

Web-based Life Skills Instructional and Assessment Framework for Secondary School Students in Kerala

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Abstract

Life skills education plays a pivotal role in promoting the psychological and social well-being of adolescents. The existing instructional and assessment tools often lack contextual relevance and technological adaptability for regional educational settings. This paper presents the development and implementation of a Web-based Life Skills Instructional and Assessment System (WLSIAS) tailored for secondary school students in Kerala. A WLSIAS conceptualised on the World Health Organization's ten core life skills following a pilot psychometric evaluation involving 200 Class IX students from Secondary Schools in Kasaragod District, Kerala, with dual operational modes - Admin Mode for content management, data export, and statistical analysis; and Student Mode for interactive training and pre-test, post-test for skill acquisition and retention. It is powered by a structured SQLite database and a Python Flask framework, integrating automated quiz generation, multimedia-based learning modules, and application of t-tests, Wilcoxon signed-rank tests, and Friedman ANOVA. The system autonomously generates performance charts and report documents to visualise improvement patterns across life skills dimensions. Experimental deployment demonstrated significant post-training improvement and measurable skill retention, validating the tool's potential as a scalable digital intervention framework for regional life skills education. The designed WLSIAS thus bridges the gap between psychometric rigour and digital pedagogy, contributing a replicable model for life skills education in secondary schools.

Keywords: Life Skills Education, Web-based Learning System, Instructional Framework, WHO Core Life Skills Assessment

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INTRODUCTION

The National Education Policy (NEP, 2020: p. 5, 12) of India observed that imparting life skills to school students is instrumental for creating holistic and well-rounded individuals for the nation. Life skills are developed as a result of a constructive processing of information, impressions, encounters and experiences—both individual and social—that are a part of one's daily life and work, and the rapid changes that occur in the course of one's life (Singh, 2003). The WHO (1994, 1997) defined life skills as, “abilities for adaptive and positive behaviour that enables individuals to deal effectively with the demands and challenges of everyday life” by specifying ten core-skills—self-awareness, empathy, critical thinking, creative thinking, decision making, problem solving, effective communication, interpersonal relationship skills, coping with stress, and coping with emotions. Life skills are a range of psychosocial and cognitive abilities that help children to make informed decisions and choices, manage their emotional well-being, and communicate effectively (Singh and Menon, 2016). UNICEF (2019) has defined life skills as, “a behaviour change or behaviour development approach designed to address a balance of three areas—knowledge, attitudes, and skills.”

The WHO (1994) explains self-awareness is recognition of ourselves, our character, our strengths and weaknesses, and desires and dislikes;

empathy is the ability to imagine what life is like for another person, even in a situation that we may not be familiar with; critical thinking is an ability to analyse information and experiences in an objective manner; creative thinking contributes to both decision making and problem solving by enabling us to explore the available alternatives and various consequences of our actions or non-action; decision making is dealing constructively with decisions about our lives; problem solving is dealing constructively with problems in our lives; effective communication is expressing ourselves, both verbally and non-verbally, in ways that are appropriate to our cultures and situations; interpersonal relationship skills is relating us in positive ways with the people we interact with; coping with stress is about recognising the sources of stress in our lives, recognising how this affects us, and acting in ways that help to control our levels of stress; and coping with emotions involves recognising emotions in ourselves and others, being aware of how emotions influence behaviour, and being able to respond to emotions appropriately. Further, WHO paired these ten skills into five main life skills areas—decision making and problem solving, creative thinking and critical thinking, communication and interpersonal relationships, self-awareness and empathy, and coping with emotions and stressors (Singh and Menon, 2016).

Globally and in India, life skills education has been connected with improvements in psycho-social outcomes, reductions in depression and anxiety symptomatology, gains in self-efficacy, and school engagement with multiple delivery mechanisms such as out-of-school programmes and well-structured school-based formal programmes (Singh and Menon, 2016). Prajapati *et al.* (2017) argue that life skills education not only bridges the gap between the basic functioning and capabilities, but also strengthens the ability of individuals to meet the needs and demands of the present society and helps them in dealing with the above issues in a manner, to get the desired behaviour practically. Sherif *et al.* (2023) observed that life skills education is helpful for preventive measures, promoting healthy positive behaviour, and strengthening communication and socialisation skills. In India, the CBSE (2005) introduced life skills education as an integral part of the curricula through continuous and comprehensive evaluation for students from Grades 6 to 10. Recent systematic and empirical studies indicate that both face-to-face, and digitally mediated life skills intervention programmes can positively affect adolescents' mental health and socio-emotional functioning, particularly when the interventions are theory-driven, culturally adapted, and include active learning components (Sherif *et al.*, 2023; Fernández-Batanero *et al.*, 2025).

Despite the established theoretical value of life skills education, there are different approaches followed to deliver life skills education in formal school settings as a stand-alone subject, or integrated curriculum, and measurement of immediate-term, short-term, and long-term outcomes from life skills education. Even though measurement tools such as self-rating scales, teacher-rating reports, and behavioural measure activities are widely used to assess the outcomes of the life skills education, they are not consistent and comparable (Singh and Menon, 2016). Furthermore, the psychometric instruments and training materials developed in one cultural context often perform poorly when transported without adaptation, yielding questionable construct validity and measurement equivalence (that is, items may not map onto local expressions of behaviour or reasoning), and resource constraints and variable teacher training can limit reliability of programme delivery, reducing the consistency of learning experiences of students across schools are the evident limitations and challenges in life skills education outcomes measurement mechanisms. These problems motivated the researchers to think about context-sensitive tools that combine validated measurement with accessible delivery modalities, for example, web-based instructional packages that embed multimedia content, automated assessments, and analytics for monitoring implementation fidelity.

The UNICEF (2019, p. 36) also emphasises providing access to life skills development programmes and delivering them in a safe and secure school environment and platforms.

It is also noted that digital life skills interventions are increasingly prominent in the literature because they promise standardisation, reach, and enhanced engagement of students through multimedia content, and interactive and personalised learning (Arkan and Bal, 2025). The randomised and quasi-experimental protocols of online life skills education programmes have begun to show effectiveness in improving coping, reducing psychological distress, and strengthening specific competencies when programmes are designed to be developmentally appropriate and culturally relevant (Sherif *et al.*, 2024; Fernández-Batanero *et al.*, 2025). Importantly, online programmes additionally permit automated data capture that facilitates psychometric evaluation (item functioning, reliability) and longitudinal tracking (pre-test → post-test → retention test), enabling both programme refinement and research-quality inference.

In India, and specifically in Kerala, educational stakeholders have prioritised socio-emotional learning and life skills education within school health initiatives, but rigorous and regionally validated digital tools to implement and assess the life skills education in secondary school settings remain scarce. Local adaptation matters, such as curricular examples, role-play

prompts, and assessment items, should reflect students' cultural idioms and school-life realities to maximise face and content validity. Studies in India have reported positive impacts of structured life skills training on depression, anxiety, stress, and social competence. However, many of these studies used a paper-based or teacher-led implementations with limited digital integration, and few studies reported detailed psychometric quality of the assessment instruments used (Ramakrishnan and Sylvia, 2024). This gap creates an opportunity for a web-based, psychometrically defensible system design, specifically for Kerala's secondary school context. Therefore, this paper aims to address this gap by describing the development, deployment, and initial validation of a Web-based Life Skills Instructional and Assessment System (WLSIAS) tailored for Grade 9 students of secondary schools in Kerala. The system is based on the WHO's ten-core life skills framework and iteratively designed after a pilot psychometric evaluation with 200 students of Grade 9 to ensure contextual relevance and acceptable measurement properties. WLSIAS integrates adaptive content management (admin-uploadable lesson documents and multimedia for each WHO-specified life skills domain); automated quiz generation and secure storage of pre-test, post-test, and retention-test scores; and built-in statistical analysis (paired t-tests, Wilcoxon signed-rank tests, Friedman ANOVA); and visualisations,

to summarise changes at both the skill-specific and overall levels. The WLSIAS thus combines educational delivery with real-time experience, and an evidence-generation tool, suitable for both practitioners and researchers.

This paper mainly focuses on the design and implementation of WLSIAS, describing system architecture, module composition, and workflow for admin and student modes. It reports psychometric and outcome evidence from the pilot deployment (N = 200), examining reliability, construct coherence, and pre-post-retention changes across the ten-core WHO life skills domain. It further illustrates how the embedded statistical routines and automated reporting support the classroom-level decision-making and programme refinement. The discussion situates empirical findings within existing evidence for life skills interventions and digital tools, and identifies practical considerations for scale-up in Kerala and comparable educational settings in India. Practically, combining culturally adapted instructional content, validated assessment instruments, and an accessible web-based delivery model, WLSIAS aims to bridge the long-standing divide between psychometric rigour and scalable pedagogy. The system's pilot results and implementation lessons, provide a replicable template for integrating life skills education, into school curriculum and leveraging digital platforms for rigorous programme implementation and evaluation.

LITERATURE REVIEW

The Assam Life Skills Framework (2023) broadly categorises the life skills into emotional skills, cognitive skills, and social skills. Further, it explains that life skills education helps adolescents in promoting the positive and healthy behaviours, healthy decision-making and sociability; improving communication abilities; enhancing self-management abilities, and emotion management abilities; and increasing self-esteem.

