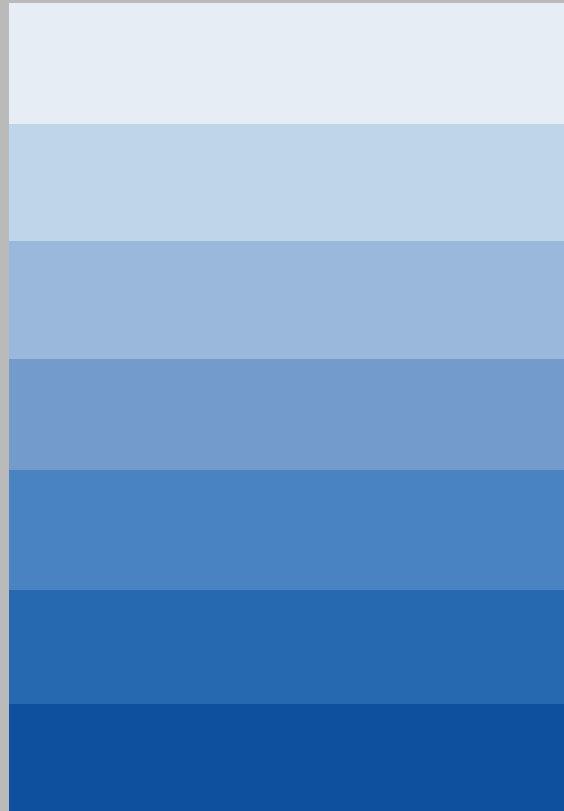


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**Bridging Theory and Practice: Exploring Advanced Level
Biosystems Technology Teachers' Approaches to Embedding
21st-Century Skills in Education**

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ABSTRACT

This study explores the perceptions, challenges, and strategies of 200 Advanced Level Biosystems Technology teachers in Sri Lanka regarding the integration of 21st-century skills—including critical thinking, creativity, collaboration, communication, and digital literacy, into their teaching practices. Employing a mixed-methods approach, the research combined quantitative data from Likert-scale questionnaires with qualitative insights from open-ended responses to offer a comprehensive view of the effectiveness of skill integration. The findings revealed a strong consensus among educators on the importance of these skills for fostering adaptability, innovation, and lifelong learning. Teachers reported using pedagogical approaches such as project-based learning and collaborative problem-solving to enhance student engagement and skill development. However, significant barriers were identified, including rigid and content-heavy curricula, limited access to resources, and inadequate professional development opportunities. Additionally, a lack of technological integration and limited access to digital tools, particularly in under-resourced areas, were highlighted as critical challenges. The study concluded with a call for systemic reforms that prioritize skill development over rote learning, advocate for equitable resource distribution, and emphasize ongoing professional development. By addressing these challenges, the research advocates for an educational transformation that empowers students to become critical thinkers and leaders in a rapidly globalizing world.

Keywords: *Biosystems technology, Educational transformation,
Teaching-learning process, Mixed-methods approach*

INTRODUCTION

Biosystems Technology is an interdisciplinary field that applies principles of biology, technology, and engineering to develop sustainable solutions for managing biological systems. In Sri Lanka, Biosystems Technology is a specialized subject offered under the Advanced Level technology stream, designed to prepare students for careers in agriculture, environmental conservation, food production, and sustainable development. The curriculum emphasizes 21st-century skills, equipping students to tackle real-world challenges in bioengineering, resource management, and sustainable practices. It encourages innovation and the development of eco-friendly solutions, aligning with global trends in sustainability and technological advancements in the biological sciences.

The increasing emphasis on 21st-century skills in education highlights the urgent need to equip students with competencies essential for success in an interconnected and dynamic world. Critical thinking, creativity, collaboration, communication, and digital literacy have become foundational to modern teaching and learning processes (Agaoglu & Demir, 2020). As global education systems adapt to these demands, teachers play a pivotal role in integrating these skills into classroom practices (Schleicher, 2012). However, the implementation of 21st-century skills faces significant challenges. Rigid and content-heavy curricula, limited

access to resources, and inadequate professional development opportunities create barriers to embedding these competencies in daily teaching (Burns, 2023).

Despite the importance of these skills, there is limited research on how these skills can be effectively implemented within specific subjects, such as Biosystems Technology at the Advanced Level. Given the interdisciplinary and applied nature of Biosystems Technology, understanding teachers' perceptions, strategies, and challenges in integrating 21st-century skills is essential for identifying gaps in current educational practices and informing the design of targeted interventions to support educators. This study addresses a critical gap in the literature by exploring the unique context of Biosystems Technology education in Sri Lanka, where limited empirical evidence exists on how 21st-century skills are being integrated into this subject area.

To address this gap, a teacher training program was conducted by the National Institute of Education, Sri Lanka, in 2023, aimed at equipping Biosystems Technology teachers with the knowledge and skills to incorporate 21st-century skills into their teaching practices. Three months following the training, a questionnaire was administered to the participating teachers to gather feedback on their perceptions of the importance of these skills, the strategies they employed to integrate them into their classrooms, and the challenges they encountered in doing

so. The research findings will contribute valuable empirical evidence to inform future curricular reforms, teacher training programs, and professional development initiatives, ensuring that the integration of 21st-century skills in Biosystems Technology education is both effective and sustainable.

The primary aim of this research is to comprehensively examine the role and implementation of 21st-century skills in educational settings, with a focus on Advanced Level Biosystems Technology teachers in Sri Lanka. The specific objectives of the study are as follows:

1. To explore teachers' perceptions of the importance of 21st-century skills in teaching and learning.
2. To investigate the strategies employed by teachers to integrate these skills into their practices.
3. To identify the challenges faced by teachers in embedding 21st-century skills in the classroom.
4. To assess teachers' perceptions of the effectiveness of current approaches and resources for integrating these skills.

By addressing these objectives, the study provides valuable insights into current pedagogical strategies and identifies areas for improvement, thereby contributing to the development of future educational policies and initiatives aimed at fostering 21st-century competencies. The findings of this research are expected to inform educational stakeholders in designing more effective support systems for teachers, ultimately enhancing

students' preparedness for an increasingly complex and interconnected global environment.

METHODOLOGY

2.1. Sampling and study design

For robust and comprehensive understanding of the research problem, the study adopted a mixed methods approach, which integrates both quantitative and qualitative data collection methodologies. This approach is widely recognized for its ability to combine the statistical power of quantitative research with the depth of qualitative inquiry, thus enabling a more holistic understanding of the phenomenon being studied (Creswell & Plano Clark, 2023; Johnson et al., 2007).

The study was conducted with a total of 200 Advanced Level Biosystems Technology teachers, who had participated to the teacher training program conducted by National Institute of Education representing both Sinhala and Tamil medium, from all nine provinces of Sri Lanka. For the quantitative component, stratified random sampling was used to ensure representation across all provinces. This method, commonly applied in educational research, minimizes selection bias and increases the external validity of the findings by ensuring that each subgroup (in this case, province and language medium) is appropriately represented (Singh & Masuku, 2014). Stratified random sampling is particularly effective in educational contexts, where demographic factors such as region or medium of instruction can significantly

influence the research outcomes (Nugba, 2020). In contrast, the qualitative component relied on purposive sampling to capture a diversity of experiences and perspectives. Purposive sampling is often employed in qualitative research to ensure most relevant and insightful information (Campbell et al., 2020).

2.2. Data collection instruments

The questionnaire was self-designed based on an extensive review of relevant literature, with selected items carefully adapted to align with the specific cultural and educational context of the local setting. This approach ensured that the questions were both theoretically grounded and practically relevant to the participants. Prior to its final administration, the questionnaire underwent a comprehensive validation process, which included both language and content validation by five education experts in the National Institute of Education. This validation aimed to ensure the clarity, conciseness, and alignment of the indicators with the research objectives. The experts provided detailed comments and recommendations, which were incorporated to refine and enhance the instrument. The questionnaire developed, incorporating five-point Likert scale questions (1-Strongly agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly disagree) designed to evaluate various dimensions of the teachers' experiences. The Likert scale, widely used in educational and social science research, enables researchers to quantify subjective perceptions

and attitudes, thus making it easier to analyze trends (Alismail & Zhang, 2020). After finalizing the items the questionnaire was pre-tested with a 50 group of teachers to ensure clarity and relevance of the items. The reliability of the questionnaire was evaluated using Cronbach's alpha, which yielded a value of 0.85, indicating excellent internal consistency.

Data collection was conducted in 2024, three months after the completion of the teacher training program, over a one-month period. A mixed-method approach was used, combining a standardized scale with open-ended questions to gather both quantitative and qualitative data. The survey was administered through Google Forms and was provided in the respondents' native language to ensure clarity, reduce misunderstandings, and create a more comfortable environment for participants. The inclusion of open-ended questions (number of questions) allowed for in-depth qualitative insights into teachers' experiences, particularly regarding the integration of 21st-century skills in their classroom practices (Şahin & Han, 2020).

2.3. Data analysis

A comprehensive quantitative and qualitative analysis was conducted on the data collected from teachers. Quantitative analysis was performed using Likert scale responses, with statistical calculations made via Microsoft Excel to summarize participants' views. Descriptive statistics were used to characterize the dataset, including measures of

central tendency (mean, median, and mode) and variability (standard deviation, range). These measures are critical in educational research as they provide a concise summary of the data, allowing for easier interpretation. Through this analysis, patterns emerged that offered a more profound understanding of how various factors influenced teachers' perspectives (Papamitsiou & Economides, 2014).

