is gig work which means students can work there as freelancers in a company in the format of internships which are often paid. Topcoder contains communities and blogs where students can discuss about the difficulties and situations that they have faced while they are solving a problem in Topcoder. It is not just a platform it is a community of various fields. Students can code while discussing it with all the others in the community who are in the process of solving.

For organizing the events under the APJ Hacker's Academy club we have the following student teams:

1. **Problem Designing Team:** This team prepares the excellent problems/questions that participants might come across when attending club events. We assess the participants programming knowledge with the help of these questions.
2. **Community Approach team:** This team represents the club and advertises the club events to all the college students. Community approach team creates attractive and thought-provoking posters.
3. **Organizing Team:** This team supervises the club's internal activities and assigns it to the other teams. Members of this team coordinate with other teams of the club and organize events/activities.
4. **Platform Leads & President:** In addition to the teams that have been listed above, every coding platform also has a lead, and there is president of the club is the lead for all the teams.

In addition to student teams, there is a faculty coordinator who is responsible for guiding the teams and serving as a mentor.

APJ Hacker's Academy has organized many events. List of events organized so far by the club are listed in the below table 1.

TABLE I
LIST OF EVENTS ORGANIZED

Sl.No	Name of the Event	Date
1	Orientation	18th - 20th Apr, 2021
2	VTITOR 1	17th - 20th Jul, 2021
3	VTITOR 2	27th - 28th Dec, 2021
4	Code-Hunt	22nd Apr, 2022
5	Tech-C	3rd Sep, 2022
6	Code-it-Out	23rd - 24th Sep, 2022
7	NULL 2.O	2nd -12th Nov, 2022
8	NULL 3.O	19th -29th Nov, 2022
9	Face-it-Out	9th Mar, 2023
10	CodeWars	16th Jun, 2023

1. **Orientation:** The first-year students had participated actively in the orientation of the club. The students showed great interest in knowing about the APJ Abdul Kalam's Hackers Academy club and the various coding platforms it promotes. The team had planned to help them assess their current coding knowledge by projecting the problems on the screen. The students seemed enthusiastic and answered the questions to the best of their ability. The team finally revealed the answers and explained the logic behind each of the solutions. The platforms were explained in detail as well, and the unique features of each of the platforms were informed. Explained how they got started with the club and how these platforms helped them become better coders. They explained the significance of certifications and rankings on these platforms, as well as how they help in placements and the development of coding abilities.
2. **VTITOR 1 & 2:** The competitions took place in 4 different coding platforms. It began with the student

being given two challenging problems to solve within an hour. The top 50 participants were selected for the university level round. The shortlisted participants were divided into teams. The university level round took place in 2 rounds.

Round 1: The students were given two low-to-medium difficulty challenges and could choose between Python and C as their language. Teams qualified for the second level if they met all requirements in the shortest amount of time.

Round 2: The challenges of level 2 were extremely complex. The winning team was the one that could provide accurate code and meet every test case in the shortest amount of time. Details on the event are as follows: (There are three members in each team.) 150 teams had registered for the event. The number of teams that were selected for Level 1 was forty. The total number of teams that were chosen and won in Level 2 is five.

3. **Code-Hunt:** The club hosted the Code Hunt event as part of the university technical fest. A code is offered as a hint in the level-based treasure hunt competition Code Hunt, and the participant's goal is to decipher the code. When they solve it, they receive a hint, which they must use to figure out how to get there. A brief coding competition was held among the top 15 teams who made it to the finals, and the winners and runners-up were determined by their performance. Details on the event are as follows: There are seventy-five teams that have registered. The number of teams that have been selected for the finals is fifteen.
4. **Tech-C:** On the occasion of the 50th anniversary of C language, A.P.J. Hackers Academy had planned to conduct an event to enhance the student's technical knowledge. In this event three sets of questions were distributed among the students and the winners decided based upon the time taken for each set to complete.
No of Participants: 300
5. **Code-it-Out:** The platform codechef was utilized in order to organize a coding competition that was open to all of the members of the university student body. Only the C programming language was used for the competition, which consisted of two levels. The contestants were presented with two different code problems during the first round. In the second round, the most outstanding performers were chosen. One challenge was presented to each participant in the second round, and the top five teams were chosen to be the champions of the competition. Details on the event are as follows: The total number of teams that have registered is 145. There were 75 teams that made it to the Level 1 shortlist. The total number of teams that were chosen and won in Level 2 is five.
6. **NULL 2.O & 3.O:** These were the coding practice sessions conducted in online mode using Codechef platform for improving the coding skills.
7. **Face-it-Out:** On the occasion of technical fest, we have conducted this event. This is a three-level Event where the participants were filtered out and the top 2 teams were declared as winners. Registered participants