Yadav and Iqbal (2009) argued that imparting life skills education has a positive outcome when taught as a part of the curriculum in schools. The study carried out in Kerala by Suresh and Subramonian (2015) points out that life skills education is more focused on the development of arithmetic, writing, and reading skills in the majority of the schools. Albertyn *et al.* (2001) believed that life skills training enhances the critical thinking abilities, and further, it impacts living life actively, being responsible in the job and in future planning too.

Smith *et al.* (2006) noted that life skills education has created significant improvement in interpersonal relationships and a reduction in aggression and behavioural problems. The investigation of Tuttle *et al.* (2006) shows the extraordinary capability of teens to promote positive outcomes and flexibility due to the life skills training.

Vranda and Rao. (2011) proved that life skills training enhanced students' psycho-social competencies. Puspakumara (2011) in his study showed that life skills training was effective in preventing a wide range of problems such as substance abuse, teenage pregnancies, violence, bullying, and promotes self-confidence and self-esteem among the adolescents. Roodbari, Sahdipoor, and Ghale's (2013) research showed that life skills training has a positive effect and improves social development, and emotional and social adjustment among students.

Bandela and Chandrasekhar (2013) recommend life skills education for capacity building of a person, developing resiliency skills and preventing taking risks. Kumar *et al.* (2022) experimental study on the effectiveness of life skills training on academic performance among adolescents in Kollam, Kerala shows a positive impact in improving the academic performance of students. Annapurna and Lakshmi (2023) noted that life skills education is able to meet the changing needs of the professional, social, cultural, and economic life of humans, which demands an education that develops a complete personality, focusing on academic achievement.

Choudry and Bakshi (2024) found the dynamic interplay between education, life skills, and academic achievement in fostering well-rounded individuals. Kavitha *et al.* (2024) found a significant positive correlation between the level

of life skills and academic performance among nursing students in Thrissur. Verma (2024) observed that life skills education not only bridges the gap between basic functions and capabilities but also strengthens the individual's ability to meet the needs of the current society and helps in addressing the above issues. Halder (2024) suggests life skills education for the development of higher-order cognitive skills, as well as the socio-emotional competencies and character building among students.

A women's organisation in Kerala called 'Sakhi' works with young people, and the interventions have varied from its inception in 1998. The organisation offers life skills programmes to enhance the life skills of adolescent girls in the age group of 12-14, called "Adolescent Life Skill Education Programme (in Malayalam it is known as 'Viriyunna Mukulungal')." By 2015, it was able to enhance the life skills of 8322 young children from 71 panchayats of 12 districts of Kerala. A life skills programme known as 'Ullasapparavakal' was implemented by the SCERT (2018) of Kerala in selected 93 schools, during the academic year 2016-17, as a responsibility to children, and it was found that the life skills programme is beneficial for promoting a healthy attitude toward life among students.

Anand (2024) lists different kinds of training design models to provide life skills education to school students, to create a learning environment that directly addresses their specific needs

and difficulties faced by the teachers in classroom transaction of life skills curriculum, that includes the ADDIE Model, Successive Approximation Model, Bloom's Taxonomy Model, Kirkpatrick's Model, and Gagne's Nine Events Model. Further, it is suggested that a technology-enabled training design model in life skills training, as technology is revolutionising training delivery, making it more economical, flexible, and customised. Also, it is easy to reach out to the learners, possible to modify the content according to the needs and demands of the learners, and provides a consistent personalised learning experience to every learner. Over the past five years, there has been a notable shift toward integrating life skills within school health programmes while leveraging digital modalities to increase reach and standardise delivery (Singla *et al.*, 2020; Wani *et al.*, 2024).

The literature review identifies three broad streams relevant to designing and evaluating a regionally tailored, web-based life skills instructional and assessment system—core evidence for life skills programmes in low- and middle-income countries, psychometric and measurement concerns for life skills assessment, and promise and pitfalls of digital delivery and retention assessment.

Structured life skills curricula can reduce risky behaviours, improve psychosocial outcomes, and strengthen decision-making capabilities when implemented with

fidelity and contextual adaptation (Singla *et al.*, 2020). These syntheses emphasise core implementation ingredients of active learning, teacher facilitation, and community engagement while also noting heterogeneity in outcomes due to differences in delivery, dosage, and contextual stressors. More recent field trials in South Asia and Africa have extended these findings by testing shorter, modular programmes and after-school delivery formats, showing promise especially when local stakeholders shape content and examples (Ravindranath *et al.*, 2024). Collectively, this work argues that context-specific curricular examples and culturally aligned scenarios are necessary to realise reliable gains in adolescent competencies.

The psychometric quality of life-skills measurement remains central to credible programme evaluation. Studies deploying life skills instruments in diverse settings, often report variability in internal consistency, factor structure, and item performance, underscoring the need for pilot testing, item revision, and local validation (Singla *et al.*, 2020). A recent study emphasises the use of repeated measures designs (pre-post-retention tests) to evaluate both immediate learning and medium-term retention, and advocates for paired statistical tests alongside non-parametric alternatives where distributional assumptions are violated (Taylor *et al.*, 2024). Embedding psychometrically sound brief scales reduces measurement

error and enables meaningful interpretation of changes across the ten-core WHO-specified life skill domains, which is especially important when interventions are short and sample sizes in pilots are modest.

Digital and hybrid delivery platforms have gained traction as vehicles for life skills education because of their potential for scalability, standardisation, and data capture. Randomised trials of adolescent digital mental health and life-skills interventions report significant but modest effects on stress, rumination, and loneliness, with higher benefits for engaged users and for programmes that combine multimedia content with interactive tasks (Boucher *et al.*, 2024; Taylor *et al.*, 2024). Scoping and systematic reviews of digital mental health interventions for adolescents highlight that while digital mental health interventions can broaden reach, they are not a panacea, but engagement, equity of access, and the need for pedagogically sound content remain critical concerns (Wani *et al.*, 2024; Potts *et al.*, 2025). Program developers are therefore encouraged to integrate design features that enhance motivation (short modules, multimedia, quizzes) and to provide dashboards and exportable reports that support teacher-led follow-up.

Retention assessment is a practical dimension that has received comparatively less attention in school-based life skills education literature, though analogous research

in educational and skills training domains indicates that retention is influenced by opportunities for practice and reinforcement (Landman *et al.*, 2023). Short retention intervals are a reasonable starting point in pilot research to detect early decay in knowledge or application, and to inform whether booster activities are needed. For school systems, the feasibility of retention testing relies on minimal disruption to the class schedules and simple logistics and hence the appeal of web-based systems that can automate scheduling and scoring.

Implementation science considerations underscore that digital life skills platforms must be context-sensitive to allow administrators upload local-language lesson files, provide culturally resonant examples, and role-play activities, and to produce easy-to-interpret statistical summaries for teachers and policymakers (Taylor *et al.*, 2024; Zimmermann *et al.*, 2024).

Literature review also highlighted that automated analytics facilitate iterative item refinement, by flagging items with poor discrimination or differential functioning across subgroups and thereby improving the psychometric robustness of scales over time. Taken together, these strands justify the present study's combination of local psychometric piloting with 200 Grade 10 students, an administratively controlled content management system to ensure cultural fit, and automated analytics to support continuous measurement

improvement and evidence-based decision making.

METHODOLOGY

This paper presents the development of a Web-based Life Skills Instructional and Assessment System (WLSIAS), a comprehensive digital platform designed to train and evaluate the life skills of secondary school students in Kerala. The system is built on the WHO-specified ten-core life skills framework: self-awareness, empathy, critical thinking, creative thinking, decision making, problem solving, communication, interpersonal skills, coping with stress, and coping with emotions. This digital platform integrates instructional delivery, adaptive assessment, and psychometric data analysis into a single, interactive environment.

The WLSIAS platform was developed using the Python Flask microframework on two user modes: Student Mode and Administrator Mode, each serving a distinct pedagogical or administrative role. The system employs a client-server architecture with a lightweight SQLite backend for data persistence, and a JSON-based content repository to store skill-specific lessons, multimedia materials, and quiz question banks. It enforces a structured pedagogical flow through three assessment phases: pre-test, post-test, and retention-test, thereby quantifying both skill acquisition and retention. The following subsections detail the complete

implementation and workflow of the system, beginning with the student-oriented components, followed by the administrative and analytical subsystems.

SYSTEM ARCHITECTURE

The overall architecture of the WLSIAS is organised under four functional layers. The Presentation Layer encompasses all visual and interactive interfaces for students and administrators. It supports user authentication, navigation, and content rendering, providing an intuitive and responsive environment for accessing lessons and assessments. The Application Logic Layer governs the system's operational flow, including routing, access control, content management, quiz generation, scoring mechanisms, and statistical evaluation. It serves as the central control unit that coordinates communication between the interface and the data components. The Data Layer manages structured storage of user profiles, assessment scores, and analytical outcomes through a relational database system. Complementing this, a structured content repository maintains metadata for each life skill, encompassing learning objectives, textual lessons, multimedia resources, and question banks. The Storage and Media Layer handles persistent storage of educational documents, audio-visual learning materials, statistical reports, and visual analytics outputs. During

system initialisation, necessary data structures and directories are automatically verified to ensure operational integrity. The modular representation of skill data allows new life skill domains to be integrated or existing ones to be modified seamlessly without necessitating changes to the underlying database or programme logic. This flexible design supports the continuous evolution of the instructional package as educational requirements expand. Fig. 1 depicts the architectural design of the WLSIAS framework, and the corresponding homepage interface is shown in Fig. 2.