For the qualitative analysis, a thematic analysis was conducted on the open-ended responses. This method, widely regarded for its flexibility and depth, is used to identify, analyze, and report themes or patterns within qualitative data (Castleberry & Nolen, 2018). The thematic analysis allowed for a detailed examination of the teachers' experiences and insights, revealing nuanced views that complemented the quantitative findings. Together, these analyses provided a holistic view of the teachers' perspectives and the factors influencing their views.

RESULTS AND DISCUSSION

3.1. Demographic profile of teachers

Descriptive statistics of the data set is presented in the Table-1 below.

Table 1: Descriptive sampling information

	Percent tage
Gender	
Male	42
Female	58

Marital status	
Single	6
Married	94
Ethnicity	
Sinhala	70
Tamil	20
Muslim	10
Other	0
Age (years)	
20-30	12
31-40	14
Above 40	74
Highest Educational Qualification	
O/L	0
A/L	0
Bachelor's Degree	10
Postgraduate	90
Other	0
Province	
Western	18
Sabaragamuwa	11
Eastern	12
North Western	4
Northern	12
Uva	13
Southern	12
North Central	6
Central	12
Teaching Experiences (years)	
0-5	10
6-10	24
Above 10	66

The descriptive sampling information presented in Table 1 provides an overview of the demographic characteristics of the

participants, emphasizing key variables such as gender, marital status, ethnicity, age, educational qualifications, province of residence, and teaching experience. This analysis provides valuable insights into the composition of the sample and highlights the diversity within the population under investigation.

In terms of gender distribution, a majority of the participants were female (58%), while males accounted for 42% of the sample, suggesting a slightly higher presence of women in the teaching profession. Regarding marital status, the vast majority (94%) of respondents were married, while only 6% were single, indicating that the teaching workforce in this sample is predominantly consisted of individuals in stable family units. Ethnically, the sample consisted primarily of Sinhala individuals (70%), followed by Tamil (20%), and Muslim (10%), which reflects the general demographic distribution found in Sri Lanka. Notably, there was no representation from other ethnic groups, indicating that this study primarily focused on the three dominant ethnic communities in the country.

In terms of age, the largest group of participants was above 40 years old (74%), followed by those aged 31-40 (14%), and a smaller group in the 20-30 age range (12%). This suggests that a majority of the teaching staff in the study have considerable life experience, which may also relate to their teaching experience. Most participants held advanced educational qualifications, with 90%

having postgraduate degrees, while only 10% had a bachelor's degree. This high level of educational attainment aligns with the advanced qualifications often required in the teaching profession.

The distribution of participants across provinces revealed a relatively balanced representation, with the Western Province having the highest representation at 18%, followed by provinces such as Uva (13%) and Northern (12%) provinces, while the North Western Province had the least representation at 4%.

In terms of teaching experience, the data showed that a significant majority of respondents possessed over 10 years of experience (66%), followed by those with 6-10 years of experience (24%), and only 10% with less than 5 years. This indicated a well-experienced teaching cohort, which may impact their perceptions and teaching practices.

This descriptive analysis provided a clear profile of the participants, revealing that the sample was composed of highly educated, experienced teachers, predominantly female, and representing a variety of ethnic backgrounds and provinces.

The results of the study were presented and discussed below both quantitatively and qualitatively in alignment with its four key objectives.

3.2. Investigation of teachers' perceptions regarding the importance of 21st-century skills in the teaching and learning process

The quantitative analysis examined teacher perceptions using Likert scale responses on five essential 21st-century skills: critical thinking, collaboration, creativity, digital literacy, and communication. Table 2 summarizes teacher response

3.2.1. Quantitative analysis

Table 2: Teachers' Perceptions of 21st-Century Skills

Skill	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)
Critical Thinking	87	12	1	0
Collaboration	85	13	2	0
Creativity	90	10	0	0
Digital Literacy	88	12	0	0
Communication	89	11	0	0

According to Table 2, teachers acknowledged the critical importance of integrating 21st-century skills into the educational curriculum. Among these skills, critical thinking stood out as a fundamental attribute, with 87% of teachers strongly agreeing that it significantly enhances students' problem-solving abilities, while an additional 12% agreed. Collaboration (85% strongly agree, 13% agree) was also widely endorsed, though 2% remained neutral, possibly due to contextual challenges. Creativity (90% strongly agree, 10% agree) received support. Digital literacy (88% strongly agree, 12% agree) was believed critical for student success, while communication skills (89% strongly agree, 11% agree) were considered essential for personal and professional development.

3.2.2. Qualitative analysis

This section offers a qualitative analysis based on responses to open-ended questions. This approach facilitated a rich understanding of the teachers' experiences, which would not have been captured through quantitative methods alone (Terry et al., 2017). Through thematic analysis, several key themes emerged that capture teachers' views on the integration of 21st-century skills into their teaching practices, as well as the challenges they face in this endeavour.

A prominent theme emerged were discussed below.

Project-based learning & experiential methods

Teachers emphasized active learning through real-world problem-solving. One respondent stated, "Group tasks encourage students to collaborate and apply critical thinking." Another

noted, “Project-based learning fosters creativity and engagement.” This theme highlighted the belief that hands-on, active learning is an effective approach for developing essential skills needed for success in today’s world.

Digital literacy & resource limitations

Another critical theme identified in the qualitative analysis is digital literacy and the integration of technology into educational practices. Many teachers emphasized the necessity of preparing students for a future in which digital competency is essential. However, they also underscored several challenges, particularly those related to resource limitations. One teacher articulated, “We encounter issues such as limited access to technology in classrooms, which hinders our ability to fully utilize digital learning tools”. Another participant remarked, “Students must be digitally proficient to thrive in today’s world, and we require additional support to achieve that”.

Critical thinking as a core competency

Critical thinking emerged as a consistently recognized foundational skill by teachers, deemed essential for both academic achievement and the ability to navigate complex life challenges. One teacher noted, “Students need critical thinking to adapt and solve real-world problems.” Another educator reinforced this perspective by describing critical thinking as “vital

for students’ academic success and future careers”.

Challenges in Assessing Collaboration

While collaboration is widely regarded as a valuable component of education, teachers reported facing challenges in assessing its effectiveness. Many educators indicated that they utilize peer evaluations, self-assessments, and rubrics to evaluate student performance in group settings. One teacher noted, “By monitoring group dynamics and observing the final product, I can gauge how well students are learning from each other”. Despite its importance, collaboration assessment remained challenging. One teacher remarked, “Observing group interactions helps, but measuring collaboration is difficult.”

Creativity & future preparedness

Another strong theme is the emphasis on creativity as an essential skill for students’ future success. Teachers believed that fostering creativity equips students to be more innovative and adaptable, especially in the face of uncertainty. One teacher explained, “Creativity is essential for students to adapt to future challenges and come up with innovative solutions.” Others emphasized that in a rapidly changing world, students need the ability to think outside the box.

Institutional support needs

A recurring theme was the lack of resources and insufficient professional development opportunities for teaching 21st-

century skills, particularly digital literacy. Many teachers expressed feeling unprepared to fully integrate these skills due to limited access to technology and training. One teacher stated, "We need more professional development to integrate digital tools into our teaching." Another remarked, "The lack of resources, like digital devices, limits how much we can incorporate these skills in our lessons." This theme underscored the need for institutional support in providing the necessary resources and training to effectively teach and assess 21st-century skills.

Importance of Soft Skills

However, some teachers acknowledged that measuring soft skills, such as communication and cooperation, remains a significant challenge. This theme illustrates that although collaboration is perceived as integral to 21st-century learning, there is a pressing need for more refined and effective assessment methods to track its impact on student learning outcomes.

The integration of quantitative and qualitative data revealed a consistent consensus among educators regarding the significance of 21st-century skills, particularly critical thinking, creativity, digital literacy, and communication. While collaboration was equally valued, it posed distinct challenges in terms of assessment and effective implementation. The qualitative themes elucidated the practical obstacles teachers encounter, including resource constraints and the need for enhanced professional development. Although teachers are

committed to cultivating these skills through active, project-based learning methodologies, greater support is necessary to fully realize their instructional objectives. Furthermore, soft skills, such as emotional intelligence, are increasingly recognized as essential components of contemporary education. The findings indicate that while teachers strongly advocate for integrating 21st-century skills into the curriculum, substantial challenges must be addressed to ensure these competencies are effectively taught and evaluated.

The growing emphasis on developing 21st-century skills, including critical thinking, creativity, collaboration, communication, and digital literacy, was widely acknowledged by teachers. This study's findings aligned with similar research outcomes from Agaoglu and Demir (2020), who asserted that these skills are critical for students to succeed in an era characterized by rapid technological advancements and increased global interconnectedness. Innovative teaching practices are being adopted to foster these competencies. For instance, Alrajeh (2021) found that project-based learning facilitates critical thinking and problem-solving, while collaborative tasks enhance teamwork and communication, supporting the observations in this study. Similarly, Audrin and Audrin (2022) emphasized the growing relevance of digital literacy, given the increasing need for students to navigate large volumes of digital information effectively, a conclusion

consistent with the present research. Furthermore, Malik (2018) argued that these competencies not only prepare students for future career pathways but also empower them to become lifelong learners capable of adapting to evolving challenges.

