Research Article

Effect Of Value-Integrated Constructivist Approach (Vica) On Secondary School Students' Life Skill Development In Biological Science Pedagogy

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Abstract

The present paper is an attempt to study the effectiveness of Value-Integrated Constructivist Approach (VICA) in developing life skills of Class VIII students through the pedagogy of biological science. While the importance of life skills is recognized in global and national educational frameworks, such as the Delors Report (UNESCO, 1996), the National Education Policy (NEP, 2020), and the National Curriculum Framework (NCERT, 2005), the systematic incorporation of life skills into the pedagogy of science classrooms remains underexamined. Based on constructivist learning theory, VICA is a biology teaching approach that intentionally incorporates basic human values through inquiry-based learning, collaborative interaction, real-life contextualization, and structured reflection.

A non-randomized control group pre-test–post-test quasi-experimental design was carried out in 2 public secondary schools of Andhra Pradesh for a 1-year intervention period. Quantitative analysis using independent t-tests and chi square tests and qualitative analysis of student reflections showed a statistically significant positive gain in life skills for students who received VICA-based instruction compared to students who were taught using traditional methods that did not incorporate values. The findings show that the integration of life skills and values into constructivist biology teaching broadens the scope of learning beyond conceptual knowledge and enhances students' personal, social, and ethical development. The paper offers insights into value-embedded, participatory pedagogies that enable meaningful and holistic learning in secondary science education.

Keywords: Value-Integrated Constructivist Approach (VICA), Biology Education, Life Skills Development, Value-Based Pedagogy, Holistic Learning.

1. Introduction

In a dynamic and changing world, education is expected to go beyond the mere transmission of academic content and address the holistic development of learners. The focus of today's discussion about education is the need to develop social and emotional competencies. These competencies include critical thinking, empathy, self-awareness, interpersonal skills and responsible decision making. These competencies are crucial to enable learners to adapt well to their environments, participate meaningfully in society and lead purposeful and fulfilling lives (UNICEF, 2019; WHO, 1994). Therefore, education systems around the world are starting to acknowledge student autonomy, agency and intentional action as fundamental learning outcomes (AlAfnan, 2024).

The OECD Future of Education and Skills 2030 framework identifies learner agency the capacity to act with purpose, autonomy and accountability as an essential educational goal (OECD, 2019). In this sense, there is an increasing demand for pedagogical approaches that actively involve students and promote their cognitive and socio-emotional development (Mameli, 2025). However, traditional teaching methods, which are primarily teacher-centred and compliance-oriented, tend to limit student agency and provide little room for value inculcation and life skill-based learning. In such approaches, compliance is typically regulated externally through rewards and punishments rather than through internalized motivation and self-regulation (Ryan & Deci, 2020).

Conversely, research-informed movements toward learner-centered and constructivist pedagogies are concerned with meaningful engagement, reflective thinking and internalizing values through authentic learning experiences. The methods emphasize the importance of linking classroom learning to real-world situations, with activities designed by students and collaborative inquiry (Nachtigall, 2024). Such pedagogical orientations are increasingly recognized as important levers for bridging the gap between schooling and learners lived realities.

These perspectives influenced the development and implementation of the Value-Integrated Constructivist Approach (VICA) in secondary school biological science classrooms. VICA is an attempt to integrate human core values with constructivist teaching-learning principles to enhance students' active participation in learning and to foster essential life skills (Yaman, Anılan, 2021). The fundamental assumption of VICA is that learners build knowledge by experience, communication and reflection in value-laden learning contexts, leading to deep and

meaningful learning. Such processes assist in the development of cognitive, academic but also affective, social and ethical growth (Gunawardena et al., 2021). In this way, VICA offers a pedagogical framework that promotes deeper comprehension of concepts and the development of life skills needed in everyday life.

There is a broad consensus that life-skills-based education is important, but limited empirical research on the impact of value-integrated pedagogical approaches on life skill development (Kirchhoff et al., 2021). In many traditional teaching models, the integration of values is treated superficially and life skills are often viewed as outcomes of co-curricular activities instead of as integral parts of classroom instruction (Lovat, 2011). This disconnect signals the need for systematic inquiry into classroom pedagogies that explicitly integrate values with subject learning.

The present study is an attempt to fill this gap by empirically investigating the effect of value integrated constructivist approach on life skill development of Secondary school students with special reference to biological science instruction. The study is focused on important life skills mentioned in WHO such as communication, empathy, emotional regulation, decision making and social relationships. It also explores how the presence of values in the science classroom facilitates the internalization of values and activation of students' agency, which leads to self-driven behaviour, meaningful learning and responsible action. This approach emphasizes internal regulation and self-regulation rather than external mechanisms such as rewards and sanctions (Reeve & Tseng, 2011). In so doing, the study contributes to the growing literature that advocates for value-based, constructivist pedagogies as a means of producing holistic, future-ready learners.

