

Exploring the Impact of Using Resnik's 4P Framework in the Curriculum Development of an Engineering Communication Course

Brainerd Prince
Centre for Thinking, Language and
Communication
Plaksha University
Mohali, India
brainerd.prince@plaksha.edu.in

Mhonbeni E Humtsoe
Centre for Thinking, Language and
Communication
Plaksha University
Mohali, India
mhonbeni.humtsoe@plaksha.edu.in

Abstract—This research-to-practice full paper studies the different approaches to curriculum development in both Engineering and Humanities courses and explores how the role of having an integrated narrative structure in the Personal Communication course for undergraduates impacts student learning. The Personal Communication course offered to engineering students in the undergraduate program is part of the larger interdisciplinary initiative of a technology university to develop engineering graduates with a strong social presence and effective communication skills. This course has been taught using different pedagogies to two different batches of engineering students. For the control group (first batch, semester 4), the course was taught by focusing on various personal communication capacities and skills independent of each other. Each capacity, for example, empathy, was taken as an end in itself and skills required to acquire empathy were taught. Five capacities in all were taught (Intentionality, Relationality, Empathy, Articulation, and Composition). However, for the experiment group (second batch, semester 2) a new pedagogy was devised which was based on the premise that if these capacities are conceptually linked and cumulatively built through a narrative structure over the course then, engineers will be less apathetic to learning a non-technical communication course. Resnik's 4P framework was employed as the foundation for the curriculum development of the Personal Communication course. While Resnik's 4P framework has previously been utilized in the educational journey of K-12 students, its application within a university context has never been done. This research on our innovative curriculum design, inspired by Resnik's framework, argues that the narrative strength of Resnik's 4P framework offers an inherent coherence and internal rationality to the Personal Communication course. This, in turn, positively influences student learning outcomes, thus marking a pivotal advancement in the field of educational methodology. This study uses a between-subjects research design and gathers data from engineering students, by looking at their course performance. Additionally, it also uses a 5-point Likert Scale and a subjective questionnaire to assess student perception of course curriculum and its impact on teaching personal communication capacities.

Keywords—personal communication, narrative structure, Resnik's 4P framework, curriculum design

I. BACKGROUND

The question of how process-driven engineering approaches differ from the less structured temperament of humanities has been explored in various scholarly works. In engineering, the emphasis on processes is evident in the deliberate and systematic approach to innovation and problem-solving in creating a tangible product. This method is frequently distinguished by its methodical approach and strict adherence to rules and guidelines. Humanities, on the other hand, entails a wide range of disciplines, including literature, history, philosophy, art, and cultural studies, which are often characterized by their interpretative and subjective nature. Therefore, there is a huge difference between how the curricula of both engineering and humanities courses are designed. Furthermore, engineering students used to a methodical and process-driven approach in their courses find it difficult to access and engage with humanities courses that do not entail such a curriculum design. However, it is well established that in our contemporary world engineers need to gain knowledge in both these domains to contribute to holistic approaches to addressing contemporary issues. They require knowledge of both humanities and engineering, as most engineering problems are defined by the social context in which they originate. However, the design of humanities curricula remains a challenge especially if humanities courses must be taught to engineering students.

A. Curriculum in Engineering courses

Most engineering courses emphasize problem-solving and product building. The methods they learn in the coursework can be applied to creating a product or solving a problem, thus having an end goal. Courses such as 'Problem-Oriented Design', 'Guided Design', 'The Engineer and the General Environment', etc. [1] each of these focus on problem-solving while also creating meaning [2]. One notable model is 'A three-layer model' comprising of (a) The foundational Level: which consists of core subjects such as math and science, providing the groundwork for engineering knowledge, (b) the Middle Layer: bridges theory and practices and knowledge

associated with learning outcomes and (c) the top layer: which combines technical skills, ethical considerations, and practical-problem solving abilities [2].