3.3. Exploration of the strategies employed by teachers to integrate 21st-century skills into their teaching practices

3.3.1. Quantitative analysis

The quantitative analysis indicated that training programs introduced a variety of strategies aimed at integrating 21st-century skills, which were perceived as highly effective by participating teachers.

Table 3: Key areas employed by teachers to integrate 21st-century skills

Key Findings	Percentage of Teachers Who Strongly Agree
Practical activities (e.g., simulations, case studies) are essential for skill development	50%+
Knowledge of 21st-century education methods	78.6% (Tamil medium); 47.6% (Sinhala medium)
Skill development (collaboration, problem-solving)	60%+
Modern assessment methods are necessary for 21st-century education	50%+

As shown in Table 3, more than 50% of respondents strongly endorsed the value of incorporating practical activities, underscoring the significance of experiential learning in fostering skill development. These practical sessions, which included simulations, fieldwork, and case studies, equipped teachers with concrete methodologies to implement in their classrooms. Teachers frequently employed collaborative projects, technology-enhanced instruction, and problem-based learning as core strategies. Such approaches not only actively engaged students but also facilitated the application of theoretical knowledge in real-world contexts, thereby enhancing comprehension and knowledge retention. The qualitative feedback further

corroborated the effectiveness of these strategies, highlighting their success in promoting student-centered learning and cultivating critical 21st-century competencies. Both Sinhala and Tamil medium teachers possess a clear understanding of how assessment processes should be conducted in the context of 21st-century education. Over 50% of the teachers strongly agreed on the necessity of employing modern assessment methods, indicating a strong alignment between teachers' perceptions and contemporary educational objectives.

The data showed that participation in the training sessions led to a substantial enhancement of knowledge among both Sinhala and

Tamil medium teachers. Specifically, 78.6% of Tamil medium teachers and 47.6% of Sinhala medium teachers strongly agreed, demonstrating the training program's effectiveness in expanding their subject knowledge. Similarly, Moreover, data reveals that the training sessions significantly contributed to skill development, with over 60% of teachers from both language groups strongly agreeing on this point. These findings underscored the tangible benefits of the training, particularly in equipping educators with the practical competencies required for effective teaching.

In conclusion, the findings indicated that teachers from both Sinhala and Tamil mediums are successfully implementing strategies to incorporate 21st-century skills into their teaching practices. The training programs had positively influenced their knowledge, skills, and attitudes—key elements necessary for creating an innovative and adaptable learning environment. To further strengthen these outcomes, future training sessions should prioritize advancing teachers' attitudes and refining assessment methodologies to better align with the continuously evolving educational landscape.

3.3.2. Qualitative analysis

To address the second objective, which explores the strategies teachers employ to integrate 21st-century skills into their teaching practices, a detailed qualitative analysis was conducted. This analysis is based on teachers'

comments gathered through open-ended questions, revealing insights into the methods they use, the successes they have experienced, and the challenges they face in doing so.

Key strategies used by teachers to integrate 21st-century skills, as gathered from qualitative feedback.

Experiential learning

A prominent theme identified was the emphasis on experiential learning and practical activities. Teachers consistently indicated that approaches such as simulations, fieldwork, and case studies were particularly effective in engaging students and promoting the development of key 21st-century competencies, including critical thinking, problem-solving, and collaboration. These methods were perceived to bridge the gap between theoretical knowledge and its real-world application, thereby enhancing the relevance and impact of learning. One participant remarked, "*Simulations and case studies bring real-world problems into the classroom, making learning more relevant and interactive for students. This approach ensures that students not only grasp theoretical concepts but also gain practical skills in applying them to authentic scenarios*". Another teacher underscored the value of fieldwork, stating, "*Fieldwork and hands-on activities enable students to apply theoretical knowledge in meaningful ways, which boosts their motivation. When students can connect classroom learning to real-life contexts, their engagement and*

knowledge retention increase significantly”.

Collaborative projects and problem-based learning

In addition to practical activities, collaborative projects and problem-based learning were identified as core strategies for developing 21st-century skills. Teachers highlighted how these methods foster critical thinking, communication, and teamwork, which are increasingly essential in modern educational contexts. One teacher shared, “I incorporate group projects where students must work together to find solutions to complex problems. This not only builds their critical thinking but also helps them learn to communicate and collaborate effectively.” Another teacher elaborated on the impact of problem-based learning, stating, “Problem-based learning is an excellent way to teach students to think on their feet and apply concepts in new situations. It encourages students to explore multiple solutions and consider various perspectives, which are key aspects of critical thinking.” These strategies, according to the teachers, also cultivate independence and adaptability in students, traits that are crucial for success in the rapidly evolving workforce.

Technology-enhanced learning

However, despite the success of these strategies, teachers reported encountering significant challenges related to resource limitations and assessment difficulties. One major issue was the lack of adequate technological resources, particularly in rural and under-resourced areas.

One teacher pointed out, “While I try to integrate technology into my lessons, the lack of resources, especially in rural areas, makes it hard to fully implement digital learning. Many students don’t have access to the devices they need to participate in technology-enhanced learning activities.” Another teacher explained, “Even though I am familiar with digital tools, I don’t always have the necessary devices or internet connectivity to use them consistently in the classroom. This creates a significant gap in the learning experiences between students who have access to technology and those who do not.”

Challenges with assessment

Another challenge mentioned by many teachers was the difficulty in assessing 21st-century skills like collaboration, problem-solving, and creativity. Traditional exams and assessments, which are often focused on rote memorization and individual performance, do not effectively capture these competencies. One teacher remarked, “Assessing 21st-century skills is difficult. Traditional exams don’t capture collaboration and problem-solving effectively. We need more refined tools to measure these skills.” Another teacher suggested that peer and self-assessment could be useful but acknowledged that these methods are still developing and require additional training to be used effectively. “While peer evaluations and self-assessments offer some insights into students’ collaboration and teamwork, they are not always consistent, and we need more comprehensive methods to

accurately gauge how well students are developing these skills,” one teacher noted.

Barriers to Effective Technology Integration

In terms of technology integration, teachers were well aware of its growing importance in modern education, particularly for fostering digital literacy a critical 21st-century skill. However, they also identified significant barriers, especially in terms of access to digital tools and the infrastructure necessary to fully implement technology-enhanced learning. *“Technology is essential for teaching digital literacy, but not all schools have the infrastructure. We need more resources to close the gap,”* one teacher explained. Another shared, *“Even though I understand how to use digital tools, our school doesn’t always have the necessary devices or reliable internet connectivity to use them consistently in the classroom.”* The digital divide, both between schools and within classrooms, was seen as a key barrier to ensuring equitable access to 21st-century learning opportunities for all students.

Need for Ongoing Professional Development

Teachers also expressed the need for ongoing professional development to stay updated on new teaching methodologies, digital tools, and assessment techniques that align with 21st-century education. While they acknowledged that the training sessions they had attended were valuable, they called for more comprehensive and continuous support to address the rapidly

changing educational landscape. *“The training sessions were helpful, but there needs to be more ongoing support to ensure we can keep up with the rapid changes in education, especially when it comes to digital tools,”* one teacher explained. Another teacher highlighted the need for more training on assessment, saying, *“We need workshops specifically focused on how to assess collaboration, critical thinking, and problem-solving in students. The current methods are not adequate for measuring these skills in a meaningful way.”*

Finally, many teachers emphasized the growing recognition of the importance of attitude development alongside skill acquisition. As one teacher observed, *“In addition to teaching content, we need to help students develop positive attitudes toward learning and collaboration. This is key for their success in the 21st century.”* Another teacher expanded on this by noting that fostering an open mindset and adaptability is just as important as teaching specific skills. *“Students need to be ready for a future that’s constantly changing, and developing resilience and adaptability is critical for that,”* the teacher said. Attitude development, according to these teachers, is essential for equipping students not just with technical skills but with the emotional and psychological tools they need to navigate an uncertain and rapidly evolving world.

In summary, both the quantitative and qualitative analyses of teachers' comments reveal that while they are

committed to integrating 21st-century skills into their classrooms such as hands-on learning, collaboration, and technology they face significant challenges. These challenges include resource limitations, particularly related to technology, and the difficulty of assessing complex skills like collaboration and critical thinking. Teachers have expressed a desire for more professional development and institutional support to address these barriers.

Alahdadi and Ghanizadeh (2017) emphasized the importance of fostering positive attitudes toward learning and adaptability, essential for students' success in today's educational landscape. This aligns with the present study's view that adaptability is critical for navigating 21st-century education demands. Both studies highlight the growing emphasis on these attributes in educational discourse. Similarly, Albar and Southcott (2021) noted that project-based learning enhances critical thinking and problem-solving, echoing the current study's focus on hands-on, collaborative learning. However, both studies recognize the challenges teachers face in effectively assessing these complex skills, indicating a need for improved assessment tools.

