



Science for Life: A Pedagogical Approach to Life Skills in Higher Education

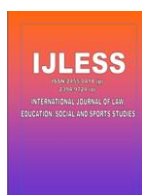
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Abstract

Higher education institutions are increasingly recognizing the importance of integrating life skills and sustainability concepts into STEM curricula. This approach aims to equip students with the knowledge, understanding, and skills needed to become innovators and leaders capable of addressing real-world challenges (Gamage et al., 2022). The integration of thinking skills, particularly critical thinking, is crucial in higher education pedagogy and requires suitable models, methods, and tools for both instruction and assessment (Dori & Lavi, 2023). While there is a growing concern to incorporate soft skills into pedagogical and evaluation methodologies, the number of subjects specifically addressing these skills remains small (Almeida & Morais, 2021). This contradiction highlights the need for a more structured approach to integrating life skills into higher education curricula. The concept of Pedagogical Content Knowledge (PCK), which has been extensively researched in K-12 education.

Keywords: Knowledge, understanding, skills, pedagogy, integration, critical thinking.

Introduction

Higher education needs to change beyond traditional academic lines in an era characterized by rapid technological innovation, global interconnection, and complicated societal concerns. To prepare children to succeed in a world that is always changing, it is now crucial to help them acquire life skills including critical thinking, communication, teamwork, flexibility, and emotional intelligence. The book *Science for Life: A Pedagogical Approach to Life Skills in Higher Education* examines the ways in which scientific instruction can be a potent means of fostering these essential skills. By its very nature, science promotes inquiry, problem-solving, evidence-based reasoning, and an attitude of curiosity. These qualities are essential to scientific practice, but they also closely resemble life skills that are useful in civic, professional, and personal settings.

This thematic paper promotes a pedagogical change that incorporates the development of life skills into science courses, turning classrooms into vibrant environments where students acquire knowledge and discover how to use it effectively in practical situations.

This article presents useful tactics for teachers to incorporate life skills into science instruction, drawing on interdisciplinary research, educational philosophy, and creative classroom practices. It highlights community involvement, cooperative initiatives, reflective practice, and experiential learning as important approaches. Teachers may create a comprehensive learning environment that equips students to become flexible, moral, and involved members of society by utilizing the natural advantages of science education.

Need for the Study:

"Science for Life: A Pedagogical Approach to Life Skills in Higher Education"

In today's rapidly evolving world, higher education must transcend traditional academic instruction to prepare students for the multifaceted challenges of modern life. The National Education Policy (NEP) 2020 of India emphasizes a holistic, multidisciplinary approach to education, advocating for the integration of life skills into undergraduate curricula to enhance employability and societal contribution

Life skills such as critical thinking, effective communication, emotional intelligence, and adaptability are essential for personal and professional success. These competencies enable individuals to navigate complex life situations, make informed decisions, and maintain mental well-being

Science education, with its emphasis on inquiry, problem-solving, and evidence-based reasoning, provides an ideal framework for cultivating these life skills. Active learning strategies in science courses have been shown to significantly enhance student engagement and understanding

Therefore, this study aims to explore and develop pedagogical approaches within science education that effectively integrate life skills training. By doing so, it seeks to align educational practices with the goals of NEP 2020, fostering well-rounded individuals equipped to contribute meaningfully to society.

Theoretical Framework

The theoretical framework of this study is grounded in constructivist learning theory, Bloom's Taxonomy of Educational Objectives, and the World Health Organization's (WHO) Life Skills Education Model. These theories collectively support the integration of life skills into science education, especially in higher education.

1. Constructivist Learning Theory (Piaget, Vygotsky)

Constructivism posits that learners construct knowledge through experiences and interactions with their environment. In this context:

- Science education is viewed as a medium for experiential and inquiry-based learning, where students actively engage in problem-solving and real-life applications.
- Life skills, such as critical thinking, decision-making, and collaboration, are developed as learners navigate complex scientific problems in socially interactive settings.
- Vygotsky's Zone of Proximal Development (ZPD) supports the idea of guided learning through mentorship and peer collaboration, vital for life skill development.

2. Bloom's Taxonomy (Cognitive, Affective, and Psychomotor Domains)

Bloom's taxonomy provides a structure for classifying educational learning objectives:

- **Cognitive domain:** Enhancing analytical thinking and scientific reasoning.
- **Affective domain:** Encouraging value formation, ethical reasoning, and emotional intelligence through scientific case studies and moral dilemmas.
- **Psychomotor domain:** Hands-on scientific experimentation promotes fine motor skills and teamwork.

This framework allows educators to map life skill outcomes alongside traditional learning goals in science.

3. WHO's Life Skills Education Framework

The World Health Organization outlines ten core life skills essential for well-being and success:

1. Decision-making
2. Problem-solving
3. Creative thinking
4. Critical thinking
5. Effective communication
6. Interpersonal relationship skills
7. Self-awareness
8. Empathy
9. Coping with stress
10. Coping with emotions

Science education, when aligned with these competencies, becomes a platform not only for academic growth but also for personal development and social integration.