2. Literature Review

The Value-Integrated Constructivist Approach (VICA) can be described as a pedagogical model used in the classroom that combines the core elements of constructivist learning with a conscious focus on the promotion of human values and psychosocial skills (Hipkins, 2025). VICA is based on socio-constructivist and humanistic learning theories and encourages active knowledge building through experiential inquiry, peer interaction, learning scaffolding, and structured reflection (Çibukçiu, 2025). The approach aims to promote cognitive understanding and holistic development of the learner through placing learning in meaningful, value-laden contexts.

VICA's constructivist foundation is mainly built upon Piaget's theory of cognitive constructivism and Bruner's theory of active learning, where learner engagement, social mediation, and instructional scaffolding are highlighted as essential components of meaningful learning (Bruner, 1981); (Ryan, 2019). Empirical studies with the Constructivist Learning Environment Survey (CLES) have shown that key features of effective constructivist classrooms are personal relevance, critical voice and student negotiation (Çibukçiu, 2025). These dimensions are in close accord with the principles that support VICA, as they foster learner engagement, empathy and agency – qualities that are conducive to both academic learning and the development of life skills.

Additionally, studies have shown that embedding values in constructivist learning environments leads to measurable improvements in learners' critical thinking, decision-making abilities, self-awareness, resilience, and ethical reasoning (Neiroukh et al., 2025). Value-integrated constructivist pedagogies that move beyond unidirectional models of knowledge transmission create meaningful learning experiences that support ethical internalization. This integrated orientation reflects a growing recognition that scientific literacy must be accompanied by social, emotional and moral competencies to enable learners to effectively engage with complex real-world challenges.

VICA is further relevant as it aligns with current global educational initiatives that focus on learner agency and holistic development. The concept of student agency, as described by the World Health Organization (WHO, 1994), is the ability of learners to act independently, purposefully and responsibly. Similarly, UNESCO's Sustainable Development Goal 4.7 (UNESCO, 2019) emphasizes the value of education that empowers learners to acquire the knowledge, skills, values and attitudes needed to promote sustainable lifestyles, human rights, gender equality, peace and global citizenship and appreciation of cultural diversity. VICA embeds values and reflective practices into disciplinary learning, bringing these global priorities to life at the classroom level.

A key strength of the VICA framework is that it can be adapted to different cultures. Research has indicated that value-integrated pedagogies can be effectively contextualized to culturally-specific traditions and value systems. In the Asian contexts, moral and values education has been a core element of family life and socialization (Weis et al., 2023). In the Indian context, value education has been traditionally promoted through storytelling, teacher modelling, encouragement for self-control and promotion of collective harmony and social responsibility. Research in comparable cultural contexts has demonstrated that the incorporation of culturally relevant biographies, real-life ethical dilemmas, storytelling and values-oriented questioning in science classrooms

improves student motivation, ethical awareness, responsible environmental behaviour and empathy, and also facilitates conceptual learning in life sciences (Lovat, 2011).
In relation to this, the interdisciplinary and integrated STEM education models, which include sustainability and ethical decision-making as part of science learning, have conceptual similarities with the VICA framework (Rahmawati, 2022). In this way, students make more interdisciplinary connections, see the relevance of values in solving real-world problems and connect scientific knowledge with ethical and societal concerns in ways that are relevant and contextualized. Furthermore, values have been found to enhance the development of learners' 21st-century skills, such as collaboration, motivation, social skills and moral reasoning, embedded into the learning design of experiential learning contexts like science and STEM makerspaces, co-creation environments and platforms for collaborative inquiry (Mäkelä, 2022).
The growing use of digital and hybrid learning environments further expands the pedagogical potentials of VICA. Reflective blogs, online discussion forums, collaborative storyboards, virtual laboratories, and AI-supported inquiry environments are digital resources that can extend the reflective, participatory and self-regulated dimensions of value-integrated constructivist learning beyond the physical classroom (Yuan, 2024). Intentionally designed such tools can enable contextualized, values-led and ethically informed engagement with content of biological science.
Overall, the Value-Integrated Constructivist Approach is a systematic, theory-based and culture-sensitive teaching model that integrates constructivist learning principles and explicit value teaching. The literature suggests that this approach has the potential to foster life skills, ethical orientation and meaningful conceptual understanding simultaneously, thus enabling learners to deal with complex scientific and societal challenges more effectively (Singh, 2025).

3. Research Method

3.1 Research Methodology:
The quantitative research method of this study is a quasi-experimental pre-test post-test control group design. This design is especially appropriate for educational research in actual classroom settings where random assignment of participants is not feasible, but the aim is to study the causal effect of an instructional intervention. The main purpose of adopting this design was to assess the effectiveness of VICA in developing the life skill among the students of Class-VIII through the Pedagogy of Biological Science.

3.2 Participants and Sampling
The sample consisted of two whole groups of Class VIII students from two secondary schools in the state of Andhra Pradesh, Anantapur District, following the State curriculum. The groups were selected through purposive sampling according to the following inclusion criteria:

Curriculum equivalence: Both groups followed the same biological science curriculum and learned the same learning units during the intervention period.