In contrast, Audrin and Audrin (2022) emphasized digital literacy as crucial for modern students, finding it often treated as a standalone skill. The present study, however, gives equal weight to competencies like collaboration and critical thinking alongside technology integration. On

another note, Orak and İnözü (2021) observed varied teacher commitment to implementing 21st-century skills, with some still focusing on traditional exam-oriented methods. This contrasts with the current study, which showcases teachers' dedication to innovative practices, despite resource and support limitations.

Overall, the findings underscore teachers' commitment to preparing students for the future, despite obstacles. They highlight the need for continued support in professional development, resource allocation, and effective assessment methods to achieve the goals of 21st-century education (Alahdadi & Ghanizadeh, 2017; Audrin & Audrin, 2022).

3.4. Identification of the challenges and barriers faced by teachers in embedding 21st-century skills in the classroom

The 3rd objective of the study as to *explore the challenges and barriers faced by teachers in embedding 21st-century skills in their classrooms*, specifically focusing on areas such as curriculum alignment, teacher training, resources, and classroom management. The findings revealed significant insights into the complexities teachers encounter as they strive to develop critical thinking, creativity, collaboration, and digital literacy in students.

3.4.1. Quantitative analysis

The data revealed a diverse range of opinions regarding the current system.

Table 4: Challenges and barriers faced by teachers

Theme	Level	Percentage
Curriculum Support for 21st-Century Skills	Fully supports 21st-century skills	21%
	Does not support 21st-century skills	34%
	Somewhat supports 21st-century skills	45%
Challenges in Aligning the Curriculum with 21st-Century Skills	Lack of flexibility hindering innovation	20%
	Insufficient emphasis on critical thinking and creativity	10%
	Overemphasis on rote learning and exams	55%
	Lack of interdisciplinary approaches	15%
Integration of Project-Based Learning, Collaboration, and Problem-Solving	Very challenging	25%
	Somewhat challenging	36%
	Not challenging	39%
Training Needs	Need for more training to teach 21st-century skills	65%
	Training needed in critical thinking and problem-solving strategies	34%
	Training needed in digital tools and technology use	13%
	Training needed in interdisciplinary teaching methods	23%
	Training needed in managing collaborative activities	30%
Barriers to Effective Teaching of 21st-Century Skills	Insufficient resources and technology	64%
	Insufficient access to technology	31%
	Lack of digital tools and software	22%
	Poor internet connectivity	31%
	Budget constraints for resources	16%
Classroom Management and Engagement Challenges	Lack of administrative support for integrating technology	38%
	Lack of student motivation hindering collaboration	20%
	Difficulty managing group dynamics	17%
	Time constraints for including collaborative activities	32%
	Large class sizes	31%
	Very challenging	52%

Challenges in Fostering Critical Thinking and Problem-Solving	Somewhat challenging	41%
	Not challenging	7%
Barriers to Creativity and Innovation	Limited time to foster creativity	24%
	Pressure to cover content for exams	31%
	Lack of resources for creative lesson planning	10%
	Insufficient classroom space	22%
	Student resistance to open-ended tasks	13%

The data revealed a diverse range of opinions regarding the current curriculum's support for 21st-century skills.

Curriculum's support for 21st-century skills

While 21% of teachers believed that the curriculum fully supports these skills, a notable 34% indicated that the curriculum does not support them, and 45% stated that it somewhat supports 21st-century skills. This mixed response points to the need for a more adaptable and comprehensive curriculum that aligns with modern educational goals.

Specific challenges teachers face in aligning the curriculum with 21st-century skills were identified as follows.

Lack of flexibility in the curriculum

A rigid curriculum makes it difficult for teachers to innovate or integrate new methodologies that encourage critical thinking and creativity.

Insufficient emphasis on critical thinking and creativity

This suggests that the curriculum

still prioritizes traditional content over skills such as problem-solving and innovation.

Too much focus on rote learning and exams

Over half of the teachers highlighted the dominance of rote learning, which leaves little room for the active learning strategies required for 21st-century skill development.

Lack of interdisciplinary approaches

The absence of cross-disciplinary integration limits opportunities for students to apply their knowledge in diverse contexts.

Additionally, when it came to integrating project-based learning, collaboration, and problem-solving activities in the classroom, teachers faced varying levels of difficulty. A quarter of teachers (25%) found it very challenging, 36% found it somewhat challenging, and 39% did not find it challenging at all. These findings indicate that while some teachers can successfully implement such activities, others struggle due to curriculum limitations or classroom constraints.

A substantial 65% of teachers expressed that they require more training to effectively teach 21st-century skills. This highlights the gap between the expectations for modern teaching methods and the support provided to educators.

When asked about specific training needs:

- **34%** of teachers indicated a need for training in classroom strategies for critical thinking and problem-solving.
- **13%** mentioned the need for training in the use of digital tools and technology, showing a lack of confidence in navigating technological resources.
- **23%** highlighted the need for training in interdisciplinary teaching methods, which aligns with the previously mentioned curriculum challenge.
- **30%** identified managing collaborative activities as a key area for further development.

These findings underscore the importance of comprehensive professional development programs that not only introduce teachers to the concept of 21st-century skills but also provide practical strategies for classroom application.

Lack of resources and technology was another significant barrier. Approximately 64% of teachers reported that insufficient resources and technology hinder their ability to teach 21st-century skills effectively. The specific barriers identified included.

Insufficient access to technology

A considerable portion of teachers struggles with basic access to the technological tools necessary for modern education.

Lack of digital tools and software

The absence of specific software for learning further limits the ability to foster digital literacy.

Poor internet connectivity

Internet access, a fundamental requirement for many modern educational tools, is a recurring issue.

Limited budget for resources

Financial constraints prevent schools from acquiring the necessary materials to support innovative teaching practices.

Additionally, 38% of teachers cited a lack of support from school administration in integrating technology into their teaching. This indicates that institutional barriers, such as insufficient leadership or administrative backing, further complicate efforts to modernize education.

Classroom management and student engagement presented another set of challenges. Teachers identified several obstacles when encouraging collaboration and teamwork among students.

Lack of student motivation

Unmotivated students make it difficult to foster collaboration and active participation.

Difficulty in managing group dynamics

Teachers face challenges in ensuring that students work effectively in groups.

Time constraints

Limited time to cover the curriculum often restricts the ability to include collaborative activities.

Large class sizes

Larger classrooms make it harder to implement group work or individualized attention for students.

Engaging students in critical thinking and problem-solving activities was also challenging, with 52% of teachers stating that it was very challenging, 41% finding it somewhat challenging, and only 7% stating it was not challenging. This suggests that while teachers understand the importance of fostering these skills, they struggle to do so within existing classroom structures.

Teachers also identified specific barriers to incorporating creativity and innovation into their lessons.

Limited time

Teachers often feel pressured by the curriculum to cover content, leaving little time for creative activities.

Pressure to cover specific content for exams (31%)

This examination-oriented approach restricts creative exploration in the classroom.

Lack of resources

A lack of materials prevents teachers

from developing innovative lesson plans.

Insufficient classroom space

Physical limitations within the classroom hinder creative and hands-on activities.

Student resistance to open-ended tasks

Some students are uncomfortable or unfamiliar with open-ended or exploratory tasks, making it difficult for teachers to introduce creativity into the classroom.

The findings highlight that while teachers recognize the value of 21st-century skills, they face multiple barriers in embedding them into their teaching practices. These include inflexible curricula, inadequate professional development, lack of resources, and challenges in classroom management and student engagement. Addressing these challenges will require systematic changes, including curriculum reform, enhanced teacher training, greater administrative support, and improved access to technology and resources. By tackling these barriers, schools can better equip teachers to foster the 21st-century skills necessary for students to thrive in a rapidly evolving world.

3.4.2. Qualitative Analysis

From the set of comments provided, several key themes emerge related to the changes and improvements that would help teachers better integrate 21st-century skills into their teaching. These themes highlight the challenges teachers face and the support they require to foster critical

thinking, collaboration, creativity, digital literacy and other 21st-century skills. and technological literacy in their students.

Curriculum flexibility

Several comments point to the need for a more flexible curriculum that allows teachers to incorporate 21st-century skills into their lessons without being constrained by content-heavy or exam-focused approaches. Statements such as the need for *"more flexibility in the curriculum to include project-based learning and creativity-focused activities"* and *"allowing more time in the curriculum for creativity and critical thinking activities"* indicate that many teachers feel the current curriculum does not sufficiently prioritize these skills. There is a strong need for curriculum reform that reduces the emphasis on rote learning and standardized testing while increasing opportunities for creative, interdisciplinary, and skill-based learning activities.

Technology and resources

The lack of adequate technology and resources was a dominant theme in the comments. Teachers expressed concerns about outdated tools, limited digital access, and poor internet connectivity, as reflected in statements like *"access to up-to-date digital tools and software is essential for teaching students' technological skills"* and *"better internet connectivity in classrooms is crucial for using online tools."* Schools need to invest in digital infrastructure and provide access to modern technological resources to ensure that teachers can effectively teach

Professional development

Many teachers highlighted the need for ongoing professional development aimed at helping them integrate 21st-century skills into their lessons. Comments such as *"ongoing professional development specifically aimed at teaching 21st-century skills would be very helpful"* reflect that teachers feel underprepared or unsupported regarding new teaching methodologies and technological tools. There is a need for tailored professional development programs that focus specifically on teaching 21st-century skills, such as critical thinking, creativity, collaboration, and the use of digital tools.