received QR codes to scan at locations in the first round. Scan the code, retrieve the code snippet output, then discover another QR code at the next site. After verifying QR codes, the top 30 teams advanced to the next round. The first-round winners will receive a code and receive four human traits. Teams that generate their product will receive a QR code to scan and obtain a collage of 25 people. If they identify the proper figure, they will advance to the third round. Participants that passed the second round will be assigned two HackerRank issue statements, and the top two teams that solve them fastest will win the event face-it-out. Information regarding the event: Forty-five teams have registered for the event. The number of teams that were selected for Level 1 was twenty-one. A total of two teams were chosen as winners in the Level-2 competition.

8. Codewars: This was a two-level event organized using HackerRank platform, the participants were only the first year students. It was a 2 level event. In the first level, they had to solve 5 questions within 2.30 hrs duration which were based on C language. In the level-2, the shortlisted participants had to solve 3 questions within 2.00 hrs duration. Top 3 performers were selected as winners of the event. The specifics of the event are as follows: The total number of teams involved is 84. The number of teams that were selected for Level 1 was 35. Three teams were chosen as winners in Level 2, and they were all selected.

Figure 2, Figure 3, and Figure 4 provide glimpses of a few of the events that were organised by the APJ Abdul Kalam Hacker's Academy coding club.



Fig.2. Inauguration of Face-It-Out event



Fig.3. Participants of Code It Out event



Fig.4: Participants of CodeWars event

III. FINDINGS

It has been demonstrated that the influence of the coding events that were organized by the APJ Abdul Kalam Hacker's Academy was beneficial in enhancing the students' coding skills and problem-solving skills as interns, which ultimately assisted them in passing the technical rounds of employment interviews.

The coding challenges that were displayed by the APJ Abdul Kalam Hacker's Academy coding club in these events were extremely diverse. Individual tasks were the first step, and then they moved on to university-level rounds that were team-based and tested the participants' ability to collaborate on coding. A dynamic learning experience was provided to the students via the multi-round approach, which allowed them to advance based on their ability in coding.

A revolutionary treasure hunt-style competition was created at the Code Hunt event. This competition had coding challenges with a twist that was completely unique. In order to progress, participants had to decipher codes, which helped them develop their ability to solve problems and their creative side. It was further emphasized in the final coding competition how important it is to have both the capacity to think creatively and to be proficient in coding.

The testimonies offer a glimpse into the experiences, motives, and perceptions of the participants regarding the coding activities that were organized by our coding club. A few of the testimonies are included in the following paragraphs.

1. I'm delighted to be the part of the VITTOR coding competition conducted by our university. This competition helped us improve our coding skills even better. I find myself fortunate for participating in this coding competition. It helped us improve our logical thinking, time management and team work. All the questions in this competition were related to real – world scenarios. So, it was fun and great opportunity to solve.

-Sushma

2. Thank you for one of the best professional coding competition tech c. It was substantial, social, fun and inspiring. A great event for students who love to code.

-Rithwik Reddy

3. This was a good experience participating in the Code Hunt event. I personally learnt a lot from this coding competition.
– Cherishma

In summary, these coding events served as platforms for students to develop and showcase their coding skills, with each event offering a unique format and focus. From traditional coding competitions to innovative treasure hunts and practice sessions, these events collectively provided students with valuable opportunities to sharpen their coding abilities and foster a competitive spirit in a collaborative environment.