Similar learner profile: Students in both groups were similar in age, educational background, and previous experience with traditional biology instruction.

Baseline academic equivalence: Initial group equivalence was established before the intervention by collecting pretest life skills scores.

Institutional approval: The school authorities gave the necessary permissions to carry out the study and to implement the intervention.

The total sample comprised of N = 174 students, with n = 89 students in the control group and n = 85 students in the experimental group.

3.3 Intervention: Design and Duration
The intervention was implemented for 1 year and comprised 40 contact hours of instruction in biological science for both groups.

The experimental groups were taught by using the Value-Integrated Constructivist Approach (VICA) which systematically combines constructivist learning principles with explicit value integration and life skills development. While control group was taught by traditional method.

The intervention consisted of the following instructional strategies:
• Storytelling with real-life role models and metaphors that are consistent with biological concepts
• Co-operative group learning and peer negotiation
• Inquiry and experiential learning activities
• Scenario-based problem-solving tasks
• Reflective journaling and Guided classroom reflection
• Structured debrief to articulate and internalize value.

Values such as respect for life, responsibility for the environment, and collaboration were intentionally woven in and associated with certain biological science topics such as reproduction, cell structure and function, ecosystems, and health education.
The control group was taught the same biological science units over the same time period by the same teacher, but using conventional teacher-centred instructional methods without explicit constructivist scaffolding or value-integration strategies. This meant that any differences in learning outcomes could be attributed mainly to the teaching approach and not to differences in the content taught, the time spent teaching or the teacher.

3.4 Data Collection Instrument
Life skills development was assessed using the Life Skills Scale developed by Vranda and Rao (2009) based on the WHO Life Skill Framework (WHO, 1994). The instrument measures ten key life skills:
Self-awareness, Empathy, Interpersonal relationships, Communication, Decision making, Problem solving, Creative thinking, Critical thinking, managing stress, Managing emotions.
The scale is a 5-point Likert scale from 1 (Never) to 5 (Always) with higher scores indicating greater presence of life skill behaviours. The instrument has shown good internal consistency, reliability and construct validity and has been widely used in Indian educational and psychosocial research settings.
3.5 Procedure of Data Collection
The data collection was carried out in three stages:
Pre-test administration: Prior to the intervention, the life skills scale was administered to the experimental and control groups in an effort to assess the baseline level of life skills and to ensure the groups' comparability.
Instructional intervention: The experimental group received VICA-based instruction and the control group received conventional instruction.
Post-test administration: At the end of the one-year intervention period, the same life skills scale was administered to both groups to assess changes in life skills development.
3.6 Data Analysis Techniques
Data collected through Life Skills Scale were analyzed by using appropriate descriptive and inferential statistical techniques to test the stated research hypotheses. Independent samples t-tests were performed to investigate the differences between the experimental and control group in post-test life skills scores and mean gain scores. The distribution of students across the low, moderate and high levels of life skills was compared between the pre-test and post-test stages using chi-square tests.
Additionally, the qualitative data obtained from students' reflective responses and interviews were thematically analyzed using the MAXQDA software to identify recurring patterns related to students' development of life skills, internalization of values and learning experiences. The combination of quantitative and qualitative findings provided a rounded picture of the impact of the Value-Integrated Constructivist Approach on students' holistic development.
3.7 Study Variables
Independent Variable: Biological Science Instruction employing Value-Integrated Constructivist Approach (VICA)
Dependent Variable: Scores of students of life skills development (pre-test, post-test and gain scores)
Control of Extraneous Variables: To minimize threats to internal validity and fidelity of implementation, the following controls were used:
To reduce teacher-effect bias, both groups were taught by the same teacher, teaching time, content coverage and assessment conditions were maintained consistent and neither group was exposed to any additional value-education outside the planned intervention.
3.8 Statistical Hypotheses
The following null hypotheses were tested:

H01: There is no significant difference between life skills development of students taught by VICA and students taught by traditional method.
H_{o2}: There is no significant difference between the mean gain scores of the experimental and control groups in the development of life skills.
H_{o3}: There is no significant difference between experimental and control groups in the distribution of students in the categories of life skills at the pre-test stage.
H_{o4}: There is no significant difference between the experimental group and control group on the post-test stage in the distribution of students at the levels of life skills.
H_{o5}: There is no significant difference in the percentage distribution of life skills levels between the post and pre-test scores of the control group.
H_{o6}: There is no significant difference between the experimental group's pre-test and post-test scores in terms of the percentage distribution of life skills levels.