The University of Massachusetts (UML) has also developed the 'Service Learning (SL)' model in many of its core courses over the past three years. Service Learning is a hands-on learning approach where Engineering students learn to tackle real-life community problems as a part of their coursework, 'students achieve academic objectives in a credit-bearing course by meeting real community challenges' [3][4]. In this type of curriculum, students are actively involved in their learning process, they learn by doing. Blending engineering theory with practical skills in creating a real product also enables them to learn how to work in teams and communicate efficiently. This approach also helps 'to impart skills and strategies associated with collaborative planning, executing, and monitoring of project progress. This educational model therefore attempts to reflect the realities in the corporate work environment' [3].

B. Curriculum in Humanities Courses

The overall approach in the humanities tends to be more open-ended and exploratory. While engineering is typically associated with structured processes and systematic problem-solving, the humanities offer alternative approaches that emphasize creativity, critical thinking, and humanistic perspectives. Scholars in the humanities often engage in critical inquiry, interpretation, and theoretical analysis, drawing on diverse sources and perspectives to generate insights and advance learning and understanding. Each book in a humanities course has its own integrity however, each book gains greater significance when read alongside the other, Kuhn writes, 'as the inquiry proceeds, it becomes evident that the works read relate to one another in their content, structure, and styles. No book itself is as significant as that book compared with and read with reference to another book' [5]. However, this approach doesn't land well in the engineering fraternity because it is difficult to delineate the course structure and map it onto their projects [6].

A study by Vampola et al (2010) reveals that some engineering students do not value the importance of writing and communication skills and they find it irrelevant to their studies. For instance, students say '*I wonder when we will get to the real work of engineering. I want us to stop all this grammar stuff. Another says, let us do more real learning. Another also says, the writing and speaking lectures is time wasting, I want to quickly get over this and start proper studies*' [7]. The question thus arises as to how can non-traditionally engineering courses be developed and their curriculum designed so that they are relevant to engineers. To prepare engineers for addressing sociotechnical problems engineers need to have a wide array of knowledge and skills, which necessitates their study of humanities courses. Engineering education must also encourage learners to value contextual aspects during problem-solving. However, the theoretically loaded curriculum with a

lack of process-driven structure makes the access of humanities courses challenging for engineering students.

C. Role of Narrative Structure

There has been a recent increase in interest amongst the educational research community in studying the basic way of knowing and teaching. Many theorists in the social sciences have come to recognize the value of having a narrative or story-like structure in enhancing students' learning [8]. Stories shape our understanding of the world and allow us to communicate this understanding to others, this narrative way of knowing is ingrained in human experience, "We create stories about ourselves that we communicate in various ways to our colleagues. This self-narrative enables us to construe who we are and where we are heading in our lives" [8]. Narrative structure is not just a way to tell a story, but it makes an event more comprehensible, we can make sense of individual occurrences by seeing how they fit into the bigger picture and how they influence each other [8]. Every individual possesses an internal library of story structures, called schemas, when we encounter a new situation or idea, our brains instinctively try to match it to a familiar schema, a process requiring skill and experience [9] also known as "narrative thinking", this helps us make sense of the world by filtering it through the lens of stories.

For Aristotle, all narratives have a beginning, middle, and end. In other words, 'narrative is not just a set of materials but is a quite specific method of organizing those materials. Narrative definition is ineluctably bound to plot, and the plot in question is always of a particular kind' [10]. Drawing inspiration from Paul Ricoeur who sees narrative as a fundamental tool for understanding human action, Polkinghorne writes that human beings exist in three realms - the material realm, the organic realm, and the realm of meaning [11]. The Material Realm or the physical world consists of tangible objects, matter, energy, and the law of physics, and scientists study this realm using empirical methods. The organic realm pertains to living organisms, it includes everything from single-celled to complex ecosystems, this realm deals with understanding life processes, evolution, and ecological dynamics. The realm of meaning involves our thoughts, emotions, values, and the significance we attach to experience. The understanding of the meaning realm is furnished by narratives (a story relating to a series of events), this is the focus of human science where narrative plays a crucial role in creating meaning, these series of events arranged in a specified order give a unified whole (story). This story is held together by a pattern called a plot with a beginning, a middle, and an end; all of these events come together to create meaning [11].