IV. RESULTS

According to the findings, the students who took part in the activities that were organized by the APJ Abdul Kalam Hacker's Academy coding club witnessed an improvement in their overall performance as a direct result of their involvement in the events. The research was carried out on sixty students who were in their second year of study. The purpose of the research was to determine whether or not the students were able to solve problems both before and after they took part in the coding sessions. Figure 5 presents a study of the students' performance in terms of attainment both before and after they participated in the coding events that were organized by the APJ Abdul Kalam Hacker's Academy.

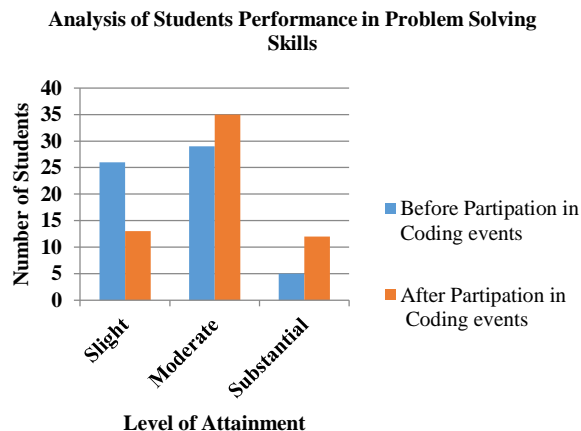


Fig.5. Analysis of students' performance in terms of attainment before and after participation in the coding events organized by APJ Abdul Kalam Hacker's Academy

Prior to taking part in the coding activities, 43.3, 48.4, and 8.3 percent of students had achieved slight, moderate, and substantial levels of proficiency. Following the coding events, 21.6, 58.3, and 20 percent of students achieved slight, moderate, and substantial levels of proficiency, respectively. It clearly demonstrates that the students' ability to solve problems has significantly improved.

The feedback we have gathered from the participants demonstrates that we have been successful in fostering a culture of coding throughout the university. Fig. 6, Fig. 7, and Fig. 8 include few examples of event feedback.

Does this code competition helped you to improve skills?

132 responses

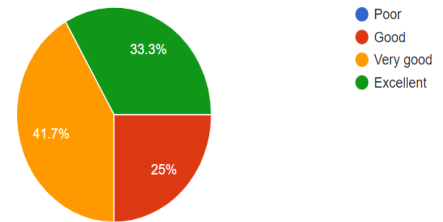


Fig.6. Feedback on improvement of coding skills

How do you rate Code wars Contest?

132 responses

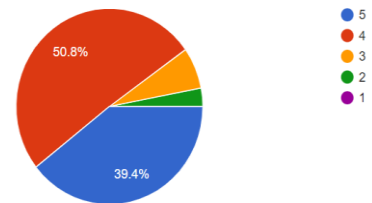


Fig.7. Feedback on CodeWars event rating

10.Do you participate in future code competitions?

39 responses

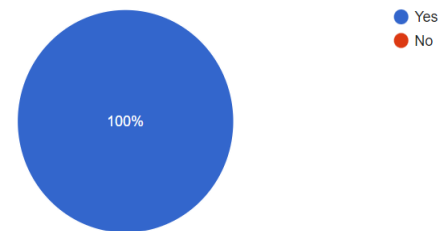


Fig.8. Feedback on participation in future coding events

The activities that involved coding not only helped the students become more proficient in coding, but they also contributed to the students' success in winning the hackathon prizes. This is demonstrated by the fact that our team, led by Akshay Reddy K, President of APJ Hacker's Academy, was awarded the Best Prototype Award at the VJIT National Level Hackathon (36 hours) for the prototype that included Alcohol Detection and Engine Auto Locking System with Accident Alert Notification along with GPS Location.



Fig.9. Akshay Reddy K team Won Best Prototype Award at VJIT National Level Hackathon

Every club member was placed in the package range of 7–11 LPA, while the others were placed in the range of 3-5 LPA. Furthermore, the club president, Akshay Reddy K, got placed in Darwinbox with 16.3 LPA package. Many students were placed at MNCs like as IBM, CtrlS, Cognizant, and many others.