Table 1: Demographic Characteristics of the Sample (N=174)

Variable	Total N=174	%	Experimental Group N= 85	%	Control Group N= 89	%
Gender:						
Male	91	52	36	42	50	56
Female	83	48	49	58	39	44
Educational Institution						
School 1 (Urban area Government school)	86	49	43	51	43	48
School 2 (Rural area Government school)	88	51	42	49	46	52

Data Analysis

Data analysis was conducted using a combination of descriptive and inferential statistics to evaluate the effectiveness of the Value-Integrated Constructivist Approach in Class 8 biological science pedagogy. Descriptive statistics (mean, SD, frequencies, and percentages) were used to examine trends and score distributions for life skills across experimental and control groups. Independent sample t-tests were applied to determine mean differences between groups for life-skill development (pre-test, post-test, and mean-gain scores), while Chi-square tests assessed distributional differences across low, moderate, and high life-skill categories at both testing points. Methodological strengths of the study include its quasi-experimental classroom-based implementation, value-embedded constructivist design, validated instruments, and triangulated feedback from teachers and students, which together strengthen the ecological validity, replicability, and practical relevance of the VICA framework in secondary biology pedagogy.

Results

This section includes the descriptive statistics of the variables studied for the study sample, the correlation table indicating the association between the variables measured for the baseline data, results for the paired samples t-test and the qualitative content analysis tables for the control and experimental groups respectively.

Hypothesis 1: There is no significant difference in life skills development between students taught using VICA and those taught using the traditional method.

Table 2

Variable	Method of Teaching	N	Mean(pre-test)	Mean(post-test)	S.D.	f-value	t-value	Sig (2-tailed)/ p-value
Life Skill	VICA	85	347.58	386.33	36.377	4.244	2.645	0.009**
	Traditional	89	368.32	369.63	46.494			
	N=174							

**Rejects null hypothesis at 1% level.

The results show a statistically significant difference in life skill development between students taught through VICA and those taught through the traditional method. Students exposed to the Value-Integrated Constructivist Approach demonstrated significantly better life skill outcomes, validating the effectiveness of VICA in fostering life skills through biology education.

Hypothesis 2: There is no significant difference in mean gain scores in life skills development between the experimental and control groups.

Table 3

Variable	Method of Teaching	N	Mean	S. D	t-value	p-value
Experimental	VICA	85	38.753	25.751		
Control	Traditional	89	1.303	2.894	13.632	<0.001**
N=174						

** Rejects null hypothesis at 1% level.

Results showed a significantly higher mean gain for the experimental group (M = 38.75, SD = 25.75, n = 85) compared to the control group (M = 1.30, SD = 2.89, n = 89). The difference was statistically significant, t (172) = 13.63, p < .001, indicating that the VICA method was more effective in enhancing life skill development than the traditional method. The results reveal a highly significant difference in mean gain scores between the experimental and control groups (t = 13.62, p = 0.000). The experimental group showed a substantial gain in life skills (Mean Gain = 38.753), while the control group demonstrated negligible improvement (Mean Gain = 1.303). The very large t-value indicates that the life skill development improvement in the experimental group was not due to chance, and was instead a result of the Value-Integrated Constructivist Approach (VICA).

ANCOVA: Controlling for Baseline Non-Equivalence in Life Skills

Because Table 4 shows that the experimental and control groups were not equivalent at baseline ($\chi^2 = 14.796$, $p < .001$), an Analysis of Covariance (ANCOVA) was conducted on post-test life-skills scores with pre-test life-skills scores entered as a covariate, to obtain a bias-adjusted estimate of the treatment effect. Prior to interpreting the ANCOVA, the assumption of homogeneity of regression slopes was tested and satisfied: the interaction between the covariate (pre-test life skills) and the grouping factor was non-significant, $F(1, 170) = 2.14$, $p = .145$, confirming that the ANCOVA adjustment was mathematically valid. The ANCOVA itself was statistically significant, $F(1, 171) = 29.518$, $p < .001$, $R^2 = .357$, indicating that VICA produced a significant effect on post-test life-skills scores even after the baseline non-equivalence between groups was statistically controlled. This result corroborates the mean-gain analysis reported above (Table 3) using an analytically independent method, and together the two analyses provide converging evidence that the observed gains reflect the effect of the intervention rather than regression to the mean or pre-existing group differences.

H_{o3}: There is no significant difference in the pre-test distribution of students across life skills categories between the experimental and control groups.

The chi-square analysis of the pre-test distribution of students across low, moderate, and high levels of life skills revealed a significant difference between the experimental and control groups ($\chi^2 = 14.796$, $p < 0.001$). This indicates that before the intervention, the two groups were not equivalent in their baseline life-skill levels. A larger proportion of students in the experimental group fell into the low life-skill category compared to the control group, which had a more varied distribution across low, moderate, and high levels. Therefore, the null hypothesis stating that there is no significant difference in the pre-test distribution of life-skill levels between the groups is rejected.

Table 4

Group	Low	Moderate	High	Total	Chi-Square	p-value
Experimental	81	4	0	85	14.796	<0.001**

Control	67	14	8	89
Total	148	18	8	174

** Rejects null hypothesis at 1% level.

H_{o4}: There is no significant difference in the distribution of students across levels of life skills between the experimental and control groups at the post-test stage.