D. Narrative Theory in Curriculum Design

In education and curriculum designing, a new way of thinking and redesigning curriculum could be devised through a narrative approach as from a very young age, it is in human nature to interpret all aspects of the world that surrounds us [12]. Incorporating a narrative approach in curriculum

development could reshape the entire curriculum leading to a more fundamental change in the education system. A teacher's role goes beyond instructing the material and a curriculum goes beyond the content, it can be used as material to guide for pedagogical journey [12]. Few, however, have examined the broader curriculum mandates that might flow from a narrative perspective on teacher preparation. The argument here is that this perspective has far greater consequences for how teacher educators think about preparing teachers than current practice might suggest [12]. Despite curriculum documents being designed as a framework for a more narrative approach, many teachers still read these curriculum texts as rigid prescriptions imposed from outside and they often find these materials irrelevant. Teachers may find the pre-determined structures as 'vague, ambiguous, irrelevant, or meaningless, often choosing to ignore them completely' [13]. However, the pre-determined course content can be viewed as a story starter in which, 'their own and their students' lived curriculum stories come to life in context' [13]. 'As individuals learn to value their narrative knowledge constructed and reconstructed through experience' this will allow them to interpret curriculum documents as frameworks for creating engaging classroom narratives.

According to Dewey's concept of knowledge construction, 'learners construct and reconstruct knowledge through the individually continuous and socially interactive nature of experience' [13]. From a narrative perspective, the curriculum transforms into a living narrative through student and teacher interactions, they create a narrative of lived experience. The curriculum is therefore not just a set of pre-determined content, but it is shaped by the shared situation and relationships where every individual student actively builds on their narrative knowledge [13], 'plot outlines prescribed in curriculum documents shape classroom curriculum stories, individuals uniquely author these outlines within each classroom, according to personal and situational particulars' [13]. Each experience weaves characters (Students, teachers), setting (classroom activities), and plot (learning journey/coursework) into a unique narrative. By viewing curriculum as a story, narrative inquiry becomes a powerful tool to examine the real-life experience that shapes both teaching and learning. Recognizing curriculum as a course of study and curriculum as the construction and reconstruction of lived experience can complement each other in a more enriching educational experience for both teachers and students [13] [14].

E. Narrative in Engineering Education

According to David Nye, 'the meaning of a tool is inseparable from the stories that surround it' [15] and using narrative in engineering can enhance 'mastery of engineering knowledge' [16]. Using literary and figurative stories, case studies, and cautionary tales and exploring 'missing narratives' will enable an engineer to understand better the role of ethics and values in engineering designs and technological failures. This Narrative approach also improves learning interest, explores missing narratives (voices and stories that are silenced or excluded in a given narrative) [16], opens multidisciplinary

approaches by learning through questioning, and problem-solving' [16].

This study therefore looked at how narrative structure can be used to teach a communication course to undergraduate engineering students using Resnick's 4Ps as its framework and see its impact on students' perception of the course,

II. METHODOLOGY

A. Participants

A total of 199 engineering students (104 from the second semester and 95 from the fourth semester; 137 male, 62 female) of a technological university constituted the participants.

B. Personal Communication Course for Engineering Students

The Personal Communication course has been taught using different pedagogies to two different batches of engineering students. For the control group (first batch), the course was taught by focusing on various personal communication capacities and skills. Each capacity, e.g. empathy was taken as an end and skills required to acquire empathy were taught. Five capacities in all were taught (Intentionality, Relationality, Empathy, Articulation, and Composition), however for the experiment group (Second batch) a new pedagogy was devised which was based on the premise that if these capacities are conceptually linked and cumulatively built over the course then, the narrative-based structure of the course will result in positive outcomes.