Classroom management and student-centered learning

Another recurring theme is the challenge of managing classrooms in a way that supports collaborative learning and critical thinking. Comments like *"smaller class sizes would allow for more personalized teaching and better engagement with students"* and *"encouraging student-led projects could enhance problem-solving and teamwork skills"* highlight that large class sizes and traditional teaching models may not be conducive to fostering 21st-century skills. Consequently, classroom management strategies, including reduced class sizes and more student-centered approaches, can facilitate greater engagement in collaboration, problem-solving, and innovation.

Support from school administration

Some teachers pointed out the lack of support from school administration and budgetary constraints as significant barriers to integrating 21st-century skills. Comments such as *"increased support from the school administration in terms of resources and training would improve the integration of 21st-century skills"* and *"increasing the budget for classroom resources would allow us to use more innovative teaching methods"* suggest that teachers need more institutional support to implement innovative teaching strategies. Therefore, administrative support, both in terms of budget allocation and guidance, is crucial for teachers to effectively integrate 21st-century skills into their classroom practices.

Adapting to evolving technology

To identify the challenges and barriers faced by teachers in embedding 21st-century skills in the classroom, both quantitative and qualitative analyses reveal that addressing these barriers requires a multifaceted approach. Systematic changes, including curriculum reform, professional development, and improved resource allocation, are essential for equipping teachers to foster critical thinking, creativity, collaboration, and digital literacy in their students.

The findings of this study align with prior research regarding the challenges teachers face in integrating 21st-century skills into education. Similar to Khan et al.

(2022), this study identifies curriculum reform as a key barrier, with outdated curricula impeding the inclusion of skills such as critical thinking, creativity, and digital literacy, emphasizing the need for curriculum updates. Professional development also emerges as a crucial issue, as Roshid and Haider (2024) highlight the importance of continuous, skills-focused training for teachers to implement 21st-century teaching methods effectively. Without such training, many teachers feel unprepared to foster collaboration and problem-solving skills. Additionally, both studies highlight resource limitations, such as insufficient access to modern educational technologies, as a significant obstacle to creating future-ready learning environments. The role of administrative support is similarly emphasized, with Fix et al. (2021) pointing to the importance of school leadership in guiding the adoption of new teaching strategies.

However, differences in findings are also noted. While Khan et al. (2022) stress the importance of digital literacy, this study underscores the challenge of adapting to rapidly evolving digital tools, with teachers expressing concern about both teaching digital literacy and keeping up with technological advancements. Classroom management, identified by Khan et al. as a key issue, is found to be less significant in the present study compared to resource availability and training. Additionally, this research introduces a focus on teachers' confidence in delivering skill-based

education, advocating for a deeper understanding of teacher psychology to facilitate the integration of 21st-century skills with traditional subjects. Supporting research from Tangney et al. (2023) and Scherer et al. (2021) further highlights the importance of teacher effectiveness and collaboration in successful skill integration.

In summary, both this study and previous research emphasize the need for curriculum reform, enhanced professional development, and sufficient resources, while also pointing to evolving challenges in the digital age. A comprehensive approach combining systemic change, teacher empowerment, and technology integration is essential to overcoming these barriers and embedding 21st-century skills effectively.

3.5. Examination of the perceived effectiveness of existing approaches and resources for integrating 21st-century skills into teaching and learning

Under the 4th objective of this study, questionnaire aimed to evaluate teachers' perceptions regarding the effectiveness of existing methods and resources for integrating 21st-century skills into their teaching practices. The responses provide valuable insights into the effectiveness of teaching approaches, resource availability, curriculum alignment, and professional development opportunities.

3.5.1. Quantitative analysis

Table 5 highlight the multifaceted challenges teachers face in embedding 21st-century skills in the classroom, with solutions requiring curriculum reform, better resources, ongoing training, and administrative support.

Table 5: Perceived effectiveness of existing approaches and resources

Category	Response	Percentage
Effectiveness of Teaching Approaches	Very effective	78%
	Somewhat effective	22%
	Ineffective/Uncertain	0%
Support from Available Resources	Fully supportive	43%
	Partially supportive	57%
	Unhelpful/Uncertain	0%
Curriculum Alignment with 21st-Century Skills	Poor alignment	75%
	Some alignment	25%
	Excellent alignment	2%
Professional Development Support	Highly supportive	43%
	Could improve	57%
	Unsupportive/Uncertain	0%

The overwhelming majority of teachers (78%) believe that current teaching approaches are very effective in developing 21st-century

skills among students, such as critical thinking, creativity, and collaboration. Only 22% view these approaches as somewhat effective, with no reports of ineffectiveness or uncertainty. This indicates a strong confidence among teachers in their methods for fostering essential skills in their students.

While 43% of teachers feel that available resources fully support the integration of 21st-century skills, a significant 57% believe that resources only partially support this integration. Notably, there are no reports of resources being unhelpful or teachers being unsure, suggesting that while resources are generally positive, there is still room for improvement in their adequacy and effectiveness.

The data reveals a critical gap in curriculum alignment with 21st-century skills, as 75% of teachers perceive the current curriculum to have poor alignment, with only 25% acknowledging some level of alignment. The very low percentage (2%) indicating excellent alignment highlights a substantial need for curricular reform to better incorporate essential skills alongside required content.

Regarding professional development opportunities, the responses indicate that 43% of teachers find these opportunities to be highly supportive and sufficient, while 57% feel that they could improve. Importantly, there are no teachers who feel unsupported or lacking relevant training, suggesting that current professional development efforts are

at least recognized as valuable but may not fully meet teachers' needs for integrating 21st-century skills effectively.

In summary, the analysis reveals high confidence in current teaching approaches, indicating that most teachers believe their methods effectively foster 21st-century skills. However, while many feel supported by available resources, improvements are necessary to ensure comprehensive support. The significant majority of teachers view the current curriculum as poorly aligned with 21st-century skills, highlighting an urgent need for curriculum reform. Lastly, although many teachers find professional development opportunities helpful, there is also a call for improvement to ensure they adequately prepare teachers for integrating 21st-century skills. This analysis underscores both the strengths and weaknesses in current educational approaches regarding 21st-century skills and indicates areas that require attention for further enhancement.

3.5.2. Qualitative analysis

Technology integration

A key theme identified in the qualitative data was the integration of technology into classroom practices. Many educators emphasized the need for continuous professional development to effectively incorporate technological tools into their teaching. One teacher noted, "We need more professional development focused on integrating technology effectively into our lessons," reflecting the demand for

comprehensive training programs that not only introduce new tools but also demonstrate their use in promoting interactive learning. Overall, the data revealed that while technology enhances student engagement, teachers often feel inadequately equipped to use these tools effectively. Strengthening teacher proficiency in technology integration is crucial for cultivating a dynamic learning environment that supports student engagement and skill development.

Curriculum relevance

A critical focus was the alignment of the curriculum with real-world applications. Educators stressed the need to connect curriculum content with practical skills, moving beyond purely theoretical instruction. One teacher highlighted this by stating, "Students often ask, 'When will I ever use this?' We need to demonstrate how these skills are applicable in daily life." This reflects a broader educational priority to integrate 21st-century skills into students' lives. By incorporating real-world scenarios, teachers can enhance motivation and deepen understanding, emphasizing the importance of collaboration between curriculum developers and educators to ensure that learning outcomes align with future career demands.

Collaborative learning environments

The establishment of collaborative learning environments emerged as crucial in the analysis. Teachers recognized the inherent value of group projects in fostering teamwork and cooperation among students.

However, many expressed challenges in creating equitable structures that ensure all students participate actively. One educator noted, "*Group projects foster teamwork, but sometimes the structure is lacking, leading to unequal participation*". This highlighted the need for explicit strategies to cultivate effective group dynamics and facilitate inclusive collaboration. By providing teachers with frameworks for organizing productive group work, educational institutions can empower educators to create engaging learning experiences that leverage the strengths of collaboration, fostering important social skills.

Critical thinking and problem-solving

The importance of critical thinking and problem-solving abilities surfaced prominently in teachers' comments. Many educators conveyed the significance of encouraging these skills but expressed frustration regarding the constraints imposed by standardized testing. One teacher remarked, "*Encouraging critical thinking is essential, but the pressure of standardized testing often limits our ability to explore these areas deeply*". This highlighted the tension between assessment practices focused on rote memorization and the need for developing higher-order thinking skills. There is a pressing need for educational policymakers to consider alternative assessment methods that recognize and reward critical thinking and problem-solving abilities, providing teachers with the flexibility to foster

creativity and analytical skills in their classrooms.

Support for diverse learning styles

Support for diverse learning styles emerged as another significant concern. Many educators articulated the challenges posed by resources that often adopt a one-size-fits-all approach, which can hinder effective learning. One teacher stated, "*Every student learns differently, but our resources often cater to a one-size-fits-all approach*". This underscored the importance of differentiated instruction to address the diverse needs of learners. Providing teachers with a range of instructional strategies and materials can better equip them to accommodate individual learning preferences, ensuring equitable access to education for all students. Emphasizing an inclusive approach within educational systems can create environments where every student has the opportunity to thrive.