The chi-square test comparing the post-test distribution of students across low, moderate, and high levels of life skills between the experimental and control groups yielded a value of $\chi^2 = 2.73$ with a p-value of 0.255. Since the p-value is greater than the 0.05 significance level, the difference in the distribution of life-skill levels between the two groups at the post-test stage is not statistically significant. This indicates that, despite the marked baseline disparity noted under H_{o3}, the experimental and control groups had converged to a statistically comparable distribution of life-skill levels by the end of the intervention. Therefore, the null hypothesis stating that there is no significant difference in the post-test distribution of life-skill levels between the two groups is accepted.

Table 5

Group	Low	Moderate	High	Total	Chi-Square	p-value
Experimental	53	24	8	85	2.73	0.255
Control	65	16	8	89		
Total	118	40	16	174		

H_{o5}: There is no significant difference in the percentage distribution of life skills levels between the pre-test and post-test scores of the control group.

The data reveal no significant difference in the percentage distribution of life skills levels between the pre-test and post-test scores of the control group, thereby supporting the null hypothesis (Ho_5). Minor variations were observed, with a slight decrease at the low level (75.28% to 73.03%) and a marginal increase at the moderate level (15.73% to 17.89%), while the high-level distribution remained unchanged (8.99%). These negligible shifts indicate the absence of any meaningful improvement in life skills among the control group during the study period.

Table 6

Level	Pretest %	Posttest %	% Gain/ Change	
Low	75.28%	73.03%	2.25%	(minimal improvement)
Moderate	15.73%	17.89%	2.16%	(very small gain)
High	8.99%	8.99%	0% change	

H_{o6}: There is no significant difference in the percentage distribution of life skills levels between the pre-test and post-test scores of the experimental group.

There is a 33% decrease in students in the Low life skills level. There was a 24% increase in those in the Moderate level. A new High life skills category emerged with 9.41% of students shifting into it. This shows a strong positive movement from low → moderate → high levels after VICA intervention. The experimental group exhibited substantial improvement in life skill levels, as demonstrated by a 33% reduction in low-level scores, a 24% increase in moderate scores, and the emergence of a high-level life skills group (9.41%) after the VICA intervention.

In contrast, the control group displayed negligible changes across all categories.
Although the Chi-square for the post-test ($\chi^2 = 2.73$, $p = .255$) indicates no significant categorical difference between groups, the mean gain scores and percentage shifts clearly support the effectiveness of VICA in enhancing life skill development among Class 8 students.

Table 7

Level	Pretest %	Posttest %	% Gain/ Change
Low	95.29	62.35%	32.94% (major reduction)
Moderate	4.71	28.24%	23.53%
High	0%	9.41%	9.41%

Qualitative Findings: Impact of VICA on Life Skills Development
Qualitative analysis was conducted using data from approximately 30 semi-structured student interviews. MAXQDA software was employed for thematic analysis of students' reflective responses. The findings revealed that the Value-Integrated Constructivist Approach facilitated meaningful changes in students at cognitive, social, emotional, and ethical levels.

Theme 1: Empathy and Social Awareness
One of the most common student-reported outcomes of the value-integrated classroom activities was increased empathy and sensitivity toward others. The reflections indicated that the use of storytelling, discussions and examples based on values promoted emotional involvement and a sense of responsibility toward living beings and the natural environment. Students associated empathy with broader values such as humanity, compassion and ethical responsibility, implying internalization at personal and affective levels.

Theme 2: Self-Awareness and Self-Reflection
The student narratives highlighted the theme of self-awareness. Learners reported greater awareness of their thoughts, feelings, behaviors and responsibilities. Students also felt respected and heard in the classroom, which had positive effects on their confidence, self-expression, and reflective thinking. Such a nurturing learning environment fostered reflection, responsibility, and a focus on long-term goals.

Theme 3: Communication and Interpersonal Skills
Students reported significant improvement in communication and interpersonal skills, particularly through collaborative learning and group activities. Students showed development in dialog, collaboration and mutual respect, feeling more confident to share ideas, join conversations, listen to peers and respectfully consider diverse viewpoints.

Theme 4: Critical Thinking, Analysis, and Problem-Solving
Reflections indicated that the inquiry-based and questioning oriented instructional strategies under VICA facilitated the growth of higher-order thinking skills. Students identified chances to analyze evidence, evaluate alternatives and apply biological concepts to real-life and ethical contexts. Thus, value-integrated constructivist pedagogy promoted deeper cognitive engagement than rote learning.

Theme 5: Self-Discipline, Responsibility, and Ethical Orientation
Students also reported internalization of values of discipline, responsibility and ethical behavior. Reflections showed the development of self-regulated behavior and moral accountability, beyond the academic tasks to everyday life situations. These results demonstrate the more general effect of character building by the VICA intervention.

Word Cloud Analysis
Word cloud analysis generated using MAXQDA further corroborated the qualitative findings. Frequently occurring terms such as empathy, communication, self-awareness, responsibility, collaboration, critical thinking,

questioning, and analysis highlight the centrality of life skills as key outcomes of the VICA-based instructional approach.