Student Mode

The Student Mode of WLSIAS is dedicated to learners’ engagement and assessment. It provides an adaptive environment where students can register and access life skills modules,

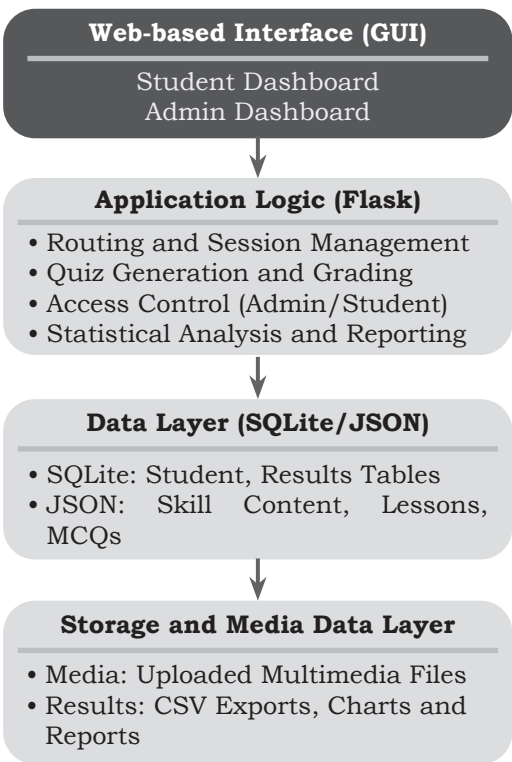


Fig. 1: Overall architecture of the WLSIAS framework

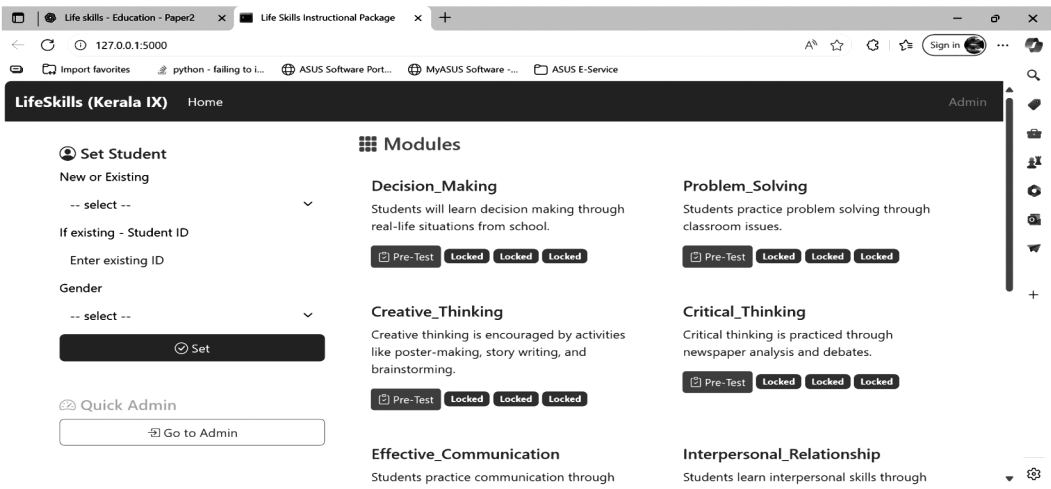


Fig. 2: Homepage interface of the WLSIAS framework

complete assessments, and review their performance progress. The system enforces a structured learning cycle—Pre-test → Intervention → Post-test → Retention-test, that aligns with outcome-based education principles and supports both self-assessment and guided improvement.

Student Identification and Session Management

Fig. 3 indicates the student registration process, which enables each learner to create a unique profile within the system. Basic demographic information, like gender, is collected to support later analytical stratification and comparative performance studies. Once registered, the system securely maintains the student's identity through session management mechanisms, that track login states, test attempts, and performance history.

This structure ensures data isolation and individual accountability while providing continuity across multiple learning sessions. Each student's learning journey is thus securely tied to their personal profile and supports accurate longitudinal evaluation.

Module Access and Instructional Flow

Each module within the system represents one of the WHO-specified life skills domains. The learner interface provides access to all available modules. However, entry into each module follows a pedagogically enforced sequence. The learner must first complete the pre-test to establish a baseline measure before accessing the instructional materials.

After the pre-test, the system grants access to the associated

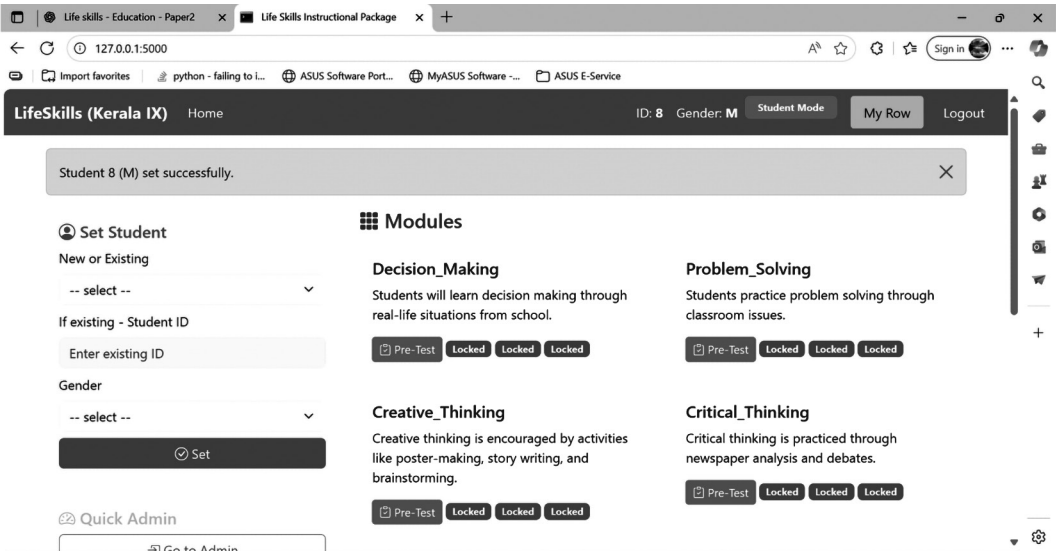


Fig. 3: Student dashboard interface following successful login

learning materials, which may include text-based lessons, interactive exercises, and multimedia content, such as images, audio narratives, and video demonstrations. This multimodal approach supports diverse learning styles and promotes higher engagement of students. Upon completion of the learning

phase, students are directed to the post-test stage, to evaluate learning progress. The retention-test phase, conducted after a defined time interval, examines the sustainability of the learning outcomes.

Quiz Generation and Presentation

The assessment component of each module is based on dynamically

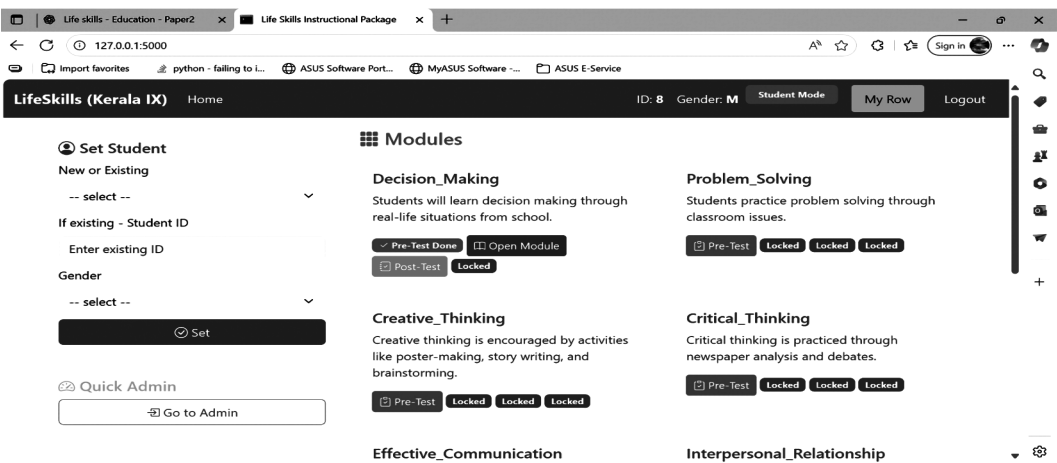


Fig. 4: Access to learning materials after completing the pre-test for the Decision Making module