Continuous professional development

Finally, the theme of continuous professional development was prevalent in the analysis. Many teachers expressed appreciation for available workshops but noted that they often feel disconnected from the realities of their teaching environments. One educator remarked, "*I appreciate the workshops, but they often feel disconnected from what I face in the classroom*." This indicates a need for ongoing, relevant professional development that addresses the specific challenges teachers

encounter. Regular feedback mechanisms and mentorship programs could provide educators with the support needed to navigate difficulties effectively and apply new strategies in their classrooms. Establishing collaborative networks and sustained support systems can empower teachers to continuously enhance their skills, adapt to the evolving educational landscape, and better integrate 21st-century skills into their teaching practices.

The qualitative findings identify several key areas for improvement in teaching 21st-century skills. Teachers stress the importance of integrating technology more effectively, aligning curriculum content with real-world applications, fostering collaborative learning, and supporting diverse learning styles. Furthermore, they emphasize the need to promote critical thinking while addressing the constraints of standardized testing. The call for continuous and context-relevant professional development reflects a desire for more tailored support to help teachers navigate challenges and effectively implement innovative teaching strategies.

Addressing these themes can significantly enhance the integration of 21st-century skills into classrooms, preparing students for future challenges in an increasingly complex and technological world.

CONCLUSION

In conclusion, this study underscores the profound necessity of embedding 21st-century skills such as critical

thinking, creativity, collaboration, communication, and digital literacy into modern education as a cornerstone for preparing students to navigate an increasingly complex, dynamic, and interconnected world. Both quantitative and qualitative analyses revealed a clear consensus among educators on the value of these competencies in fostering adaptability and lifelong learning. Teachers demonstrated a strong commitment to implementing innovative pedagogical strategies, such as project-based learning, experiential activities, and collaborative problem-solving, all of which are integral to the development of these skills. However, the findings also highlighted significant systemic challenges that inhibit the full realization of 21st-century education. Foremost among these was the misalignment between current curricula and the demands of skill-based learning. Rigid, content-heavy curricula, designed primarily for rote memorization and standardized testing, often undermine the cultivation of higher-order thinking skills and limit the capacity for creative exploration. The inadequate integration of technology into classroom practices further compounds these issues, with many teachers expressing frustration over resource limitations and inconsistent access to digital tools.

Moreover, while professional development is recognized as crucial, its relevance and effectiveness in addressing the specific challenges teachers face in real-world classroom environments

remain inadequate. The gap between theoretical training and practical application hinders educators from fully embracing and implementing 21st-century pedagogical approaches. These findings indicate a pressing need for ongoing, contextually relevant professional development, focused not only on the acquisition of new skills but also on the continuous adaptation of teaching methods to meet evolving educational demands. To overcome these obstacles, a holistic, multi-tiered reform is imperative. This must include a paradigm shift in curriculum design that prioritizes skills over content, allowing for greater flexibility and contextual learning. Institutions must invest in both physical and digital infrastructure, ensuring equitable access to resources that empower teachers to harness the full potential of technology in the classroom. Additionally, fostering collaborative networks and mentorship programs within professional development frameworks can provide educators with sustained support, enabling them to remain agile in the face of rapid educational changes.

Ultimately, the success of 21st-century education hinges on the collective effort to bridge the gaps between policy, practice, and pedagogy. By addressing the systemic barriers and equipping educators with the tools, resources, and institutional support they need, we can cultivate a generation of students not only prepared for academic achievement but also capable of thriving in the unpredictability of the future. This

transformative vision will empower societal progress in an increasingly
learners to become critical thinkers, globalized world.
innovators, and leaders, driving

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**Achieving Sustainable Development Goals Through
Geography Education in Government Schools of Sri Lanka:
Goal 15 Life on Land: A Literature Review**

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ABSTRACT

Geographical education represents an important vehicle for students of all ages to help them understand the complexity of the sustainability goal and what can be done to achieve a more sustainable future. Achieving sustainable development goals through geography education in government schools of Sri Lanka (Goal 15 Life on Land) is the one important thing for being studied. The objective of the research was to investigate literature review related to the topics how to achieve sustainable development goal 15 through geography education in government schools of Sri Lanka. The data collection method used was studying literature review related to the key words. Used Google scholar and studied related research articles done by the Research Centre for Environment, Economic and Social Sustainability (KASES), Institute for Environment and Development (LESTARI), University Kebangsaan Malaysia, Research Centre for Sustainability Science and Governance (SGK), and studied 15 research done by scholars. All searches were done in English language. The search strategy was based on the systematic categorization of keywords. The words used in searching concerning the themes were geography education, geography learning, sustainable development, Goal 15 life on land. Data analysis was conducted using a qualitative approach with content analysis. The process involved multiple steps to ensure a comprehensive examination of the findings. A descriptive analysis method was applied in presenting the results. The results of the literature analysis showed that geography education provides an important foundation for students to understand the complex relationship between humans and the natural environment, as well as its impact on the sustainability of the Earth. In addition, it helps students identify global and local environmental problems, provides insight into workable solutions, and encourages an environmentally responsible attitude. These studies confirmed that geography education has great potential in shaping a generation that is environmentally conscious, ready to participate in nature conservation efforts, and address the increasingly pressing environmental challenges of the future.

Keywords: *Sustainable development, Geography education, Goal 15: life on land*

INTRODUCTION

The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. The 2030 Agenda for Sustainable Development provides a shared blueprint for peace and prosperity for people and the planet now and into the future. There are 17 Sustainable Development Goals (SDGs), an urgent call for action by all countries (UNESCO, 2016).

According to UNESCO (2016), the Sustainable Development Goals (SDGs) aim to transform the world by addressing critical global challenges. They serve as a call to action to eradicate poverty and inequality, protect the environment, and promote health, justice, and economic prosperity for all. Sustainable development encompasses the ability of natural resources to meet human needs while navigating the social, political, and economic complexities of the modern world. The present generation bears a significant responsibility to restore, preserve, and enhance the Earth's resources to ensure a sustainable future for generations to come.

Sustainable Development Goal 15 is about "Life on land." One of the 17 Sustainable Development Goals established by the United Nations in 2015, the official wording is, "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and

halt biodiversity loss" (UNESCO, 2016).

According to Crutzen, 2002 increased pressure on the earth's resources has led to creating many problems in the present world. Desertification, loss of biodiversity, global warming, climate change, and sea levels increasing are a few of the main problems faced by the world at present. Though a whole range of environmental limits have been transformed through such pressures, due to the effect of human activities on the earth. Given the increasingly pervasive and profound influence that people have had on a wide range of earth system processes, it is hardly surprising that there are many scientists in favour of accepting that man has moved into a new geological era and that the human species has effectively already created a 'geology of mankind' (Crutzen, 2002).

Among these seventeen goals, goal 15th pays attention to life on land. Our Earth is the only planet that has congenial forces for the existence of living organisms. It is the responsibility of human beings to protect this planet Earth. Sustainable Development Goal 15 pays more attention to the main components of the Earth such as land, different landscapes, desertification, biodiversity, habitat of the living organisms, threats to these different ecosystems, and many more.

Numerous related themes of Goal 15 life on Land are related to geography education. This study is trying to find out how geography education in Sri

Lanka can support to achievement this goal. The discipline of Geography has a distinct benefit in developing a more holistic understanding of global environmental challenges in that it reaches across all the sciences. Geographical education therefore represents an important vehicle for citizens of all ages to help them understand the complexity of the sustainability goal and what can be done to achieve a more sustainable future.

The education system of a country can support achieving sustainable development goals through teaching and learning process. Geography is one of the core subjects mainly giving environmental-related education to students in government schools of Sri Lanka. Subjects like Civic Education, Science, and Environmental Studies give education related to the environment and related themes. Geography education is directly related to the themes in goal 15, Life on Land.

There are various types of schools in Sri Lanka, mainly categorized into government and private sectors. Both sectors offer geography education under different curricula. Government schools follow the local curriculum, while private, semi-government, government-approved, and international schools adopt the British, Edexcel, and local curricula. Geography is a main subject from grades six to nine in government schools in Sri Lanka. The National Education Commission Report (1992) outlined eight national educational goals for Sri Lanka,

some of which directly relate to environmental education and sustainable development. These goals emphasized environmental awareness, sustainable resource management, and the integration of environmental concepts into the curriculum. In 2015, the United Nations adopted the Sustainable Development Goals (SDGs), including Goal 4 (Quality Education) and Goal 15 (Life on Land), which align with Sri Lanka's earlier educational objectives. The 1992 report laid the foundation for environmental education in Sri Lanka, influencing policies that later aligned with the SDGs. The focus on sustainability, biodiversity conservation, and responsible citizenship in the 1992 report resonates with SDG 4.7, which promotes education for sustainable development, and SDG 15, which aims to protect ecosystems. The 1992 education policies provided an early framework that facilitated Sri Lanka's alignment with global sustainability efforts in 2015, demonstrating continuity in environmental and sustainable education policies.