C. Personal Communication Course (1st Batch, Sem 4)

In the first year, the Personal Communication courses were designed with a strong emphasis on philosophical theory and concepts from key texts of important thinkers such as Martin Buber (*I and Thou*) [17], Edmund Husserl (*Cartesian Meditations*) [18], Martin Heidegger (*Being and Time*) [19], etc. The course was taught using a combination of various teaching methods such as lectures for introducing key concepts, group discussions, Worksheets to revise various theories and skills taught, and hands-on activities (Campus-Based Learning Activities or CBEL) to give students an immersive experience. The course had four Modules, each with its own sub-skills and specific learning objectives and outcomes. The four capacities, Intentionality, Empathy, Articulation, and Composition were taught.

In the first capacity, intentionality, students were taught how to observe and listen carefully, while harbouring an unending curiosity that can be used to realize gaps that need to be bridged. This capacity can be developed to enable a human to function optimally and even extraordinarily, thus maximizing human potentiality. This capacity entails two moods or attributes. On the one hand, it receives the world as phenomena or appearance through the senses and yet primarily through sight (aboutness). This is the notion of 'aboutness'. The 'abouts' of the world that we capture and carry within us. On the other hand, the consciousness is directed to some particulars

that it has received (directedness) [20]. The second capacity empathy was taught to enable students to communicate with emotional intelligence, by inhabiting and walking in the shoes of others. This comes with a recognition that we humans never exist in isolation, even in apparent isolation, we are in dialogue with the world around us, the world that we inhabit, and the technology that supports our daily lives [11]. In the third capacity Articulation, the students were exposed to various circumstantial milieus within which speech acts are performed and then focused on the listening and performance of speech, or the ‘speech-act’ that involves both verbal and non-verbal cues. The last capacity Composition will enable students to understand different types/forms of the written word, that they can use to develop their own style through which they can communicate effectively in any social setting.

D. Personal Communication Course (2nd Batch, Sem 2)

For the second group of students, the same course has been redesigned following Resnick's 4Ps: Project, Passion, Peer, and Play. *Mitchel Resnick is an American Computer Scientist, LEGO Paper professor, and the head of the Media Lab's Lifelong Kindergarten research group.* The Core idea of the 4Ps according to Resnick is for young people to grow up as creative thinkers because in this fast-changing world, new ideas keep emerging and what they learned today may become obsolete tomorrow [21]. Hence, they must learn how to bring innovative solutions to all unexpected problems at any given time. This can happen only if one has the ability to think and act creatively, “Knowledge alone is not enough: they must learn how to use their knowledge creatively” [22]. This approach is also known as the 4Ps of creative learning [23]. Equally, what was further interesting to find was the narrative structure that entailed the 4Ps. In a broader sense, humans always find themselves in projects, for example, humans are born into the ‘family’ project, or as citizens participate in the ‘nation’ project. These could be lifelong projects, while other projects are for the short term and constructed either at school or work for a purpose. If we are to make all the projects, we are a part of, a success, then we need to not only develop a personal passion for it but also learn to work well with those who are part of the project team (peers) and optimize our time together so that our work becomes play. Thus, we found that the 4Ps – Project, Passion, Peers and Play had an internal narrative structure that could be used as a framework for developing a curriculum.

The personal communication course was redesigned for the second batch of students using Mitchel Resnick's ‘Lifelong Kindergarten’ or the 4Ps framework so that the engineering students could be trained to understand the value of relationships and effectively communicate in all their personal, professional and social projects. This course uses (the 4Ps) to structure the course, focusing on four sets of capacities, with their respective skills; empathy (setting up a collaborative *project* to empathetically solve a problem), intentionality (communicating their *passion* for the project using persuasive speech), relationality (forming trusting relationships with their project *peers*) and articulation (using effective dialogues and conversations so that work becomes *play*). The final outcome

of this course was for groups of students to do a successful project on which they worked together during the entire length of the course.