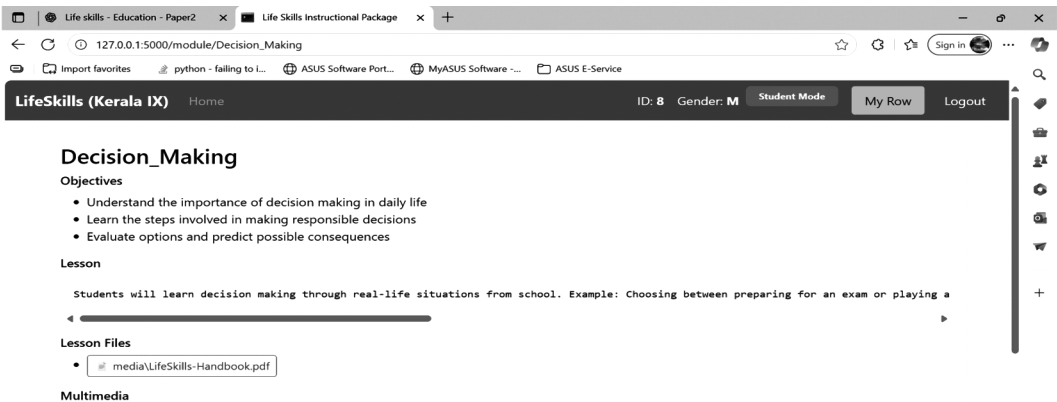


Fig. 5: Learning materials with lesson files and multimedia content for the Decision Making module

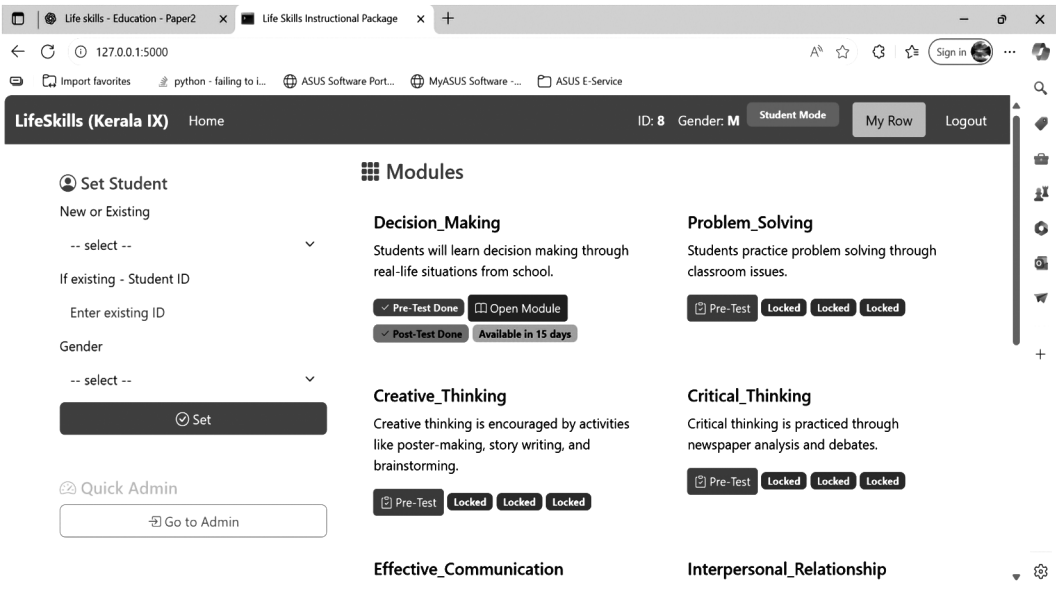


Fig. 6: Countdown initiation for the retention-test after completing the post-test in the decision-making module

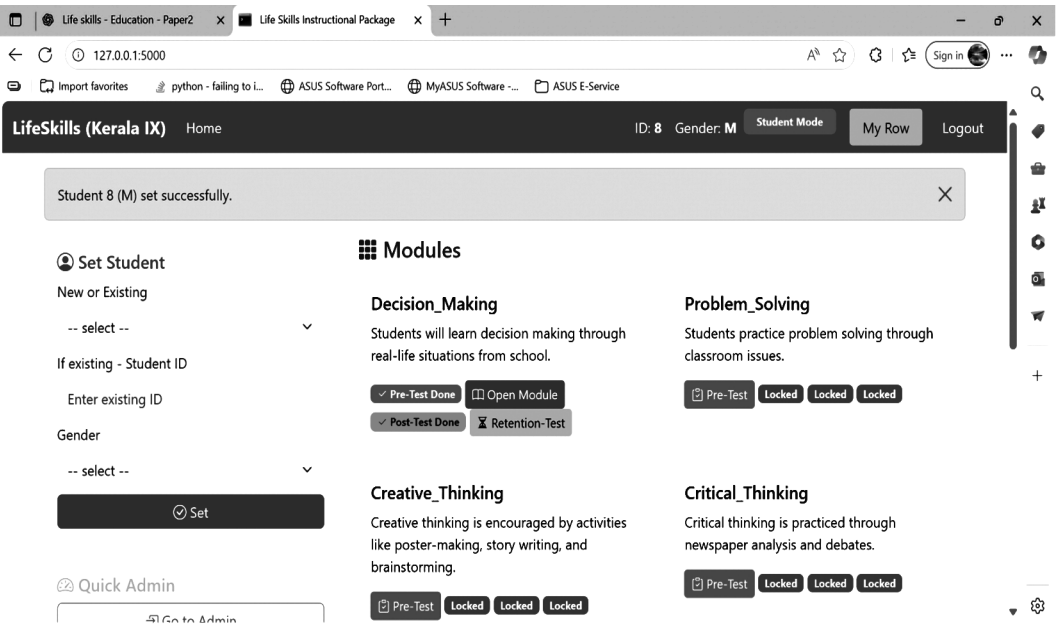


Fig. 7: Retention-test enabled after countdown completion for the decision-making module

generated multiple-choice questions derived from the corresponding question bank. For each test instance, a balanced set of questions is selected randomly to ensure variation and minimise recall bias. Each question includes multiple options with a single correct response, and the system records both the questions served and the responses submitted by the respondents to maintain the integrity of the evaluation.

This automated generation mechanism ensures consistent test difficulty across users and supports repeated administration without compromising assessment fairness.

Quiz Grading and Result Persistence

Once the learner submits the assessment, the system automatically evaluates the responses and computes the corresponding score. It records

the results across all test phases—pre-test, post-test, and retention-test, enabling both skill-specific and overall performance tracking. To ensure measurement reliability, the system continuously maintains cumulative statistics, including mean and aggregated performance indices. In the post-test stage, the completion timestamp is logged to regulate eligibility for the retention test, which can only be attempted after a specified time interval of 15 days.

The platform provides real-time feedback to learners. If the performance in the post-test does not surpass the pre-test score, the system generates targeted feedback encouraging revision of relevant materials. Similarly, retention feedback is offered to reinforce sustained understanding and long-term application of learned skills.

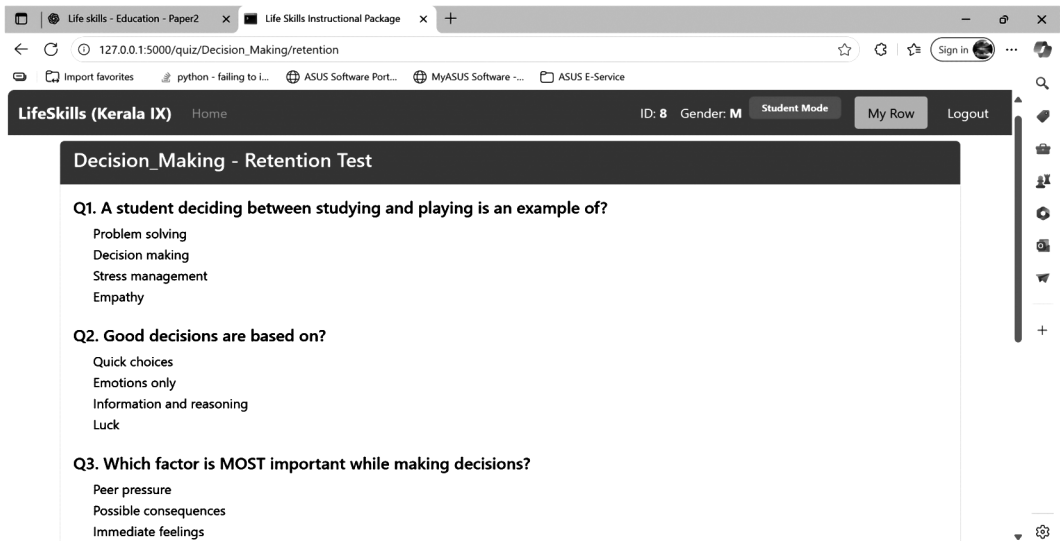


Fig. 8: Dynamically generated multiple-choice assessment for each life skill module

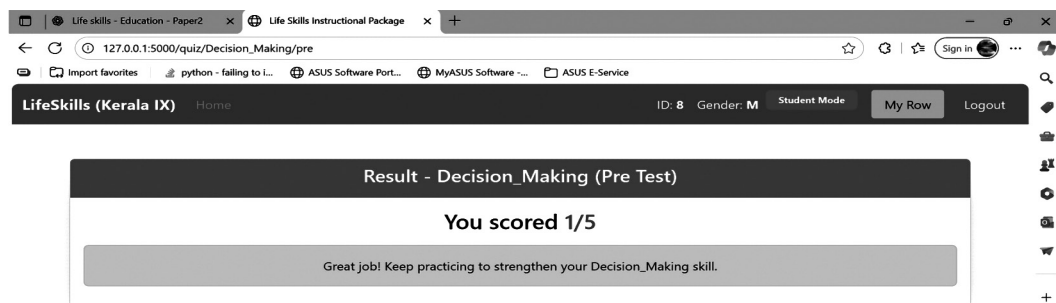


Fig. 9: Score and real-time feedback to the students after completing the pre-test

