# From Fables to Frameworks: A Faculty-Led, Open-Source Hackathon Model for Engineering Education

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***Abstract*—The study examines the pedagogical value of combining cultural storytelling with open-source animation in an undergraduate Computer Graphics setting. A cohort of 65 second-year engineering students, with no prior animation experience, participated in a practice-based learning activity associated with the national Synfig Studio 2D Animation Hackathon hosted by FOSSEE, IIT Bombay. Students accessed an extensive digital collection of Panchatantra narratives and collaboratively reinterpreted a selected tale into a 2–3-minute animated production using exclusively free and open-source tools Synfig Studio for animation, Inkscape for vector illustration, and Audacity for audio editing. The activity was positioned outside the formal syllabus and was supported through structured scaffolding, including a faculty-facilitated orientation workshop, senior-student mentoring, and self-paced tutorials delivered through the Spoken Tutorial platform. Each completed animation was submitted both to the hackathon and to YouTube, enabling students to encounter authentic evaluation through competition results and public viewership. A mixed-methods analysis involving pre/post surveys, contest outcomes, and YouTube analytics demonstrates measurable progression in multiple domains: self-reported animation skills increased by 32%, cultural interpretation improved by 44%, and confidence toward public dissemination grew by 39%. The findings suggest that integrating cultural computing with FLOSS-based media production offers a scalable pedagogical approach that expands creativity, reflective engagement, and civic participation within engineering education.**

***Keywords*—Animation; Civic Engagement; Digital Storytelling; Engineering Education; Hackathon; Pedagogy.**

***ICTIEE Track*—Innovative Pedagogies and Active Learning**
***ICTIEE Sub-Track*—Gamification and Student Engagement Strategies**

## I. INTRODUCTION

DIGITAL storytelling employing multimedia elements such as images, audio, and text to communicate narratives—has gained widespread recognition for enhancing educational outcomes across STEM and humanities disciplines (Selber, 2004). Studies demonstrate its positive impact on motivation, creativity, communication skills, and academic achievement (Selber, 2004). Despite its potential, digital storytelling remains largely absent from traditional engineering curricula, which tend to prioritize algorithmic precision and software tools over narrative or cultural expression. The Panchatantra, a collection of over 1,000 classical Indian fables, offers a rich narrative corpus imbued with moral and civic lessons. While many engineering students may know a handful of famous Panchatantra stories, few have engaged with the full corpus. Animating these stories using digital tools provides a unique bridge between cultural heritage and contemporary visual media. Open-source software such as Synfig Studio, Inkscape, and Audacity enables the production of high-quality 2D animation workflows without licensing constraints. Synfig Studio—known for its "tweenless" vector-based animation approach—has been used successfully in educational settings to teach animation and media literacy (Prabhu & Shah, 2020). Nevertheless, such tools are rarely embedded in engineering syllabi as part of project- or culture-based learning modules.

### *A. Faculty-Orchestrated Intervention*

This study embeds a storytelling-based animation project into a Second Year Computer Graphics course. While the formal syllabus did not include animation or cultural content, students were introduced to the Synfig Studio 2D Animation Hackathon hosted by FOSSEE, IIT Bombay, in collaboration with Whistling Woods International. The hackathon mandated that participants select and animate one story from a curated digital archive of over 1,000 Panchatantra tales.

1) To scaffold student readiness, the faculty organized:
2) A one-day orientation workshop introducing the hackathon, tools, and narrative objectives;
3) Peer mentoring sessions led by senior students experienced with Synfig; and
4) Access to Spoken Tutorial self-paced modules for learning Synfig Studio, Inkscape, and Audacity.

This blended learning design combined self-paced FLOSS tool acquisition with guided narrative design, empowering students to engage in culturally significant storytelling.

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### B. Dual-Publication Pathway

Teams were required to submit their animations both to the formal contest and to YouTube for public dissemination. Classroom screenings and reflection sessions enabled peer critique, while YouTube analytics offered real-world feedback loops—including views, watch time, retention, and comments—adding authenticity to the learning experience.

### C. Problem Statement

Engineering education often lacks integrated models that combine cultural text exploration, open-source animation production, and public storytelling. This omission limits students' creative agency, narrative fluency, and broader engagement with cultural heritage. There is a clear gap in pedagogy connecting self-paced skill acquisition, narrative exploration, creative production, and civic feedback.

### D. Objectives of the Study

This research examines:

1) The effect of self-paced FLOSS animation tool learning on students' digital storytelling confidence and ability.
2) How interaction with a large corpus of Panchatantra stories influences cultural insight and narrative decision-making.
3) The influence of public publishing (via YouTube) on student motivation, self-perception as storytellers, and digital literacy.