E. Projects

According to Seymour Papert, one of the pioneers of artificial intelligence and the co-inventor of Logo Programming Language, it was important for children to engage with problems in the context of meaningful projects. Seymour is of the view that learners should also be able to find their own questions and develop their own projects, not just solve them. In the Personal Communication course, the word ‘project’ is used in a broader and fundamental sense. Apart from school projects, it could include one's career, one's specific work assignment, one's family, one's social relationships, and one's entire life itself. The students were encouraged to work on world-building projects that closely align with their interests, something that they are passionate about. Resnick writes, (according to maker ethic) ‘the most valuable learning experiences come when you're actively engaged in designing, building, or creating something – when you're learning through making’ [21]. In this first stage, the students are required to share with their peers their autobiographical stories and a problem that is central to them. The goal was to understand each other's problems through empathetic listening and finally consensually, together, agree to formulate their group project around one of the shared problems.

F. Passion

According to Resnick ‘people will work longer and harder, and make deeper connections to ideas, when they're working on projects that they're passionate about’ [22]. They will be eager to immerse themselves in the project. For Resnick the best learning experience goes through alternating phases of ‘immersion and reflection’ and passion is the fuel that drives the immersive-reflection cycle. In the second stage of the course, each of the group members had to internalize the problem chosen by the group by exercising curiosity and asking for more information about the problem (as the problem would not have been their own) and then use persuasive speech to share with the group why they were interested (demonstrate passion) in solving that problem.

G. Peers

Learning flourishes as a social activity, with people sharing ideas, collaborating on projects, and building on one another's work. There are always people in the team who we didn't choose but need to optimally work with them in order to successfully collaborate on a project. To achieve this goal, the basic principles of relationality i.e., treating others as a “thou” rather than a “it” was introduced [17]. In this third stage, students are taught to form trusting relationships with their project peers and work collaboratively on the project they have chosen. Moreover, the group had to assign each team member, who were their peers, appropriate roles, functions, and responsibilities in the project to resolve the problem and build the solution. Resnick emphasizes learning with and from one

another, forming a relationship (relationality), and shifting from ‘think-it-yourself’ to ‘make-it-together’ as this is more aligned with the needs of society today [21].

H. Play

There are various kinds of play, but not all types of play are created equal. Resnick views play as an attitude of the mind and a way of engaging with the world [21]. Resnick encourages the kind of play that leads to creative learning. Learning involves playful experimentation – trying new things, tinkering with materials, testing boundaries, taking risks, and iterating again and again [21]. In this stage of the course, the students were encouraged to test the quality of their solutions through effective articulation, discussions, and dialogues of different natures [16]. This will result in both innovative solutions (to the problem) and long-lasting relationships.

I. Presentation

The fifth ‘P’ for ‘presentation’ was added to Resnick’s 4Ps as an innovation we developed in designing the course. Here the students had to together as a group showcase their project/creation which they had built over time in front of an audience. The presentation or performance was evaluated based on stage presence, voice and delivery, content, audio-visual aid, and audience engagement. Moreover, every member of the team had to participate in the presentation.

III. RESULTS

The following analyses show the effectiveness of having a narrative structure in teaching a communication course

A. Qualitative Analysis

The core idea of project-based learning is that real-world problems capture students’ interest and provoke serious thinking as the students acquire and apply the new knowledge in a problem-solving context. This paper attempts to analyze, if a humanities course, particularly a communication course is guided by a narrative structure or is done through a process-driven method, then would engineers appreciate it more, resulting in positive learning outcomes. A survey was conducted at the end of the course on (a) the impact of using Resnick’s 4Ps in building their project and (b) the Impact of the 5Ps framework in cultivating communication skills.