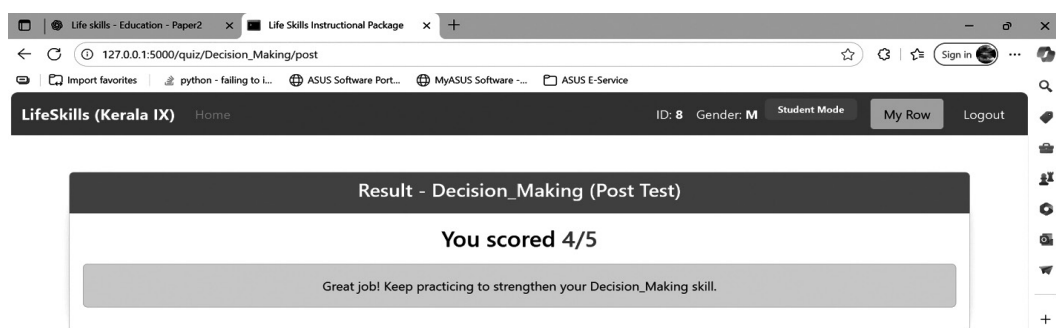


Fig. 10: Score and real-time feedback to the students after completing the post-test

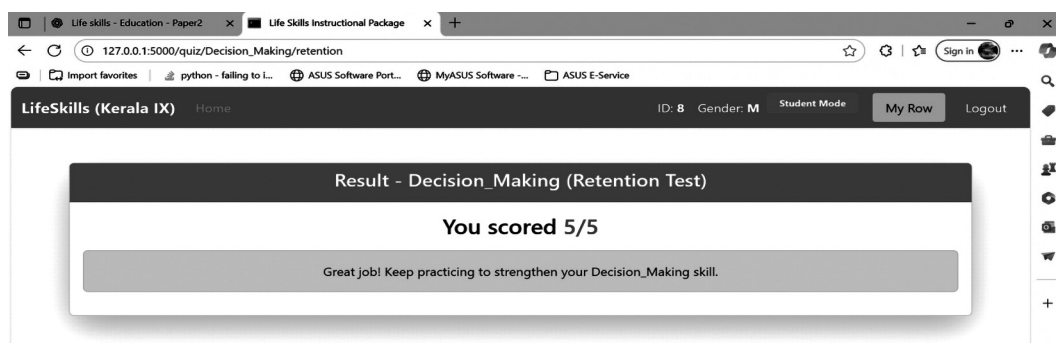


Fig. 11: Score and real-time feedback to the students after completing the retention-test

Data Visualisation and Review

A dedicated performance dashboard enables students to view the detailed summaries of their results, encompassing both skill-wise and aggregate scores. This visual feedback

allows students to identify their strengths and weaknesses across life skill areas and supports reflective learning. The design encourages self-directed improvement and fosters intrinsic motivation for skill mastery.

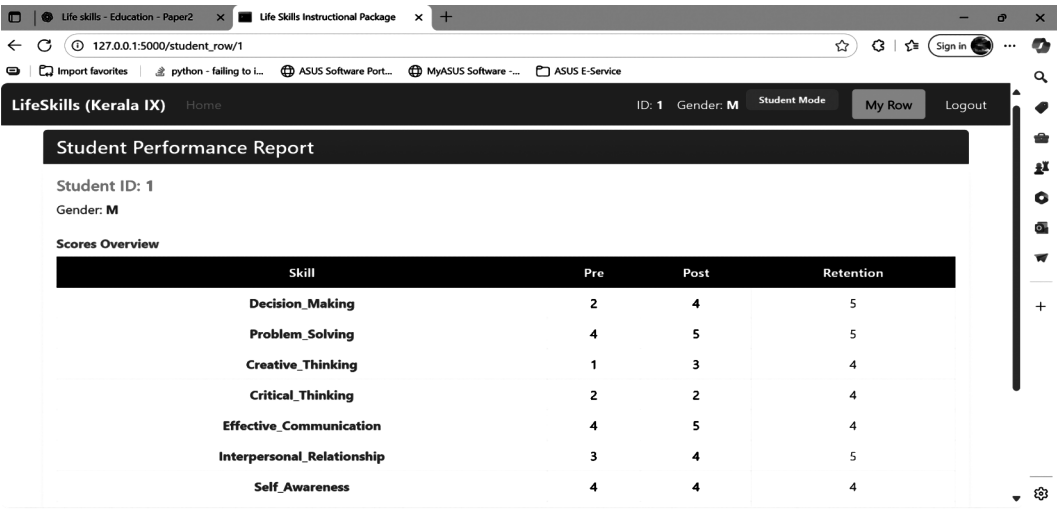


Fig. 12: Student performance report displaying skill-wise and aggregate scores

ADMIN MODE

The Admin Mode provides educators, researchers, and programme administrators with tools for content management, learner monitoring, data analysis, and report generation. It functions as the supervisory and analytical control centre of the WLSIAS platform.

Authentication and Role Control

Admin access is restricted through password authentication to ensure that only authorised personnel can manage instructional and assessment data. Once validated, the system grants access privileges associated with administrative functions, including editing modules, uploading

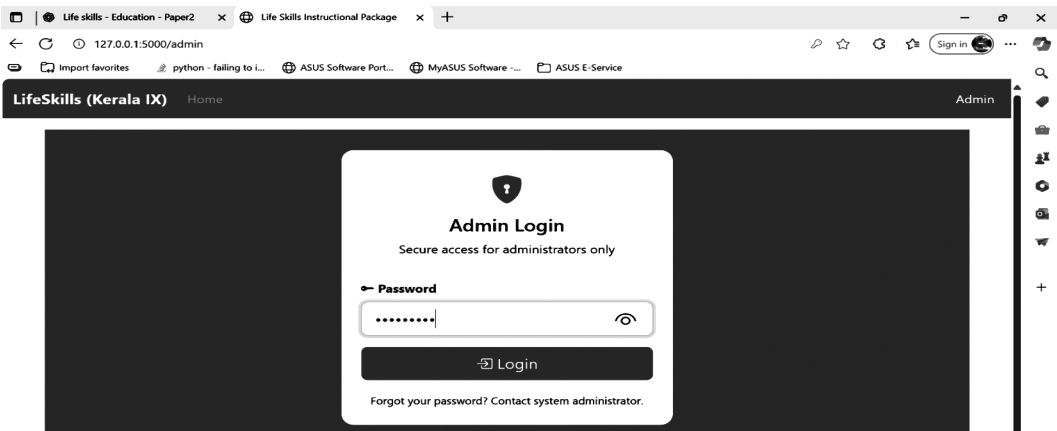


Fig. 13: Admin login authentication

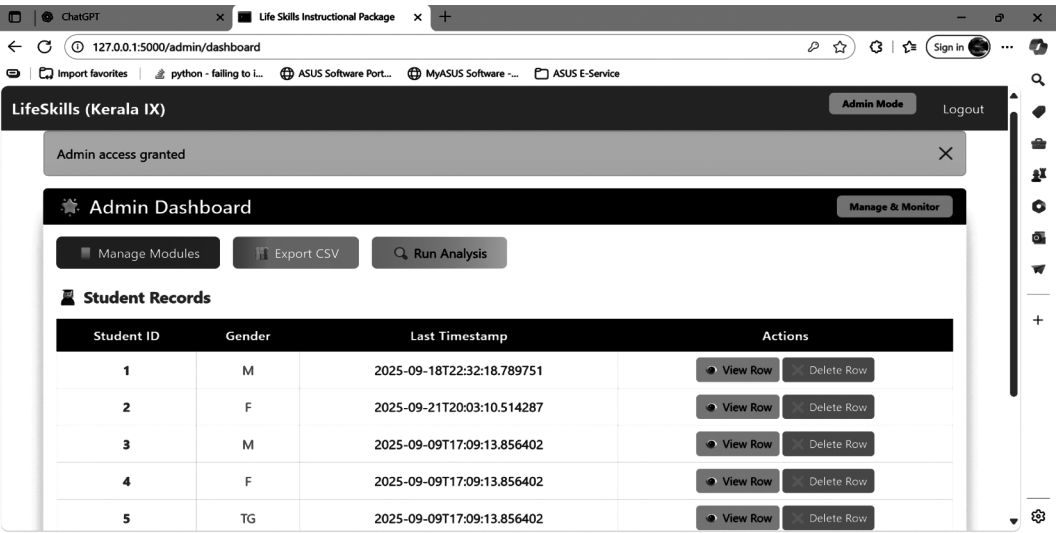


Fig. 14: Admin dashboard interface following successful login

materials, and conducting statistical evaluations. For production-grade deployments, the architecture supports integration of encrypted credentials and multi-level access control policies to enhance data security and accountability.