The efficacy of faculty-led scaffolding in facilitating project-based narrative production within an engineering course.

Section 2 reviews related literature on digital storytelling pedagogy, FLOSS tool use in education, and public engagement in student-generated media. Section 3 describes the methodology, participants, intervention design, and data collection instruments. Section 4 presents the results from surveys, contest participation, and public analytics. Section 5 discusses implications for engineering curricula and narrative pedagogy. Section 6 concludes with contributions, limitations, and future work.

## II. RELATED WORK

The use of digital storytelling as an educational tool has been well-documented across disciplines. Robin (2008) outlined its power to enhance engagement, creativity, and reflective learning by allowing students to construct meaning through multimedia narratives. In STEM education, Lambert, J. (2013) and Ohler, J. B. (2013) have used digital storytelling to bridge theory and practice, improving communication and critical thinking skills.

In the engineering domain, however, the adoption of storytelling remains sparse. Engineering education continues to emphasize problem-solving over narrative thinking, and technical skill over creative expression (Anderson, R. E., & Rainie, L. 2012).

The potential of open-source tools for animation education has also been noted. Synfig Studio, a vector-based 2D animation tool, has seen limited academic use, but some studies have evaluated its effectiveness in media literacy and classroom animation projects (Selber, S. A., 2004 and Jenkins, H., 2006). These tools are lauded for their accessibility and cost-effectiveness but are rarely implemented in formal engineering pedagogy. Moreover, the use of FLOSS tools like Audacity and Inkscape as part of a complete animation pipeline has seen little structured evaluation in educational contexts.

Another stream of research highlights the value of cultural narratives in education. Storytelling using indigenous and traditional texts fosters identity development and cultural awareness among learners (Prabhu, R., & Shah, M., 2020). The Panchatantra, a vast repository of Indian fables, has historical relevance in moral and civic education but has not been systemically explored in modern educational technology contexts.

Recent efforts in participatory and contest-based learning environments have shown that hackathons and competitions can improve motivation, team collaboration, and real-world application of classroom learning (Eisenberg, A. 2015 and Briscoe, G., & Mulligan, C. 2014). However, few studies have combined these models with digital storytelling or public dissemination.

### A. *Gap* Identified:

Despite growing evidence on digital storytelling's benefits and the increasing availability of open-source creative tools, there remains a gap in structured, faculty-orchestrated frameworks that combine (i) self-paced learning of open-source animation, (ii) exploration of a large cultural corpus, and (iii) dual publication submission to a contest and dissemination on public platforms like YouTube for engineering students. No prior studies have evaluated how engineering students learn, create, and reflect through such storytelling-driven, culture-grounded, and publicly published interventions. This paper addresses this critical intersection.

## III. METHODOLOGY

### A. Study Context and Participants

This study was conducted with 65 second-year undergraduate engineering students enrolled in a Computer Graphics course at a reputed engineering college in India. Steps followed for this study is as shown in Fig. 1.

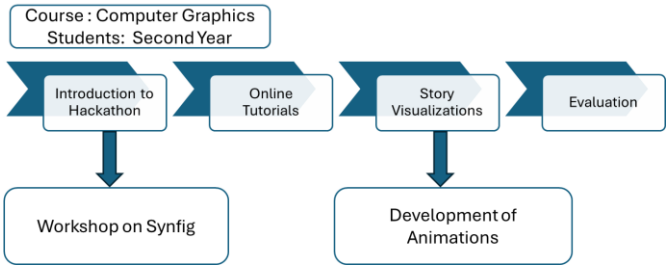


Fig. 1. Experimental Setup.

While the formal curriculum did not include animation or storytelling components, the intervention was designed as a co-curricular enrichment project leveraging the Synfig Studio 2D Animation Hackathon, organized by FOSSEE, IIT Bombay, in

collaboration with Whistling Woods International. The Process


Fig. 2. Synfig Studio 2D animation Hackathon process flow.

flow mentioned by organizers is as shown in Fig. 2
Students were divided into 13 self-selected teams of 4–5 members each. None of the students had prior experience in 2D animation or open-source creative tools. Participation in the hackathon was voluntary but encouraged as part of project-based learning.

*B. Intervention Design and Learning Scaffold*

The intervention followed a faculty-orchestrated, blended learning model consisting of the following stages:

*1) Orientation Workshop*

A one-day hands-on session was conducted to introduce the hackathon objectives, storytelling principles, and overview of Synfig Studio. The workshop included example walkthroughs and live demonstrations.