For the first theme, **students from the second batch expressed how having the 5Ps helps them in crafting their project by having an internal narrative structure in making the project**, for example, one student said, ‘*Yes, Resnik’s 4 Ps can be valuable in teaching personal communication capacities. The 5 Ps provide a structured framework, offering clarity on purpose, perspective, and storytelling elements. This aids in constructing a compelling narrative and project, fostering effective communication skills for students in personal communication courses*’, another student commented ‘*Yes, Resnik’s 4 Ps helped teach personal communication capacities. It provided structure for understanding communication dynamics and clarifying project outcomes. Incorporating the*

5th P, added depth to the narrative, and made the project inclusive and cohesion through diverse viewpoints.’

For the second theme, **students realized the importance of teamwork** as they had to work collaboratively on their project, in the process they also had to come to a consensus in choosing the problem and developing a strategy to solve the problem. As students come from various backgrounds, it was a challenge for them to work in a team while building relationships. Students commented on how they faced various challenges but managed to work it out as a team, in the process cultivating various communication skills. Some comments received from the students are:

- ‘*Yes, I feel they are very important, passion and empathy and peer reviews, all of them hold an importance in communication and they helped me a great deal.*’
- ‘*Personal communication is a crucial part of our project which requires active communication among the team members. The framework made me realize actively use empathy and a sense of respect when communicating.*’
- ‘*The 4P framework significantly aided in practicing personal communication skills throughout the project. It offered a systematic approach to consider the purpose, audience, message, and medium, ensuring clarity and effectiveness in communication. By following this structured framework, I was able to articulate ideas more effectively and tailor messages to specific audiences, enhancing overall communication proficiency.*’

From the study conducted and the response received from the students, it can be interpreted that having a narrative structure can help in cultivating not just engineering skills in building their project but also develop the interest to learn a non-traditional engineering subject. This project-based approach curriculum with an internal narrative structure proved to be an effective tool for engineering education.

B. Quantitative Analysis

Results for student performance in Personal Communication course

TABLE I: DESCRIPTIVES FOR ACTUAL STUDENTS’ PERFORMANCE

	Group	N	Mean	SD	SE
Marks Scored	Sem 2	104	84.274	5.431	0.533
	Sem 4	95	81.425	7.513	0.771
	t	df	p	Mean Difference	
Marks Scored	3.041	169.847	0.003	2.849	

Note. Welch’s t-test.

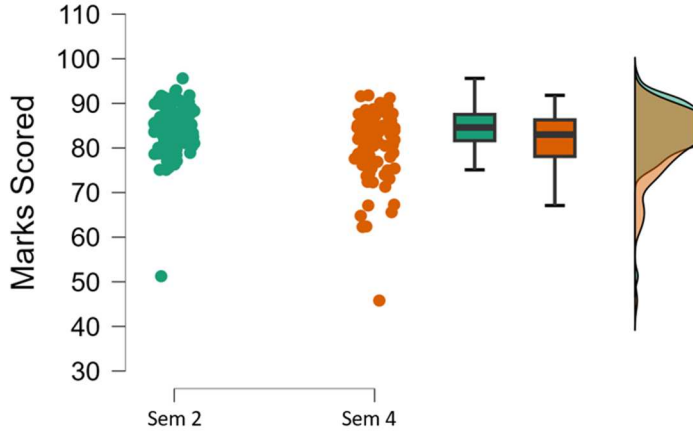


Fig. 1: Distribution of Students' Performance.

As demonstrated by Table 1 and Figure 1, an independent samples t-test was done to see the difference in actual performance scores for the experiment (Sem 2) and control trial (Sem 4). The results from the experiment trial ($M = 84.27$, $SD = 5.43$) and control trial ($M = 81.425$, $SD = 7.51$) indicate that there is a statistically significant difference in the actual performance scores between the two trials and students did better during experiment trial in comparison to the control trial $t = 3.041$, $p = .003$. The box-whisker plot also shows how the majority of students from batch 2 did well when the course's curriculum design had a narrative structure (Sem 2) compared to the performance of batch 1 (Sem 4) whose curriculum did not have a narrative structure.