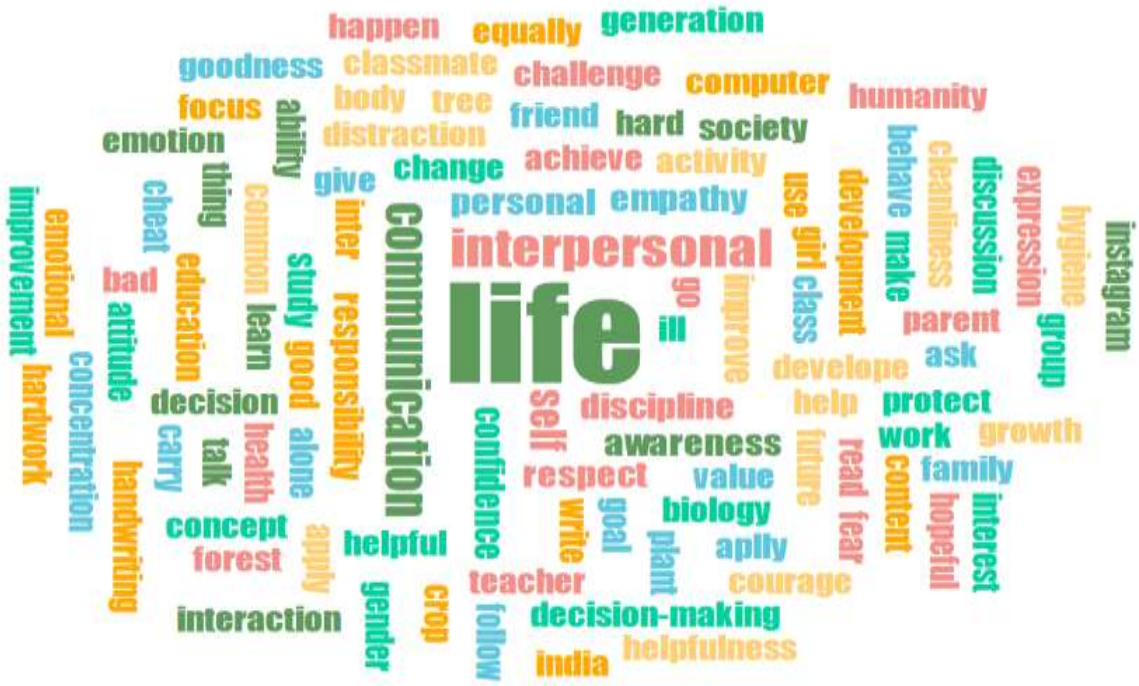

Figure1: Word Cloud of Interviews of Students on Life Skill Development, MAXQDA

Based on the qualitative and quantitative data and the observation of students by the teacher for a period of one year, the researcher proposes the Model of VICA for the implementation of Life Skills. The model proposed here shows the pedagogical structure and developmental influence of the Value-Integrated Constructivist Approach (VICA) implementation in secondary biological science classrooms. The model demonstrates a top down developmental flow starting with VICA as the core instructional philosophy. VICA is defined at the top by its core inputs: Education in Human Values (EHV), inquiry-based learning, collaboration, structured reflection and real-life contextualization of biological concepts. These inputs constitute the basis for a knowledge construction process, which is learner-centered.

The second layer of the model identifies Learning Process Catalysts, classroom mechanisms that trigger VICA. These are: (1) storytelling and metaphors that emotionally anchor values like respect for life and compassion; (2) teacher-led questioning that scaffolds 'why' and 'how' thinking; (3) peer learning and dialog through group tasks and discussions; (4) application of biological concepts to ethical and real-world situations; (5) reflective and ethics-based learning practices that extend moral reasoning to daily conduct; and (6) a supportive classroom climate where students feel heard, safe, and confident to express ideas. This layer stresses that life skills development is initiated through both social interaction and metacognitive engagement, which are the fundamental concepts of constructivist learning.

The third layer shows the Life Skills Development Domains and the outcomes from ongoing engagement with the catalysts. Students grew in empathy and social awareness, with greater compassion, humanity and environmental consciousness. The increase in self-awareness and self-reflection suggests improved emotional recognition, introspection, confidence, self-regulation and goal orientation. Improvement in communication and interpersonal skills is an indication of progress in articulation, listening, dialog, cooperation and respect for diverse points of view. Students also displayed more developed critical thinking and problem-solving skills, as shown by their ability to analyze evidence, evaluate competing choices, think through issues, and apply their knowledge of biology to real-world situations. Responsibility, ethical orientation and self-discipline themes further imply moral accountability, behavioral regulation, organized thinking and value-guided decision-making beyond academic tasks.

The model culminates at the bottom in the Holistic Life Skills Outcome, reflecting that VICA nurtured not isolated competencies but a composite skill set that includes emotional intelligence, ethical reasoning, scientific inquiry mindset, collaborative behavior, responsible citizenship, and self-regulated learning habits. The diagram thus conceptualizes VICA as a systems-based pedagogy that simultaneously builds scientific understanding and

human capacities, reinforcing that meaningful biological science education must integrate knowledge, values, skills and character formation to prepare learners for responsible life participation.