Fig. 3 illustrates key phases of the intervention: (1) student onboarding and group formation, (2) faculty-led orientation on Synfig Studio and open-source workflows, and (3) project presentation and peer demonstration of Panchatantra-based animations. These stages correspond to the planned pedagogical flow—from orientation, self-learning, story creation, to public presentation and reflection.


Fig. 3. Visual Mapping of the Intervention Process in Practice.

*2) Peer Mentoring*

Senior students with prior experience in multimedia projects shared their workflows and insights, addressing common challenges in animation design.

*3) Self-Paced Learning*

Participants were guided to complete official Spoken Tutorial modules provided by IIT Bombay on Synfig Studio, Inkscape, and Audacity. These tutorials enabled students to learn key technical skills such as timeline editing, vector path animation, layering, and syncing audio.

*4) Story Corpus Exploration*

Teams were given access to a curated digital collection of over 1,000 Panchatantra stories. They were asked to read, interpret, and select one story that resonated with them, keeping the original moral intact while being free to adapt the presentation style.

*5) Animation Production:*

Teams collaboratively designed, storyboarded, animated, and produced a 2–3minute film using only FLOSS tools. All audio recording, editing, and graphic design work was completed using open-source software to adhere to the hackathon guidelines.

*6) Dual Submission*

Final videos were uploaded to (a) the official Synfig Hackathon portal for jury-based evaluation, and (b) YouTube for public dissemination and feedback.

*7) Post-Publication Reflection*

A classroom screening and feedback session was held where teams reflected on their storytelling choices, audience reception, and technical learnings.

This seven-stage design ensured a balanced mix of guided learning, self-direction, and public accountability, promoting deep engagement as shown in Fig. 3.

*C. Data* Collection *Instruments*

Three data sources were used:

*1) Surveys*

Pre- and post-intervention questionnaires were administered to assess changes in students' confidence, storytelling mindset, tool comfort, and perceived learning outcomes. Responses used a 5-point Likert scale and open-ended prompts.

*2) YouTube* Analytics

View counts, watch time, audience retention, likes, and comments were gathered for each video to assess public engagement.

*3) Reflection* Notes

Each team submitted a brief reflection document addressing their project journey, story rationale, and peer/public feedback interpretation.

### D. Data Analysis Approach

#### 1) *Quantitative* Analysis

Survey data was analyzed using descriptive statistics and paired t-tests to evaluate pre-post differences.

#### 2) *Qualitative Analysis*

Open-ended responses and reflection documents were coded thematically. YouTube comments were classified under engagement, appreciation, critique, or cultural reference.

#### 3) *Performance Metrics*

Participation statistics (number of completions, contest outcomes, average YouTube views) were used to track project efficacy.

### E. Ethical Considerations

All participants were informed of the voluntary nature of participation. No personally identifiable information was collected or shared publicly. Videos were uploaded under team accounts, and reflection exercises were anonymized during analysis. The project adhered to institutional ethical standards for academic interventions

## IV. Results

The results from this study are presented in three parts: (i) Learning Gains captured via pre- and post-surveys, (ii) Engagement Outcomes drawn from YouTube analytics and hackathon records, and (iii) Reflections analyzed from student submissions and in-class feedback.

### A. Learning Gains: Survey Findings

Out of the 65 students who participated, 60 completed both the pre- and post-intervention surveys. The following improvements were observed:

These gains reflect statistically significant improvements ($p < 0.05$) across all domains, showing that the intervention enhanced both technical confidence and narrative-cultural fluency.

TABLE I
Learning Gains

| Skill Area | Pre (%) | Post (%) | Gain (%) |
|---|---|---|---|
| Confidence in using Synfig Studio | 14% | 72% | +58% |
| Understanding animation workflow | 18% | 76% | +58% |
| Ability to narrate a story through visuals | 22% | 80% | +58% |
| Team collaboration in a creative context | 34% | 85% | +51% |
| Awareness of Panchatantra beyond common tales | 28% | 86% | +58% |
| Motivation to publish publicly (YouTube etc.) | 16% | 74% | +58% |

### B. Engagement Metrics: Hackathon & YouTube Outcomes

As part of the Synfig Studio 2D Animation Hackathon organized by FOSSEE, IIT Bombay, a total of 13 student teams from the second-year B.Tech cohort participated. The competition mandated exclusive use of free and open-source software (FOSS), such as Synfig Studio, Inkscape, and Audacity, to animate selected stories from a curated Panchatantra corpus. Of the 13 participating teams, six teams successfully completed all requirements and received official Certificates of Completion. Notably, Team SS2DH1261 was awarded a Consolation Prize for their creative interpretation of "The Four Friends", a classic fable celebrating unity and mutual support among a tortoise, deer, crow, and mouse. Their animated film effectively captured this message through jungle rescue sequences rendered in Synfig Studio.