V. DISCUSSION AND CONCLUSION

Within the context of the constantly shifting technological landscape, it may be concluded that coding clubs play a crucial role in shaping the future of students. These groups have shown to significantly facilitate the development of problem-solving abilities, the improvement of coding abilities, and the acquisition of crucial hands-on experience. The findings that were shared highlight the practical influence that involvement in coding clubs can have, ranging from enhanced skill sets to successful placements within the industry. Further confirmation of the positive impact that these groups have on both personal and professional development is provided by the testimonials and feedback provided by students.

Despite the fact that coding clubs have the potential to be extremely beneficial, there are also obstacles and limitations that need to be addressed. The following are some of the potential difficulties that are related to coding clubs:

- Maintaining interest and participation in coding clubs over the long term can be challenging, especially if resources are limited.
- Evaluating student progress and understanding in coding can be challenging, especially if there are no standardized assessments.
- There may not always be an organized way to do things at coding clubs, which could leave members with gaps in their basic knowledge.

Our goal is to give students the best and most inspiring experiences, so we constantly develop and innovate in the coding club. We hope to improve our coding club concept by methodically addressing these limitations in future work to help aspiring engineers develop technical skills and problem-solving capabilities.

ACKNOWLEDGMENT

We extend our heartfelt gratitude to our colleagues for their unwavering support throughout the journey of this research. Their constructive feedback, engaging discussions, and consistent moral support have been instrumental in shaping the course of this work. The constructive critiques offered by our colleagues played a crucial role in refining the ideas and improving the overall quality of this paper.

Lastly, I want to acknowledge the financial support received from management of Anurag University. This support has been pivotal in bringing this research to execution.

REFERENCES

Johnson, A., & Brown, L. (2019). The Impact of Coding Clubs on Students' Technical Proficiency. *Journal of Education in Technology*, 12(3), 45-56

- Kumar, Amruth. (2015). Solving Code-tracing Problems and its Effect on Code-writing Skills Pertaining to Program Semantics. 314-319.
- Kappelman, Leon, Mary C. Jones, Vess Johnson, Ephraim R. McLean, and Kittipong Boonme.(2016). Skills for Success at Different Stages of an IT Professional's Career. *Communications of the ACM*, 59(8), 64-70
- Smith, J. (2020). Coding Clubs: Fostering Technological Skills in Education. Academic Press.
- Giordano, Daniela, and Francesco Maiorana. 2014. Use of Cutting Edge Educational Tools for an Initial Programming Course. *In IEEE Global Engineering Education Conference*, EDUCON.
- Garcia, M., & Lee, K. (2018). Enhancing Problem-Solving Skills through Coding Clubs. *In Proceedings of the International Conference on Educational Technology Springer*. 123-134.
- Chao, Po Yao. (2016). Exploring Students' Computational Practice, Design and Performance of Problem-Solving through a Visual Programming Environment. *Computers and Education*, 95,202-215
- Guzin, Sacide, Mazman Akar, and Arif Altun.(2017). Individual Differences in Learning Computer Programming: A Social Cognitive Approach. *Contemporary Educational Technology*, 8(3), 195-213
- Trumbull, Elise, and Andrea Lash.(2013). Understanding Formative Assessment: Insights from Learning Theory and Measurement Theory. *San Francisco: WestEd: Improving Education through Research, Development and Service*
- OpenAI. (2021). Coding Club for Students: Fostering Technical Skills. *OpenAI Blog*.
- Rajaravivarma, Rathika.(2005). A Games-Based Approach for Teaching the Introductory Programming Course. *ACM SIGCSE Bulletin*, 37(4),98-102
- Sharma, Ritu, and Haifeng Shen.(2018). Does Education Culture Influence Factors in Learning Programming: A Comparative Study between Two Universities across Continents. *International Journal of Learning, Teaching and Educational Research*, 17(2),1-24
- Psycharis, Sarantos, and Maria Kallia.(2017). The Effects of Computer Programming on High School Students' Reasoning Skills and Mathematical Self-Efficacy and Problem Solving. *Instructional Science*, 45(5), 583-602
- Koulouri, Theodora, Stanislao Lauria, and Robert D. Macredie.(2014). Teaching Introductory Programming: A Quantitative Evaluation of Different Approaches. *ACM Transactions on Computing Education*, 14(4), 1-28