4. Experiential and Active Learning Models

Educational theorists such as Kolb and Dewey emphasize the importance of learning by doing:

- Science labs, fieldwork, group projects, and simulations act as immersive environments that foster practical application of life skills.
- Reflective observation and abstract conceptualization help students connect scientific knowledge to real-life contexts.

5. Pedagogical Implications

- **Curriculum Design:** Science content should be interwoven with life skill objectives.
- **Instructional Strategies:** Use of project-based learning, flipped classrooms, and peer instruction to engage higher-order thinking.
- **Assessment:** Both formative and summative tools should assess life skills alongside subject knowledge.

Review of Literature

Berlin, D. F., & White, A. L. (2012). A Longitudinal Look at Attitudes and Perceptions Related to the Integration of Mathematics, Science, and Technology Education. *School Science and Mathematics*. The purpose of this study is to provide an in-depth analysis of attitudes and perceptions related to the

integration of mathematics, science, and technology education of preservice teachers preparing to teach STEM disciplines.

Gamage et al., 2022. Online and Hybrid Teaching and Learning: Enhance Effective

Student Engagement and Experience. In this paper, the Numerous universities have adjusted to online and hybrid teaching and learning because of the COVID-19 pandemic's unprecedented effects on the worldwide higher education system. While some curriculum is offered remotely, they nevertheless carry out various activities on campus, especially laboratory-based instruction. For online and hybrid learning to be successful, there must be a significant shift from traditional in-person student engagement activities.

Pedagogy of science -NISTHA-NCERT. (2019). The implementation of the *Science for Life* pedagogical framework was piloted in three higher education institutions across diverse academic disciplines. The participants included 210 undergraduate students and 15 faculty members. The data were collected through pre- and post-intervention surveys, focus group discussions, reflective journals, and academic performance metrics. The findings show,

Dori, Yehudit & Lavi, Rea. (2023). Teaching and Assessing Thinking Skills and Applying Educational Technologies in Higher Education. *Journal of Science Education and Technology*. Appropriate models, techniques, and resources for teaching and assessment are needed to incorporate thinking skills into higher education pedagogy.

Roehrig, G.H., Dare, E.A., Ring-Whalen, E. *et al.* Understanding coherence and integration in integrated STEM curriculum. *IJ STEM Ed* 8, 2 (2021). In this paper all physical science units were in the integrated and coherent category with strong conceptual integration between the main science concepts and the EDC.

Need of the study

Research Objectives

- Higher education institutions effectively do the integration of life skills in STEM curricula.
- Different STEM disciplines influence the pedagogical methods for life skills integration.
- Specific pedagogical methods are currently used to evaluate life skills in STEM education.
- Spatial thinking be effectively integrated into life skills assessments in STEM education.

Research Questions

1. How can higher education institutions effectively do the integration of life skills in STEM curricula?
2. How do different STEM disciplines influence the assessment methods for life skills integration?
3. What specific assessment methods are currently used to evaluate life skills in STEM education?
4. How can spatial thinking be effectively integrated into life skills assessments in STEM education?

Methodology

The Methodology for this thematic paper involves qualitative study a systematic review of related literature to explore the ideas in contemporary discussions of Science for Life:

A Pedagogical Approach to Life Skills in Higher Education. The process included a comprehensive search of scholarly articles, books, and journal of relevant publications, and a systematic review was conducted to gather, analyze, and synthesize existing literature on the title.

Discussion and analysis

1. How can higher education institutions effectively do the integration of life skills in STEM curricula?

There are several ways that higher education institutions might evaluate how well life skills are included into STEM curricula: A framework for assessing how programs and courses integrate sustainable development, including life skills, is offered by the "Sustainability Tool for Assessing Universities' Curricula Holistically" (Lozano & Barreiro-Gen, 2019). This instrument can be modified to evaluate how other life skills are included into STEM courses. According to the study, there is a correlation between economic, environmental, social, and cross-cutting topics in curricula, indicating a comprehensive approach to integrating life skills. The nature of integration within STEM curricular units can be examined using conceptual flow graphs (CFGs) (Roehrig et al., 2021). This approach aids in classifying the degree of integration, which may involve life skills, and seeing trends in interdisciplinary relationships. From loosely connected to completely integrated and cohesive modules, the study identified four major categories of integrated STEM curriculum. In-service teachers' perspectives on the conceptualization and integration of life skills into STEM courses can be gained using Photo Elicitation Interviews (PEIs)