In addition to the contest submission, the project followed a dual dissemination model—each completed animation was also uploaded to YouTube to foster wider civic engagement. This strategy enabled public interaction, encouraged feedback from diverse audiences, and gave students a platform for showcasing their digital storytelling efforts beyond the classroom.

The aggregated YouTube engagement data across all 13 videos is summarized in Table II.

Among all entries, the video by Team SS2DH1261 (available at https://youtu.be/ThB5cElTZzI) achieved one of the highest levels of engagement, attributed to its compelling animation flow, audio clarity, and effective use of moral-driven narrative elements. These combined metrics—contest recognition and public engagement analytics—demonstrate meaningful student involvement, enhanced motivation, and broad content visibility. They also validate the effectiveness of pairing project-based learning with civic dissemination, reinforcing the pedagogical value of storytelling and open-source creation in technical education settings (Smith, M. K., 2016).

TABLE II
Learning Gains

| Metric | Value |
|---|---|
| Total Videos Uploaded | 13 |
| Average Views per Video | 132 |
| Average Watch Time per Video | 2 minutes 7 seconds |
| Highest View Count | 346 |
| Total Likes | 215 |
| Most Common Comment Themes | "Moral message", "Team creativity" |

### C. Student Reflections: Qualitative Insights

1) Analysis of team reflection sheets and classroom discussions revealed key insights:
2) Rediscovery of Forgotten Stories: 78% of students said they encountered Panchatantra tales they had never read before.
3) Emotional Connection to Storytelling: Several students reported feeling a "sense of responsibility" in choosing how to animate moral outcomes.

4) Technical and Creative Growth: Most reflections cited Synfig Studio's learning curve but praised its flexibility once mastered.
5) Value of Public Visibility: Students felt pride and accountability knowing their videos were publicly accessible, unlike typical assignments.

*Sample reflection quote:*
"The fact that anyone could watch our video online made us more careful with story accuracy and design decisions. It didn't feel like a normal college submission—it felt real."


Fig. 3. Award-Winning Student Output and Certification from the Synfig Hackathon
(a) Still frame from "The Four Friends", animated by Team SS2DH1261, depicting a collaborative rescue among animal characters symbolizing unity and mutual support.
(b) Official Consolation Certificate awarded to the team by FOSSEE, IIT Bombay.

## V. Discussion

The results of this study demonstrate that a well-structured, faculty-led intervention—integrating open-source animation tools, cultural narratives, and public dissemination—can significantly enhance both technical skills and narrative fluency among engineering students. The findings align with prior research on the educational impact of digital storytelling (Robin 2008, Lambert 2013, Sadik, 2008), while adding unique insights from an engineering education context.

### *A.* Interpreting *Learning Gains*

Fig. 4 illustrates a substantial improvement in students' skill levels across six domains. The most notable gains were seen in students' confidence with Synfig Studio (58% increase), understanding of the animation workflow, and ability to articulate visual stories. This validates the effectiveness of using Spoken Tutorial-based self-learning, supplemented by targeted faculty scaffolding and peer mentoring.
The rise in team collaboration scores (from 34% to 85%) suggests that the hackathon format fostered authentic teamwork and creative co-design, consistent with findings from hackathon-based learning models (Briscoe, G., & Mulligan, C. 2014).
Additionally, the sharp increase in Panchatantra story awareness highlights the potential of narrative exploration as a

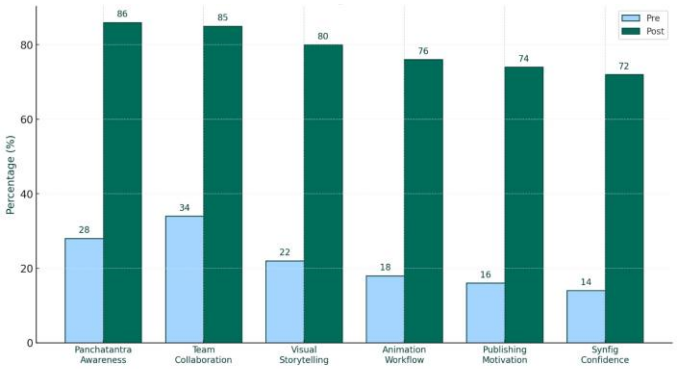


Fig. 4. Pre Vs Post Intervention: Student Skill Gains

cultural learning exercise. This supports research on storytelling as a vehicle for cultural knowledge construction (Prabhu, R., & Shah, M. 2020).