Bestowing to the National Education commission report it's mentioning evolution of a Sustainable Pattern of living, awareness of and sensitivity to the importance of the evolution of a sustainable lifestyle for the future. Furthermore, this report emphasizes awareness and appreciation of ecological balances. Willingness and ability to contribute constructively to environmental conservation and seeking a livelihood and work opportunities that are, at one and the

same time, productive and give avenues of self-fulfillment. The role of formal environmental education is to build a society that helps students to determine what is best to conserve their cultural, economic, and natural heritage and to nurture values and strategies for attaining sustainable development in their local communities. This will lead to obtaining SDGs nationally. Sri Lanka is one of the countries contributing to the triumph of the 2030 Agenda for Sustainable Development. Geography education for sustainable development is the one important thing to be studied. This research mainly investigates social issue directly connected with the whole world. Current study is trying to find out how geography education can support the achievement of sustainable development goal 15 for Sri Lanka.

1.1. Objectives

This study mainly investigates the literature review related to the topic of how to achieve sustainable development goal 15 through geography education in government schools of Sri Lanka. This study investigated a literature survey and analysis done based on four themes. Sustainable development goal 15 life on land, Geography education, teaching and learning methods of geography and models to teach geography subject, and different countries teaching-learning methods of geography are four of the selected themes.

METHODOLOGY

2.1. Materials and methods - data collection

The data collection method used in this study was studying literature review related to the key words. Used Google scholar and studied related research articles done by the Research Centre for Environment, Economic and Social Sustainability (KASES), Institute for Environment and Development (LESTARI), University Kebangsaan Malaysia, Research Centre for Sustainability Science and Governance (SGK), and studied several research studies done by scholars. All searches were done in English language. The search strategy was based on the systematic categorization of keywords. The words used in searching concerning the themes were geography education, geography learning, sustainable development, Goal 15 life on land, Sri Lanka. Furthermore, the search has proceeded manually to the articles that appear in the search results. This study employed a qualitative research method with a content analysis approach, carried out through a systematic multi-step process.

FINDINGS

Education for sustainability is now applied in the Geography curriculum in many countries across all continents in both the developed and developing world, for example in Germany (Sprengrer and Nienaber, 2017), Croatia (Brkic-Vejmelka et al., 2018), Norway (Saetre, 2016), South Africa (Dube, 2017), Vietnam (Phuong Nguyen, 2017), China (Guo

et al., 2018), South Korea (Gress and Tschapka, 2017) and India (Leder, 2018). The potential of geographical education to develop sustainability thinking through incorporating the concepts embodied in The International Year of Global Understanding has also been explored in many countries. The edited work *Geography Education for Global Understanding* (Demirci et al., 2018) includes reviews of geography curricula in relation to global understanding for a number of countries in Asia (China, Japan, and India), Africa (South Africa), Europe (Finland, Spain, and the United Kingdom), and North America (United State).

There are some elements of the sustainability challenge that lend themselves in particular to a geographical approach to education. Chang and Pascua (2017) argue that a sound grasp of spatiality is actually essential to understanding climate change and its impact, and how people, for example in the United Kingdom, routinely fail to consider their total impact on carbon dioxide emissions because they miss the fact that much of the manufacturing (and therefore greenhouse gas production) in the developing world is actually driven by consumer demand in the developed world itself. Palacios et al. (2017) meanwhile, provide an example of how comparisons between countries or regions (in their case between Coquimbo, Chile and Iowa, USA) can promote civic responsibility. There are also excellent opportunities in the use of geospatial technologies, in particular remote

sensing and GIS, to substantially enrich education for sustainability. Global environmental problems are inherently spatial and GIS enables interactive geographic visualization and analysis techniques that are vital to their resolution (Hwang, 2013).

There are many empirical research studies found which are related to the present study. Findings of these studies gave deep guidance for the improvement of the present study. Heinrich Rakuasa et al., (2023) conducted a study on Role of Geography Education in Raising Environmental Awareness. Furthermore, Kumar and Ram (2006) conducted a study on the awareness of Environmental Education among students and found that in Science stream, Post Graduate students were more aware towards Environmental Education than the students of Arts and Commerce stream. The study also revealed that the female students of Science and Commerce stream were more aware than male students. Again in Arts stream male students were more aware than female students towards Environmental Education and no interaction between sex and subjects were found towards Environmental Education among students who were post-graduate.

According to the Chief Minister of Delhi, Shila Dixit (2006), in an article, stated that children are representatives of environment and young generation should protect the environment which is facing a great challenge due to fast development. A cleaner and greener Delhi is possible with only practical contribution of

the younger generation whom the entire society will see as role model. By the efforts of various agencies, eco-club students and teachers, Delhi's green cover increased from 26 sq. km in 1997 to 268 sq. km in 2003 which has further increased up to more than 320 sq. km.

Kumar and Patil (2007) found in their study that students who had environmental education background had better environmental attitude. The study showed that no significant difference exists between male and female students in their attitude towards environmental pollution and the issues related with it. It was also found in the study that higher secondary students improved their achievement on environmental pollution after they viewed the video program related with the environmental pollution.

Meanwhile Nabila Nurul Hawa, et al., (2020) lead a study on Geography Education for Promoting Sustainability in Indonesia. For the study examined and investigated articles about geography learning and sustainability in Indonesia from 2010 to 2020. As a result, the topics of geography education in Indonesia have contained three main elements of sustainability, namely environment which the most stated, then social, and economic. The learning model and method that was mostly used was outdoor learning with contextual method. The learning media that mostly mentioned were maps, while the learning resources were local wisdom. Aspects of students'

assessment that mostly studied in geography education for promoting sustainability were students' knowledge, attitude, and skills. Overall, this study has shown that the topics related to sustainability elements contained in the articles on geography education in Indonesia includes their learning components.

The Lucerne Declaration states that the themes of the UN Decade of Education for Sustainable Development (DESD) 2005–2014 have much in common with geography's objects of study. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) are involved in monitoring the progress towards Target of Sustainable Development Goals.

According to Haubrich, he has mentioned that, Geography as a bridge between natural and human sciences is used to practice such an approach. Geographical education contributes to this by ensuring that individuals become aware of the impact of their own behavior and that of their societies, and that they have access to accurate information and skills to enable them to make environmentally sound decisions and to develop an environmental ethic to guide their actions. Education in geography fosters knowledge, skills, and concepts for better understanding our being, our relationships with other people, and the universe (Haas, 1989).

The International Charter on Geographical Education states that studying geography should support

young people to understand and appreciate how places and landscapes are formed, how people and environments interact, the consequences that arise from our everyday spatial decisions, and Earth's diverse and interconnected mosaic of cultures and societies. The achievement of SD requires geographic competences such as knowledge and understanding of the major natural systems of the Earth (landforms, soils, water bodies, climate, vegetation) and the interactions within and between ecosystems and the major socio-economic systems of the Earth (agriculture, settlement, transport, industry, trade, energy, population, and others (Haubrich, 2007).

Learning about geographical issues, such as climate change, and developing geographical thinking in outdoor environments offers good chances for problem-solving skills needed for addressing environmental problems. The outdoor environment provides an opportunity for all-inclusive learning, integrative methods, and building one's own relationship with nature. Outdoor education also promotes students' concentration, learning, and retention better than teaching and learning in a classroom. These basic skills can be used when confronting the central outdoor environmental issues, and, thus, they support effective learning about sustainability.

Children's connections to the landscape, nature, and people in it can also be developed through outdoor learning, as children learn

issues about their living environment and develop their place knowledge. Such learning would be possible if children were studying co-operatively and collaboratively through "ground learning" in local phenomena, gaining "lived experiences". Consequently, through geographical cross-curricular themes, which foster a strong sense of place and space, understanding of sustainability can also be supported (Dolan, 2016). Both theatrical and empirical studies which are related to the present study gave a correct guidance to develop this research study.

DISCUSSION

The findings revealed that nearly all analyzed articles contained elements of geography and sustainable development. These findings reinforce the fact that there is scope in the topic of geography studies covering human geography and physical geography. Human or physical geography that includes the anthroposphere is closely related to the topic of world sustainability. This topic aims to shape educated geography teachers, principals and students who can face challenges in society and community. While the physical geography that includes lithosphere, hydrosphere, atmosphere, and biosphere materials, is closely related to environmental sustainability. This is following the findings of the study stated that the topics of physical geography involved in the study of sustainability include climate change, loss of biodiversity, water resources, pollution, and land

degradation. Meanwhile, this study found that natural resources in land and water resources were the most popular elements in environmental sustainability.

CONCLUSIONS

Overall, this study done based on the literature review can show the sustainability elements contained in the geography education articles and research done in different countries. These studies include some learning components of methods and models, learning media and resources, and learning assessment of subject geography. This study also was limited to the geography subject and sustainable development goal 15. Based on the findings done by the literature survey recommends teachers of geography and other subjects for giving more attention to the learning components that support

efforts to achieve sustainable development goal 15 life on land.

The results of the literature analysis showed that geography education provides an important foundation for students to understand the complex relationship between humans and the natural environment, as well as its impact on the sustainability of the Earth. In addition, it helps students identify global and local environmental problems, provides insight into workable solutions, and encourages an environmentally responsible attitude. This study confirmed that geography education has great potential in shaping a generation that is environmentally conscious, ready to participate in nature conservation efforts, and address the increasingly pressing environmental challenges of the future.