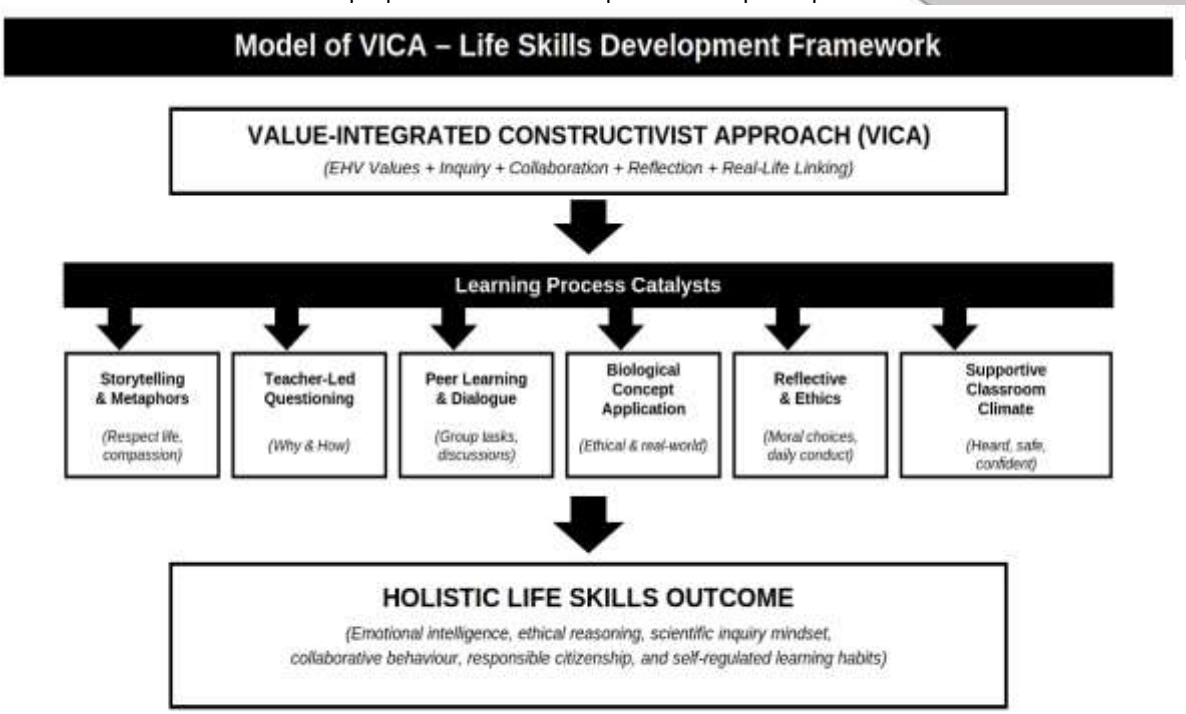

Figure 2: Model of VICA-Life Skill Development Framework

Summary of Results

The findings indicate that the Value-Integrated Constructivist Approach (VICA) had a positive and significant impact on students' life skills development. Quantitative analysis revealed statistically significant differences between the experimental and control groups in post-test life skills scores and mean gain scores. Percentage distribution analysis showed a marked shift of students in the experimental group from lower to higher levels of life skills following the intervention, while the control group exhibited minimal change. Qualitative analysis further revealed improvements across cognitive, social, emotional, and ethical dimensions, as reflected in students' reflective responses and interviews. Collectively, the results demonstrate measurable gains in life skills among students exposed to VICA-based instruction.

Discussion:

The findings revealed that the Value-Integrated Constructivist Approach (VICA) was more effective in fostering life skills among the Class VIII students of biological science than the traditional instructional methods. The experimental group had significant differences in the post-test and significantly higher mean gain scores. This means that the integration of values within constructivist pedagogy significantly enhances the students' psychosocial development. These findings support the growing recognition of the need for pedagogical approaches that integrate the cognitive, affective, and moral dimensions in preparing learners for the challenges of the present age.

The post-test difference between the experimental and control groups was statistically significant, confirming that the gains observed were due to the VICA intervention and not to chance. The experimental group had higher mean scores and less variability, providing further evidence that VICA produces more consistent learning outcomes. The findings are consistent with constructivist learning theory, which highlights active engagement, social interaction, contextualized learning and reflection as essential components in the construction of meaningful knowledge. When these principles are explicitly integrated with value education, learning is not limited to academic achievement, it extends to socio-emotional and ethical development. Mean gain analysis provides particularly strong evidence of the effectiveness of VICA. The marked improvement

of the experimental group, compared to the minimal change in the control group, suggests that the gains were not a function of maturation or testing effects, but rather a direct outcome of the value-integrated constructivist intervention. This finding aligns with previous research highlighting the significance of participatory, experiential and value-imbued pedagogies for the acquisition of transferable life skills such as decision-making, collaboration, responsibility and self-regulation (Lovat, 2011).