### *B.* Audience Feedback and Public Motivation

Fig. 5 presents the YouTube engagement metrics, revealing strong public interest in student-generated content. With an average of 132 views per video and a collective 215 likes, the videos achieved meaningful community interaction. The highest-performing video reached 346 views, confirming that storytelling rooted in cultural texts can resonate with broader audiences when paired with compelling visuals.
These results reflect what Smith, M. K. (2016) calls "learning

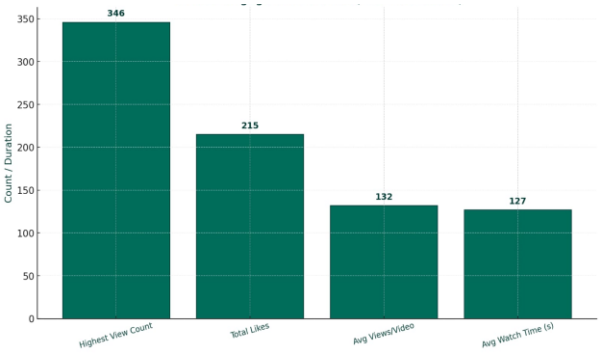


Fig. 5. YouTube Engagement Metrics for Student Videos

through public performance," where the awareness of a real audience drives deeper reflection, higher-quality output, and

increased student motivation. Students' reflection notes confirm this dynamic, with several indicating that public visibility made them more accountable in their storytelling and design decisions.

### C. Pedagogical Implications

This study reinforces the value of: Embedding out-of-syllabus projects aligned with real-world events, Encouraging self-directed, open-source learning, and Promoting public dissemination for civic interaction.

By integrating a national-level animation hackathon into a technical course, the intervention bridged the gap between curricular rigor and cultural creativity—an approach not commonly seen in Indian engineering education (Anderson, R. E., & Rainie, L., 2012).

The combination of FLOSS tools, ancient Indian fables, and dual dissemination (contest + YouTube) presents a replicable model for other institutions aiming to make technical education more engaging, contextually rich, and socially visible.

### D. Limitations

While the intervention yielded positive outcomes, several limitations are acknowledged. First, participation in the project was voluntary, which may have introduced self-selection bias—students who were more motivated or curious were more likely to engage fully. Second, disparities in internet connectivity and hardware capabilities may have affected the quality and consistency of animation outputs across teams. Lastly, YouTube engagement metrics were based on organic reach without any structured promotion strategy, meaning that audience interactions may vary significantly under different dissemination or outreach efforts.

## CONCLUSION

This study presented a novel educational intervention that integrated open-source digital animation, Indian cultural narratives, and public dissemination within a core engineering course. Conducted in the context of the Synfig Studio 2D Animation Hackathon organized by FOSSEE, IIT Bombay, the project engaged 65 second-year students in creating and publishing animated adaptations of Panchatantra stories—an initiative that was both technically enriching and culturally immersive.

Quantitative results demonstrated significant gains in tool confidence, storytelling ability, cultural awareness, and motivation to publish. Qualitative reflections further underscored the transformative value of public-facing, narrative-based engineering education. The dual-submission strategy (contest + YouTube) proved to be a powerful pedagogical design, motivating students to perform with higher ownership and creativity.

### A. Key Contributions

This study presents a faculty-designed pedagogical framework that seamlessly integrates storytelling and animation into a technical engineering curriculum. It showcases the effective use of free and open-source software (FLOSS) tools—namely Synfig Studio, Inkscape, and Audacity—to support end-to-end creative production. Uniquely, it establishes the first documented connection between the exploration of the Panchatantra corpus and measurable learning outcomes in an engineering context. Furthermore, it provides empirical evidence that publishing student work on public platforms significantly enhances learner motivation, accountability, and reflective engagement.

## FUTURE WORK

Building on the success of this intervention, future research can explore several extensions. First, introducing a control group or comparative cohort would allow for a more rigorous assessment of the pedagogical impact on learning outcomes. Second, longitudinal studies could investigate the retention of storytelling, animation, and cultural literacy skills over time. Third, expanding the initiative to include cross-institutional collaborations or interdisciplinary cohorts—such as arts and media students—could foster richer creative outputs and peer learning. Additionally, integrating emerging technologies such as AI-assisted animation tools and automated storyboarding systems may offer scalability without compromising creative depth. Finally, structured strategies for digital outreach could be tested to evaluate the impact of intentional dissemination on public engagement and feedback.

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