Content Management and Media Uploads

The content management subsystem enables admins to upload, organise, and maintain instructional materials corresponding to each life skill module. Supported formats

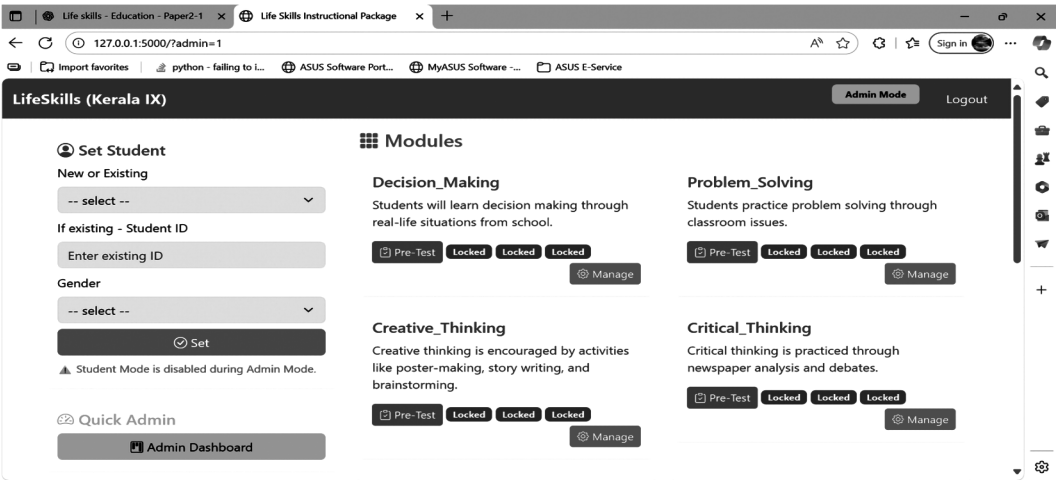


Fig. 15: Content management for each life-skill module enables handling of the contents

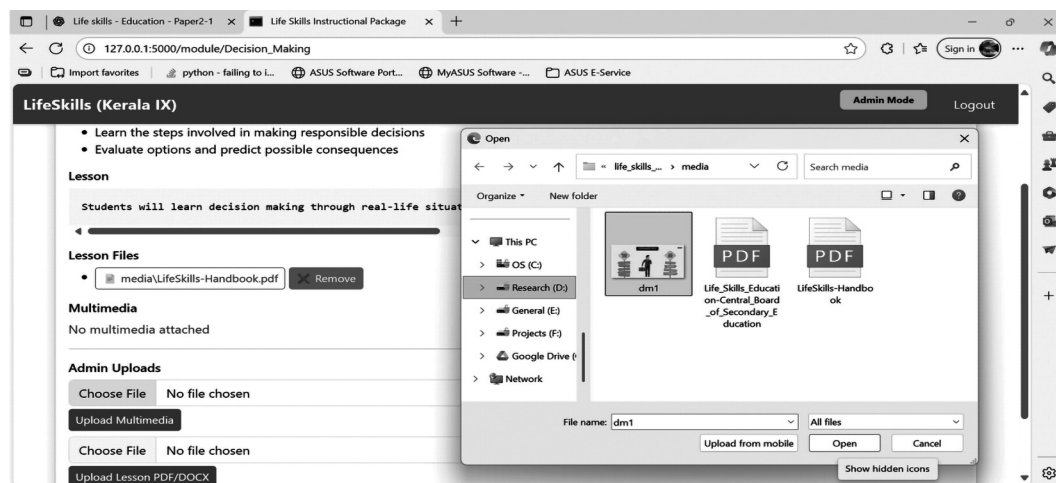


Fig. 16: Selection and uploading of multimedia images and materials for decision-making module

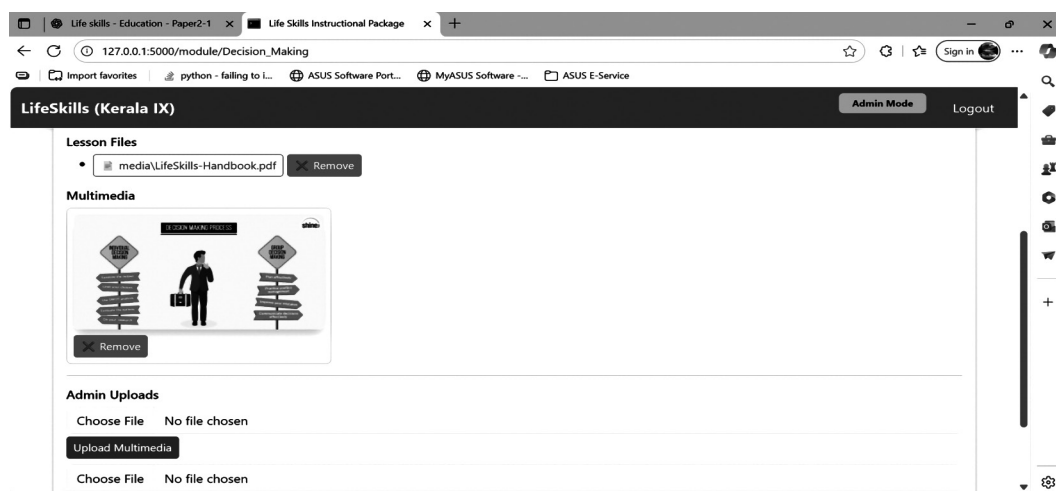


Fig. 17: Uploaded contents of the decision-making module, such as lesson files and multimedia images

include text documents, slides, and multimedia assets. Each uploaded item is categorised automatically based on its format and linked to the appropriate skill domain within the repository. The modular content structure allows continuous

enhancement of materials and contextual adaptation for different learner populations. Admin may modify, replace, or remove content at any time to ensure training materials remain current and pedagogically aligned.

Data Management

The admin dashboard presents comprehensive student records, including demographic details, progress metrics, and test completion history. Admin can filter, review, or remove student records when required, maintaining

compliance with privacy regulations. An integrated export feature allows the admin to generate data files summarising learners’ results for external analysis or institutional reporting. These exports include individual and aggregated statistics, supporting evidence-based decision-making and programme evaluation.

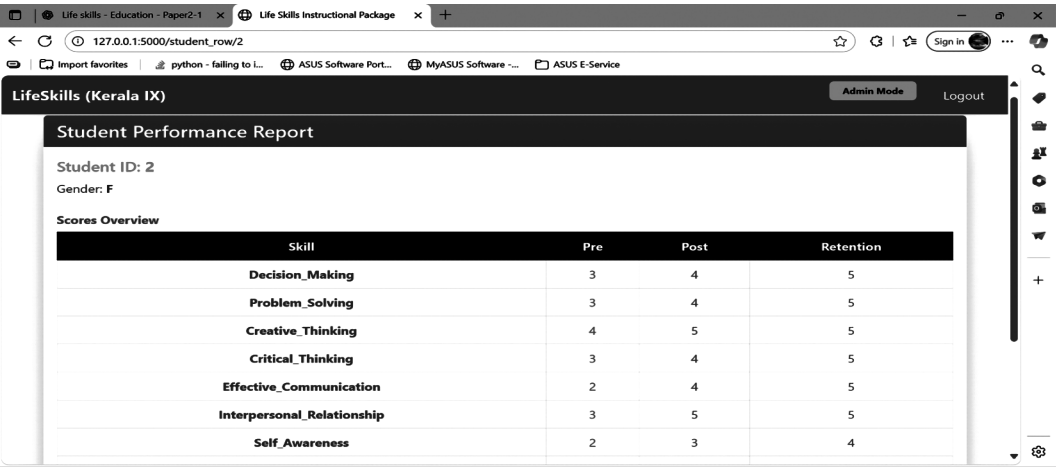


Fig. 18: Student’s performance report (admin mode)