Post-test chi-square analysis did not reveal statistically significant categorical differences between groups, however, percentage distribution patterns show meaningful developmental movement. The decrease in the percentage of students at the low life skills level and the appearance of moderate and high categories in the experimental group are signs of real progress rather than inflated scores. Conversely, the control group showed very little categorical movement, implying the very negligible effect of traditional teaching methods on the development of life skills.

The qualitative findings complement and provide context to the quantitative results by shedding light on students' lived learning experiences. Students reported increases in empathy, self-awareness, communication, cooperation, critical thinking, and ethical responsibility outcomes consistent with socio-emotional learning frameworks. These findings are in line with Vygotsky's view of learning as a socially mediated process by which cognitive and moral constructs are internalized. The noted rise in learner motivation and autonomy further testifies to the effectiveness of dialogic, reflective, and participatory learning environment enabled through VICA.

We found that narrative-based instruction and value-based case studies are particularly powerful elements of the VICA framework. When students bridged biological ideas with real stories and moral dilemmas, they were able to connect learning in science with lived experience, ethical reasoning, and emotional engagement. These findings are consistent with studies that indicate the value of storytelling as a pedagogical tool for moral and emotional development (Gunawardena & Brown, 2021). Furthermore, the evolution of the teacher's role from knowledge transmitter to facilitator fostered student agency, collaboration and ownership of learning, consistent with international recommendations that highlight the significance of empathy, flexibility and cooperation as vital skills for the 21st century.

Limitations

A key limitation of this study concerns baseline non-equivalence between groups. As shown in Table 4, the experimental group entered the study with a markedly lower proportion of students in the low life-skills category (95.29%) than the control group (75.28%), $\chi^2 = 14.796$, $p < .001$. Because the experimental group's pre-test scores were closer to the floor of the scale, part of its larger observed gain (Table 3) may reflect statistical regression to the mean or a floor effect rather than the intervention alone. Simple independent-samples t-tests and gain-score comparisons, as reported in Tables 2 and 3, do not fully rule out this alternative explanation because they do not statistically equate the groups on their pre-test standing. To address this, an Analysis of Covariance (ANCOVA) was conducted on post-test life-skills scores with pre-test scores entered as a covariate (see Results). The homogeneity-of-regression-slopes assumption was satisfied, $F(1, 170) = 2.14$, $p = .145$, and the ANCOVA confirmed a statistically significant effect of VICA after baseline differences were statistically controlled, $F(1, 171) = 29.518$, $p < .001$, $R^2 = .357$. This converges with the independent mean-gain analysis (Table 3) and indicates that the observed gains are unlikely to be fully explained by regression to the mean alone, though the possibility of a residual floor effect cannot be entirely ruled out given the non-random assignment of groups. Other limitations include the use of purposive, intact-classroom sampling rather than random assignment, reliance on a single teacher and two schools within one district, and a relatively short (one-year) follow-up window that precludes conclusions about the durability of the observed gains.

Conclusion

The present study provides strong empirical support for the effectiveness of the Value Integrated Constructivist Approach (VICA) in promoting life skills among Class VIII students within the framework of biological science education. Students with VICA based instruction had a significant increase in life skills as compared to students with traditional instructional methods. The convergence of quantitative and qualitative findings clearly indicates that the gains are a direct result of the value-integrated constructivist intervention.

Specifically, there was significant positive movement in the experimental group students from one level of life skills to another, with many moving from low to moderate and high levels. The control group, by contrast, showed little change, and thus the limited potential of traditional pedagogies to promote holistic development. These results point out the success of VICA in the development of not only conceptual learning but also important life skills such as communication, cooperation, responsibility, decision-making and ethical orientation.

The findings of this study have important implications for inclusive and equitable practices in the classroom. The significant improvement in students with low baseline life skills indicates that VICA may be particularly promising for supporting diverse learners with diverse backgrounds and learning needs. Values are embedded within a constructivist framework, promoting learner engagement, internal motivation and meaningful participation, addressing simultaneously cognitive, affective and social dimensions of learning.

The findings also have important implications for science education, teacher education and curriculum development. Constructivist science pedagogy that integrates values is a promising approach to bridge the cognitive-affective-social divide that is often found in today's education. Teacher preparation and professional development programs could benefit from explicit training in value-integrated constructivist approaches that enable educators to create learning experiences that foster academic understanding and life skills development. Curriculum planners may also wish to think about systematically including value-based constructivist activities across science topics to promote balanced and holistic learner development.

To summarize, the Value-Integrated Constructivist Approach is a pedagogically sound and contextually relevant framework for the enhancement of life skills in secondary school biology education. VICA encourages active engagement, reflection and value internalization, contributing to the development of well-rounded, responsible and future-ready learners, and to the growing body of research supporting integrated, values-based pedagogies for holistic science education.

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