Results for student perception on structural coherence of the course

TABLE II: DESCRIPTIVES FOR STUDENT PERCEPTION ON STRUCTURAL COHERENCE OF THE PERSONAL COMMUNICATION COURSE

	N	Mean	SD	SE	Coefficient of variation
Average Rating	104	3.720	0.625	0.061	0.168
T test					
			t	df	p
Average Rating			11.736	103	< .001

Note. For the Student t-test, the alternative hypothesis specifies that the mean is greater than 3.

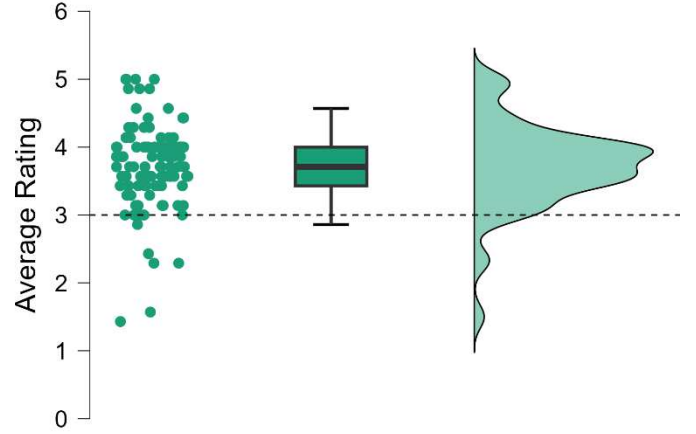


Fig. 2: Distribution of average student perception ratings on the structural coherence of the course

As demonstrated by Table 2 and Figure 2, a single sample t-test was done to see the difference in student perception ratings on the structural coherence provided by the 4P framework to the personal communication course. The results from the survey ($M = 3.7$, $SD = 0.62$) indicate that the student perception ratings on the structural coherence of the course were significantly better than the expected rating of 3 $t(103) = 11.73$, $p < .001$.

IV. DISCUSSION

This study focused on the significance of having a narrative structure in curriculum development using Resnick's 4P framework. The quantitative analysis using a single sample t-test showed that student ratings on course structure and coherence were significantly higher than the neutral rating of three as well as the student performance of the experiment group (batch 2) was significantly better than that of the control group (batch 1). This indicates that students found the course more accessible and were able to perform better when the course was designed using the narrative structure of Resnick's 4P framework. The literature also suggests that having an internal narrative structure is not just a way to tell a story, but it makes an event more comprehensible [23]. Therefore, by creating an internal narrative structure in the Personal Communication course using Resnick's 4Ps framework, the course became more comprehensible to the students and the engineering students who are used to process-driven and problem-solving courses found this humanities course more accessible.

The qualitative survey also suggests similar results. Students commented that having Resnick's 4Ps framework as a foundation of their course helped them to craft their projects more coherently while also enabling them to develop their teamwork abilities and cultivate communication skills as they worked on their projects in an integrative manner over the course of the semester. Previous studies have also shown that the curriculum with an integrated narrative structure could be the story starter and students could engage with each other in

deriving their own meaning [16]. As they worked together, they learned to communicate and strategically build on each other's ideas to complete the project.

The qualitative and quantitative responses we received to incorporating Resnick's 4Ps in designing the Personal Communication course indicate that the students significantly benefited in doing their projects as well as in cultivating various communication skills. The 4Ps – Projects, Peers, Passion, and Play gave a clear narrative structure to the curriculum of the course and students were able to easily build on their learning as they progressed from one stage to another in the course. Furthermore, adding the fifth P (Presentation/Performance) provided the students a platform to showcase their projects to the audience. Therefore, from the evidence we have acquired, we can conclude that incorporating Resnick's 4Ps framework in the course curriculum provides a coherent internal narrative resulting in a positive learning outcome.