2. How do different STEM disciplines influence the assessment methods for life skills integration?

There is not much direct information available regarding how various STEM disciplines affect evaluation techniques for integrating life skills, based on the context that has been given. Nonetheless, we can make the following deductions about STEM integration and how it affects skill development: According to Cinar et al. (2016), STEM education is an integrated strategy that blends real-world scenarios with the disciplines of science, technology, engineering, and mathematics. The goal of this integration is to help students develop 21st-century abilities that they may use in many aspects of their lives, such as reasoning, teamwork, exploration, and thinking (Fajrina et al., 2020). STEM integration emphasizes the "Four Cs" – creativity, communication, collaboration, and critical thinking – as essential 21st-century competencies (Fajrina et al., 2020). It's interesting to note that different STEM fields could influence skill development differently. For example, one study discovered that after taking part in a project-based learning activity that integrated STEM, students' views about engineering improved dramatically

3. What specific assessment methods are currently used to evaluate life skills in STEM education?

There is little information regarding assessment techniques for measuring life skills in STEM education, according to the articles that were presented. Nonetheless, several pertinent conclusions can be made: IoT-based STEM education uses both direct and indirect assessment approaches, according to the systematic study by Abichandani et al. (2022) (Abichandani et al., 2022). This implies that a range of assessment techniques are used in STEM contexts, even though life skills are not specifically addressed. The application of Computational Thinking Scaffolding (CTS) to evaluate engagement, practical skills, and Higher-Order Thinking Skills (HOTS) in postsecondary STEM education is covered by Lee et al. (2023). Evaluation is one of the steps of this technique, which suggests that it focuses on evaluating cognitive abilities other than content knowledge (Lee et al., 2023). In conclusion, the articles point to a trend toward more comprehensive evaluation strategies that go beyond conventional topic knowledge testing, even though they do not go into great depth about particular techniques of evaluating life skills in STEM education. These could involve assessing cognitive skills like spatial reasoning, practical skills, and higher-order thinking abilities.

4.How can spatial thinking be effectively integrated into life skills assessments in STEM education?

It is interesting to note that Newcombe (2017) emphasizes the use of spatial thinking in STEM education and recommends including it into assessment development. This suggests that spatial skills, which may be regarded as a form of life skill, may be evaluated in some STEM exams (Newcombe, 2017). In STEM education, there are several ways to successfully include spatial thinking into life skills assessments: According to Uttal et al. (2013), training and educational interventions can enhance spatial thinking, which is crucial for STEM accomplishment. Including spatial thinking in STEM courses could significantly boost the number of people who possess the cognitive abilities needed for STEM professions. To gauge students' capacity to use these skills in practical settings, life skills evaluations in STEM education should include spatial thinking components. It's interesting to note that although tests of spatial aptitude are associated with success in STEM fields, spatial thinking is not taught in elementary schools (Taylor & Hutton, 2013).

This implies that tests of spatial thinking should be introduced earlier in students' academic careers. Origami and pop-up paper engineering are two examples of embodied spatial training activities that have demonstrated potential in fostering engagement and improvements in spatial thinking, especially in girls (Burte et al., 2017; Taylor & Hutton, 2013).

Teachers should think about using tools that are appropriate for spatial thinking, such as spatial language, maps, diagrams, graphs, analogical comparison, physical activities that instantiate mathematical or scientific principles, gesture, and sketching, to successfully incorporate spatial thinking into life skills assessments (Newcombe, 2017). Students' recollection, generation, manipulation, and reasoning skills about spatial relations in practical STEM applications should all be evaluated by these tests. A methodical approach to putting research into practice can also be ensured by including spatial thinking into science curricula and assessments using the Knowledge Translation Framework (KTF) (Gagnier & Fisher, 2020).

Results

The findings support the hypothesis that integrating life skills into science education enhances both cognitive and non-cognitive student development. The *Science for Life* approach successfully bridges the gap between scientific knowledge and its real-world application, making science education more holistic, purposeful, and student-centered.

One of the major strengths of this pedagogical model lies in its interdisciplinarity. By embedding critical life skills within scientific inquiry, the framework aligns with constructivist principles and fosters a more dynamic learning environment. The improvement in students' soft skills indicates that higher education can and should play a key role in preparing students not only for careers but for life as responsible, adaptive, and ethically aware citizens.

While the results are promising, several limitations should be acknowledged. The study relied on self-reported data, which can introduce bias. Additionally, variations in institutional context and instructional delivery may affect generalizability.

Conclusion

The *Science for Life* pedagogical approach represents a progressive shift in higher education, one that emphasizes the integration of essential life skills into science curricula. This study has demonstrated that embedding competencies such as critical thinking, emotional intelligence, problem-solving, and ethical reasoning within scientific instruction not only enhances student engagement but also equips learners with tools to navigate the complexities of modern life.

By moving beyond traditional content delivery and fostering real-world relevance, the approach cultivates a more holistic form of education preparing students not just for academic success, but for active, thoughtful participation in society. As institutions strive to meet the evolving demands of the 21st century, approaches like *Science for Life* highlight the importance of reimagining pedagogical practices to nurture well-rounded, adaptable, and socially responsible graduates.

Ultimately, this model reinforces the idea that science is not only a body of knowledge but also a way of thinking and living one that, when thoughtfully taught, can empower students to lead informed, meaningful lives.

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