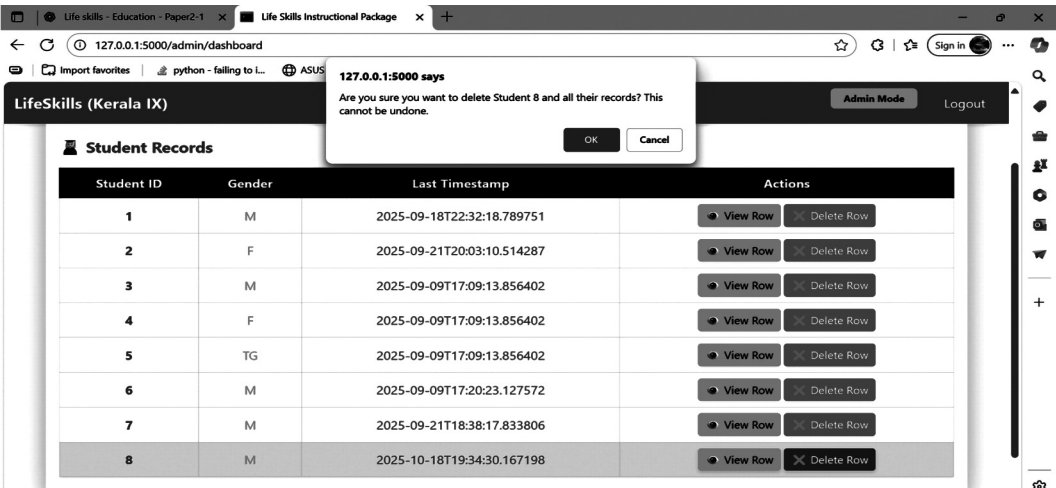
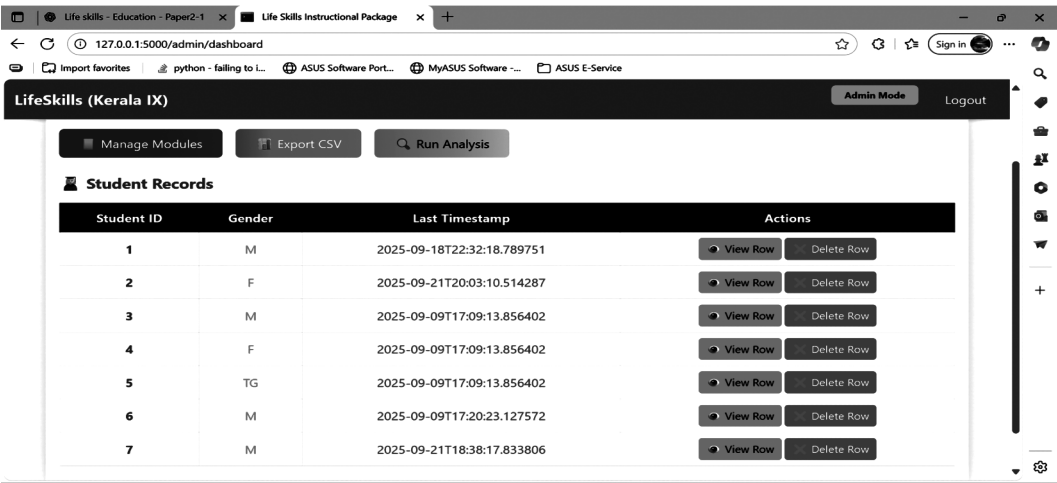


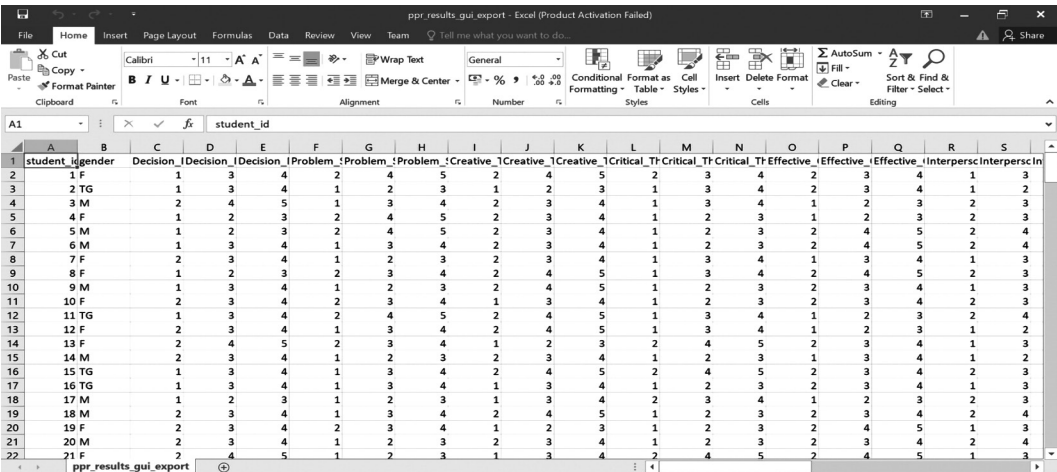
Fig. 19: Remove the student’s record if the admin decides that it is not required



The screenshot shows the 'LifeSkills (Kerala IX)' Admin Mode dashboard. At the top, there are tabs for 'Manage Modules', 'Export CSV', and 'Run Analysis'. Below these is a section titled 'Student Records' containing a table with the following data:

Student ID	Gender	Last Timestamp	Actions
1	M	2025-09-18T22:32:18.789751	<button>View Row</button> <button>Delete Row</button>
2	F	2025-09-21T20:03:10.514287	<button>View Row</button> <button>Delete Row</button>
3	M	2025-09-09T17:09:13.856402	<button>View Row</button> <button>Delete Row</button>
4	F	2025-09-09T17:09:13.856402	<button>View Row</button> <button>Delete Row</button>
5	TG	2025-09-09T17:09:13.856402	<button>View Row</button> <button>Delete Row</button>
6	M	2025-09-09T17:20:23.127572	<button>View Row</button> <button>Delete Row</button>
7	M	2025-09-21T18:38:17.833806	<button>View Row</button> <button>Delete Row</button>

Fig. 20: Sample updated students' details (admin dashboard)



The screenshot shows an Excel spreadsheet titled 'ppr_results_gui_export - Excel (Product Activation Failed)'. The spreadsheet contains a table with the following data:

student_id	gender	Decision_1	Decision_2	Decision_3	Problem_1	Problem_2	Problem_3	Creative_1	Creative_2	Creative_3	Critical_1	Critical_2	Critical_3	Effective_1	Effective_2	Effective_3	Interpers_1	Interpers_2	Interpers_3
1	F	1	3	4	2	4	5	2	4	5	2	3	4	2	3	4	4	1	3
2	TG	1	3	4	1	2	3	1	2	3	1	3	4	2	3	4	1	2	3
3	M	2	4	5	1	3	4	2	3	4	1	3	4	1	2	3	2	3	4
4	F	1	2	3	2	4	5	2	3	4	1	2	3	1	2	3	2	3	4
5	M	1	2	3	2	4	5	2	3	4	1	2	3	2	4	5	2	4	3
6	M	1	3	4	1	3	4	2	3	4	1	2	3	2	4	5	2	4	3
7	F	2	3	4	1	2	3	2	3	4	1	3	4	1	3	4	1	3	2
8	F	1	2	3	2	3	4	2	4	5	1	3	4	2	4	5	2	3	4
9	M	1	3	4	1	2	3	2	4	5	1	2	3	2	3	4	1	3	2
10	F	2	3	4	2	3	4	1	3	4	1	2	3	2	3	4	2	3	4
11	TG	1	3	4	2	4	5	2	4	5	1	3	4	1	2	3	2	4	3
12	F	2	3	4	1	3	4	2	4	5	1	3	4	1	2	3	1	2	4
13	F	2	4	5	2	3	4	1	2	3	2	4	5	2	3	4	1	3	2
14	M	2	3	4	1	2	3	2	3	4	1	2	3	1	3	4	1	2	3
15	TG	1	3	4	1	3	4	2	4	5	2	4	5	2	3	4	2	3	4
16	TG	1	3	4	1	3	4	1	3	4	1	2	3	2	3	4	1	3	2
17	M	1	2	3	1	2	3	1	3	4	2	3	4	1	2	3	2	3	4
18	M	2	3	4	1	3	4	2	4	5	1	2	3	2	3	4	2	4	3
19	F	2	3	4	2	3	4	1	2	3	1	2	3	2	4	5	1	3	2
20	M	2	3	4	1	2	3	2	3	4	1	2	3	2	3	4	2	4	3
21	F	2	4	5	1	2	3	1	3	4	2	4	5	2	4	5	1	3	2

Fig. 21: Database export to CSV for external analysis

Statistical Analysis

A significant key feature of the WLSIAS platform lies in its built-in analytics and automated reporting module. The system performs statistical comparisons across test phases to evaluate the effectiveness of life skills training. For each skill

domain, paired-sample t-tests and non-parametric alternatives (for example, Wilcoxon signed-rank tests) are used to measure learning gains between pre- and post-test phases, while repeated-measures analyses such as the Friedman test and ANOVA, evaluate longitudinal performance across all three phases.

Visual analytics are generated to illustrate mean performance trends and statistical significance levels across life skills. The system also produces comprehensive analytical summaries and formatted reports, containing tables and charts, for research dissemination and administrative review. These aspects are discussed in detail in the results and discussion section, along with the corresponding tables and charts.

DATABASE SCHEMA AND MIGRATION

The database schema is designed for dynamic adaptability. During initialisation, the system verifies the existence of required data structures and extends them automatically when new skills are introduced. Columns representing each skill and corresponding test phase are created or updated as necessary, ensuring the backward compatibility and continuous data integrity. The modular schema and automated migration procedures reduce the need for manual database intervention, minimise human error, and promote scalability across multiple institutions.

RESULTS AND DISCUSSION

In this study, the WLSIAS framework was experimentally evaluated with a cohort of 200 Grade 9 students from Secondary Schools in Kasaragod District, Kerala. The experimental procedure followed a structured three-phase evaluation sequence in accordance with the WHO's life

skills education model. Initially, each participant completed a pre-test to establish a baseline measure of knowledge and skill proficiency. Subsequently, students underwent a training phase using the system's interactive lesson materials and multimedia learning content specifically designed for each life skill. Following the completion of training, participants undertook a post-test to assess knowledge acquisition and skill enhancement.