REFERENCES

- [1] Knepler, H. "Engineering Education and the Humanities in America. Leonardo," (1973), 6(4), pp. 305–309. <https://doi.org/10.2307/1572846>
- [2] Grimson, W., Murphy, M, The Epistemological Basis of Engineering, and Its Reflection in the Modern Engineering Curriculum. 2015.
- [3] Humid A. Hadim' and Sven K. Esche, Enhancing the Engineering Curriculum Through Project-Based Learning 2"" ASEE/IEEE Frontiers in Education Conference Boston November 6 - 9,2002
- [4] Jonassen, David, Everyday Problem Solving in Engineering: Lessons for Engineering Educators
- [5] Kuhns, Richard, Humanities" as a Subject. The Journal of Aesthetic Education, Autumn, 1966, Vol. 1, No. 2 (Autumn, 1966), pp. 7-16
- [6] Duffy John, Linda Barrington, William Moeller, Service Learning Projects in Core Undergraduate Engineering Courses, International Journal for Service Learning in Engineering. Vol. 3, No. 2, pp. 18-41, Fall 2008
- [7] D. Vampola, K. Eichhorn, C. Thomson, F. Messere and R. Manseur, "Infused communication skills in an engineering curriculum," 2010 IEEE Frontiers in Education Conference (FIE), Arlington, VA, USA, 2010, pp. F1F-1-F1F-6, doi: 10.1109/FIE.2010.5673372.
- [8] Sigrun Gudmundsdottir J. Story-maker, story-teller: narrative structures in curriculum. Curriculum Studies, 1991, Vol. 23, No. 3, 207-218
- [9] Sarbin, T. Narrative Psychology: The Storied Nature of Human Conduct New York: Praeger Special Studies 1993 pp 111-113
- [10] Altman, Rick, A theory of narrative, Columbia University Press 2008, pp 5
- [11] Polkinghorne, Donald E, Narrative Knowing and the Human Sciences. Review by: Robert J. Richards American Journal of Sociology, Vol. 95, No. 1 (Jul., 1989), pp. 258-260 Published by: The University of Chicago Press Stable URL: <http://www.jstor.org/stable/2780451> . Accessed: 07/03/2014 09:27
- [12] Walter Doyle & Kathy Carter: Narrative and learning to teach: Implications for teacher-education curriculum, Journal of Curriculum Studies, 2003, 35:2, pp. 129-137
- [13] Dewey, John, Experience and Education. 1938
- [14] Olson, Margaret, Curriculum as a Multistoried Process Canadian Journal of Education / Revue canadienne de l'éducation , 2000, Vol. 25, No. 3 (2000), pp. 169-187 Canadian Society for the Study of Education
- [15] David E. Nye, Technology Matters, MIT Press, Cambridge, Massachusetts (2007) pp 8
- [16] Halada, Gary P, The Use of Narrative in Undergraduate Engineering Education ASEE conference Paper · June 2017 DOI: 10.18260/1-2--29018 <https://www.researchgate.net/publication/325072993>
- [17] Buber, Martin. I and Thou. Edinburgh: T and T Clark, 1923.
- [18] Husserl, Edmund. Cartesian Meditations. Hague: Martinus Nijhoff Publishers. 1982
- [19] Heidegger, Martin, Being and Time. Translated by John Macquarrie and Edward Robinson. Harper Collins.1962
- [20] Moran, Dermot. Introduction to Phenomenology. London: Routledge 2000 pp. 16-17
- [21] Resnick, Mitchel, Lifelong Kindergarten, Cultivating Creativity through Projects, Passion, Peers, and Play. MIT Press, Cambridge, Massachusetts, 2017
- [22] Resnick, Mitchel, "Give P's a Chance: Project, Peers, Passion, Play. Microsoft Word - Resnick-constructionism.docx (mit.edu)
- [23] Resnick, Mitchel. Projects, Passion, Peers and Play. Creating-Creators-final.pdf (mit.edu)