After an interval of 15 days, a retention-test was administered to evaluate the sustainability of learning outcomes and to determine whether students effectively retained their acquired knowledge in each skill domain. The scores obtained across all three test phases were subjected to statistical evaluation using both the parametric and non-parametric methods, including paired-sample t-tests, Wilcoxon signed-rank tests, Friedman tests, and ANOVA to analyse longitudinal performance variations and validate the efficacy of the training.

The comparative results of the pre-test, post-test, and retention-test are summarised in Table 1, while their visual representations are shown in Fig. 22 and Fig. 23. The statistical analyses clearly reveal that the proposed system effectively enhances both immediate learning and long-term knowledge retention among secondary school students.

Table 1
Summary of Statistical Analysis Report for each Life Skill

Skill	Mean Pre-test	Mean Post-test	Mean Retention test	p-Value Pre-test	p-Value Post-test	Friedman Test p-Value	ANOVA p-Value
Decision Making	2.571	3.714	4.571	0.0047	0.0453	0.0060	0.0002
Problem Solving	2.571	3.429	4.286	0.0010	0.0167	0.0019	0.0050
Creative Thinking	1.857	3.571	4.286	0.0001	0.0082	0.0013	0.0001
Critical Thinking	1.857	3.286	4.714	0.0082	0.0004	0.0011	0.0000
Effective Communication	2.143	3.571	4.571	0.0004	0.0382	0.0043	0.0006
Interpersonal Relationship	2.000	3.857	4.429	0.0000	0.0300	0.0015	0.0000
Self-awareness	2.429	3.429	4.429	0.0038	0.0038	0.0025	0.0002
Empathy	2.143	2.857	4.286	0.0465	0.0004	0.0021	0.0000
Coping with Emotions	2.000	3.143	4.286	0.0300	0.0002	0.0015	0.0000
Coping with Stress	2.429	3.429	4.571	0.0038	0.0047	0.0015	0.0001

Across all life skill modules, a marked increase in mean scores was observed from the pre-test to post-test phase, indicating a strong positive impact of training through instructional materials and multimedia components. The paired-sample t-test and Wilcoxon signed-rank test results confirmed that these improvements were statistically significant ($p < 0.05$) for all ten life skills. The Friedman test and ANOVA analyses further verified consistent longitudinal gains across the three assessment phases, substantiating the robustness of the training programme.

As illustrated in Fig. 22, the post-test scores exhibited an average improvement of 25–35 per cent over the baseline pre-test values across most skills, with the highest gains recorded in interpersonal relationships, decision making, critical thinking, and effective communication.

The retention-test scores, presented in Fig. 23, remained relatively stable with only a minor decline of 3–5 per cent compared to the post-test results, demonstrating effective knowledge retention after a 15-day time interval.

These outcomes validate the pedagogical efficacy of the WLSIAS

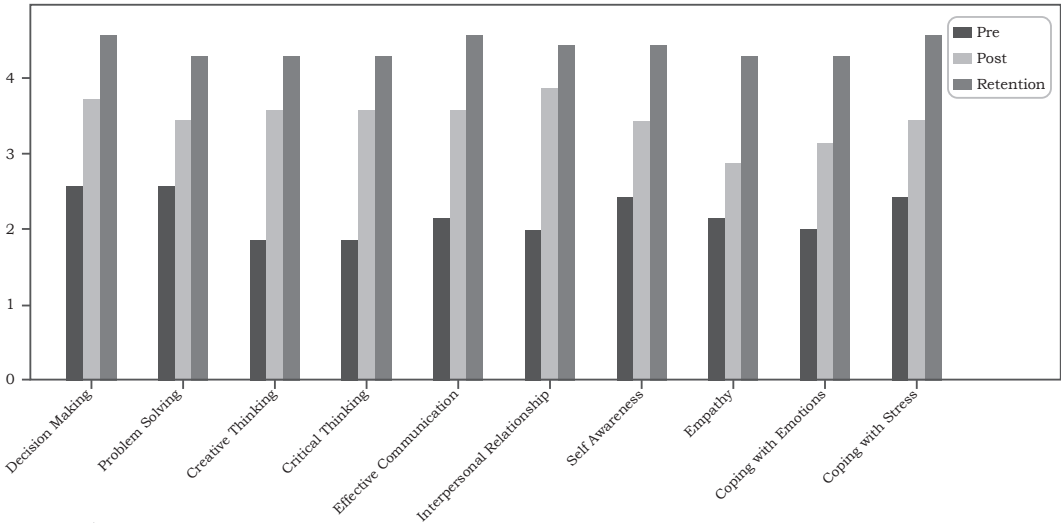


Fig. 22: Comparison of pre-test and post-test mean scores across the ten-core WHO-specified life skill domains using the WLSIAS framework

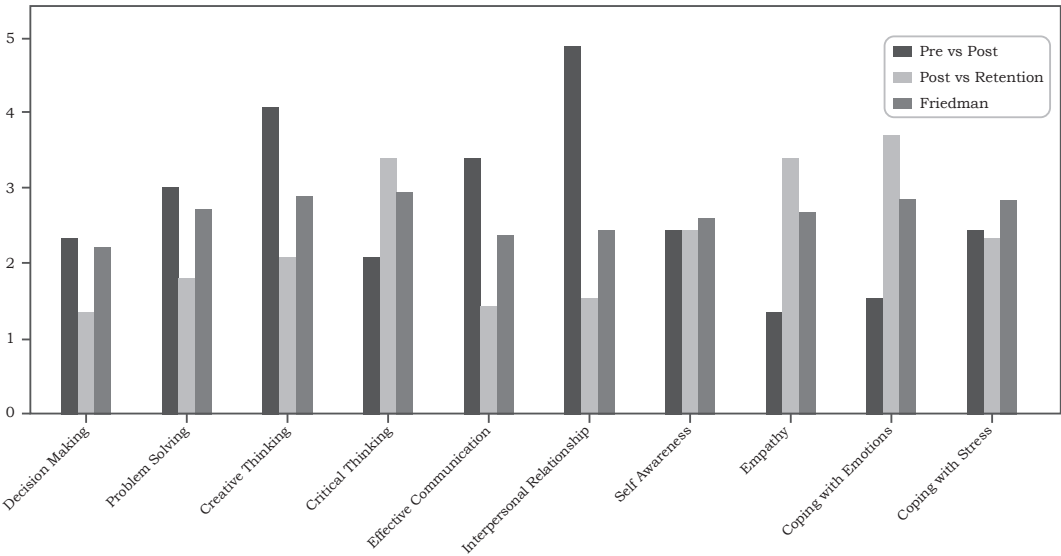


Fig. 23: Comparative analysis of post-test and retention-test mean scores illustrating knowledge retention across the ten life skill domains

framework and its ability to reinforce the sustained learning through structured, interactive, and contextually relevant content.

Furthermore, the integrated feedback mechanism within WLSIAS played a key role in reinforcing conceptual understanding by providing students

with a personalised performance summaries and targeted recommendations after each test phase. This formative feedback loop fostered self-reflection and facilitated improved performance in subsequent assessments. The statistically significant gains and stable retention outcomes collectively establish WLSIAS as a credible and scalable model for digital life skills training within secondary school environments.

CONCLUSION

The present paper introduced and validated a Web-based Life Skills Instructional and Assessment System (WLSIAS) designed in alignment with the World Health Organization's ten-core life skills framework. The system was systematically developed to integrate digital pedagogy, adaptive assessment, and psychometric rigour within a unified technological environment. By incorporating structured pre-test, post-test, and retention-test phases, the WLSIAS framework provided a reliable mechanism for evaluating both the immediate learning gains and long-term knowledge retention among secondary school students. The experimental implementation involving 200 Grade 9 students from secondary schools in Kasaragod District, Kerala, demonstrated that this system significantly improved learners' conceptual understanding and application of life skills. The statistical results from paired-sample

t-tests, Wilcoxon signed-rank tests, Friedman tests, and ANOVA analyses confirmed that the post-training scores showed substantial enhancement over baseline performance, while retention outcomes indicated minimal decay after a 15-day time period. These findings collectively validate the pedagogical effectiveness and psychometric soundness of the WLSIAS framework for structured life skills training.

Beyond its educational utility, this system carries important societal implications. By fostering essential cognitive, emotional, and interpersonal competencies through a contextually adapted, digital learning ecosystem, WLSIAS contributes to building an emotionally resilient, socially responsible, and self-aware youth populations. The use of multimedia-assisted training and real-time feedback mechanisms further enhances learners' engagement and inclusivity, making it particularly suitable for large-scale adoption in school-based life skills training programmes. From a technological perspective, WLSIAS exemplifies an innovative model for digitally-enabled, data-driven life skills instruction. Its modular design, automated assessment pipeline, and integrated analytics establish a replicable blueprint for educational institutions seeking scalable and evidence-based interventions.

Looking ahead, future research will focus on expanding this system's capabilities through AI-driven adaptive

learning, multilingual content integration, and cross-cultural validation studies to generalise its applicability across different educational and socio-economic contexts. Further, embedding machine learning-based predictive analytics could enhance personalised training pathways and early identification of learners needing targeted interventions.

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