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**Primary Education Teachers' Perspectives on
Attention Deficit Hyperactive Disorder in Sri Lanka**

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ABSTRACT

Every regular classroom has at least one student with Attention Deficit Hyperactive Disorder (ADHD) and teachers are the first persons to notice the sign and raise concerns about these children. Therefore, primary education teachers must have a comprehensive knowledge on ADHD. The research has emphasized the need of discovering teachers' knowledge and attitude on this aspect of students. The objectives of the study were to identify primary education teachers' knowledge of ADHD, assess their attitudes, and identify the relationship between teachers' knowledge and attitudes toward ADHD. For the study, 391 primary education teachers were purposively selected and quantitative data were collected by a self-report questionnaire developed based on previous studies. The analysis revealed that 65% of teachers had teaching experience of more than 20 years, and among them, only 46.5% were directly professionalized for primary education. Their general knowledge of ADHD was higher (58.9%) than the knowledge of symptoms/ diagnosis and treatments. Their perception of ADHD moderately agreed with ADHD behavioral characteristics, intervention, and medical treatments. There is no significant relationship between teachers' knowledge of ADHD and their perception. Still ADHD is one of the inattention areas in the education system of Sri Lanka. The need of proper awareness of educational policymakers and curriculum developers on this theme, well-structured educational programme for teachers to raise awareness and the need to train them on how to guide children with ADHD in the classroom are suggested. Further, the need for effective psychological counselling approaches are recommended.

Keywords: *Attention Deficit Hyperactive Disorder, Primary education, teachers' perception*

INTRODUCTION

1.1. Background of the study

Attention Deficit Hyperactive Disorder (ADHD) is one of common neurobehavioral childhood disorder (Kring et al., 2010; Anderson et al., 2012; David, 2013; Ballantine, 2015; Barkly, 2020; National Institute of Mental Health, 2020; Ronson, 2021). According to the Diagnostic and Statistical Manual of Mental Disorders (DSM -5), it is characterized by constant age inappropriate symptoms of inattention, hyperactivity and or impulsivity. Further, to confirm the diagnosis of ADHD, the symptoms should be present for a minimum of six months in a one setting and the symptoms should be evident before the age of 12. The children population in ADHD is 5% to 7% and 2.5% in adults (National Institute of Mental Health, 2020). Boys are more likely to be diagnosed with ADHD than girls and studies show that at least four out of every five cases are diagnosed in boys (Anderson, 2012; Ronson, 2021). Similarly, 30-50% of a diagnosed childhood ADHD will be continued until adolescence and adulthood. Until now an exact cause has not been revealed for this situation and it is believed that genetic, organic and environmental factors contribute to this condition. The important thing is that this disorder negatively impacts on the behavioral, academic, social, emotional and cognitive development of the child (Weinstein et al., 2000; Perera et al., 2012). Many research have shown that in every classroom there will be at least

one child with ADHD traits. ADHD effect in difficulties with academic performance and peer relationships in a child. Further, inattention leads to disruptive and aggressive behaviors and problems with working memory, planning, and organization. Hence, children with ADHD are more likely to have lower academic performance compared to their counterparts without ADHD (Bolinger et al., 2020).

1.1.1. Attention-deficit/hyperactive disorder

ADHD is often first identified in school-aged children when it leads to disruption in the classroom or problems with school work. Symptoms of ADHD include inattention (not being able to keep focus), hyperactivity (excess movement that is not fitting to the setting), and impulsivity (quick acts that occur at the moment without thought) (National Institute of Mental Health, 2020).

Symptoms and diagnosis

Children, who meet the diagnostic criteria for ADHD, differ in that their symptoms of hyperactivity, impulsivity, and inattention are noticeably greater than expected for their age or developmental level. These symptoms can affect their home environment, school work, and relationships.

Types of ADHD

- Predominantly inattentive presentation: This refers to challenges with staying on task, focusing, and organization.

- Predominantly hyperactive/impulsive presentation: This refers to excessive movements such as fidgeting, possessing extra energy, not sitting still, and being talkative. Impulsivity refers to decisions or actions taken without thinking through the consequences.
- Combined presentation: This type of ADHD is diagnosed when both criteria namely inattentive and hyperactive/impulsive types are met.

As mentioned by the American Psychological Association (APA) (2013), the diagnosis is based on the occurrence of constant symptoms over a period of time and are noticeable over six months. The medical report reveals that this could be at any age, but this disorder begins in childhood and the symptoms must be present before the age of 12 years and must have caused difficulties in more than one setting. ADHD is typically diagnosed by mental health providers. Furthermore, ADHD can co-exist with other mental health problems such as conduct disorders, anxiety disorders, and learning disorders.

Treatment for ADHD

Treatment for ADHD typically involves a combination of therapy and medication. In preschool-age children, the recommended first-line approach consists of behavioral strategies, including parent management training and school-based interventions. Additionally,

Parent-Child Interaction Therapy (PCIT) is recognized as one of the most effective therapeutic approaches (Ronson, 2021). Recent studies emphasize that psychostimulants are the primary pharmacological treatment for managing ADHD.

There are many types of medications that depend on the efficacy of treatment and tolerability of the medication. Anyhow, the goal of treatment is to improve the behavior to restore functioning in the school and home environment.

The teachers and school management can provide doctors and parents with information to help evaluate behavior and learning problems and can assist with behavioral training. However, as pointed out by researchers, school staff cannot diagnose ADHD, take decisions about treatment, or decide whether a student should take medication to attend school. Only parents can give this decision after discussion with the doctors. Anyway, students with worse situations can carry on with learning under special education under the individuals with Disabilities Education Act (National Institute of Mental Health, 2020). However, they can benefit with alternative teaching techniques and changes in the classroom set up.

Mostly, behaviors related to ADHD are first observed in the classroom setting and teachers are the first persons to notice the signs, raise concerns about the child and the

make a referral for assessment (Dupaul & Weyandt, 2006; Anderson et al., 2012; Perera et al., 2012). The studies emphasize that with timely treatments many cases can be handled and achieve their potentials in school as individuals. Hence, the teacher plays a vital role in working with school management as a psychologist and a psychiatrist in the diagnostic process by providing essential information. Furthermore, the studies emphasize that teachers can highly contribute to the implementation, evaluation and support with the remedial plans. Therefore, teachers play a crucial role with ADHD children's day to day life and it is important to find out teachers' knowledge and perception of ADHD.

Many studies have been conducted globally on this theme (Stormont, & Stebbins, 2005; Dupaul & Weyandt, 2006; Kring et al., 2010; Anderson et al., 2012; David, 2013; Ronson, 2021). More recent studies reveal that the teachers' knowledge and attitudes on ADHD are not satisfactory; for example teachers' knowledge in Canada is 68%, Colombia 48.52%, USA 46.49% and Pakistan 45.30%. Considering the Sri Lankan situation, it is surprising that only a few research have been undertaken in this area (Rodrigo, et al., 2010; Perera et al., 2012; Menikdiwela & Vojtova, 2017; Nazeer et al., 2022). The knowledge and the perspectives towards the ADHD among Sri Lankan school teachers remain largely unknown. Hence, on the above background this study

attempts to collect and analyse data on primary teachers' knowledge and perspectives towards ADHD.

1.2. Justification

In every primary school classroom, there will be at least one child with ADHD and, teachers are precious sources of information in making the diagnosis of ADHD. Approximately 63% of students with ADHD spend their day in a general education classroom setting therefore, teachers are a valuable resource (Ronson, 2021). Nevertheless, as studies revealed, the teachers tasked with educating ADHD students educating is minimal.

The previous studies highlighted that 40% of medical referrals were initiated by the teachers (Perera et al., 2012; Ronson, 2021; Nazeer et al., 2022). Consequently, early identification is of great importance and primary school teachers have a key responsibility in this regard. As has been discussed earlier, ADHD symptoms that should improve with effective management include hyperactivity, attention span, impulsivity, social interaction with peers, teachers and parents and academic productivity. Timely treatments have a chance to overcome the situation and achieve child potentials in school as individuals. As emphasized by medical experts, the most effective therapeutic approach is multimodal treatment which consist of multiple element medication, parent awareness and training programmes, educational

programmes, behavioral techniques at school and home etc. During the childhood, children spend a considerable amount of time in the school with teachers and they can highly contribute to the implementation, evaluation, and support with the treatments of child with ADHD (Youssef et al., 2015). Therefore, teachers should have a proper knowledge of ADHD for them to be able to play such a significant role in all these tasks.

Nevertheless, in the education system in Sri Lanka, there is no well-structured special education or counselling programme for teachers to raise awareness on ADHD and train them on how to teach and support relevant children in the classroom. As far as research literature is concerned, ADHD can be identified as one of an unattended area in the education system in Sri Lanka. Therefore, the previous studies stress low awareness towards the ADHD among the teachers and remedial measures remains largely unknown within the Sri Lankan context. This creates a research gap for the present research.

Besides, the dearth of valid literature and statistics has been emphasized by several researchers (Rodrigo, et al., 2010; Menikdiwela & Vojtova, 2017). Hence, it is useful to investigate into primary school teachers' knowledge and perception about children with ADHD to achieve the objectives of the education system in Sri Lanka in the long run.

1.2. Objectives

General objective

To assess the knowledge and perceptions of primary education teachers towards the Attention Deficit Hyperactive Disorder (ADHD) children in Sri Lanka.

Specific objectives

Based on the above considerations, the specific objectives of the research were,

- To identify primary education teachers' knowledge on ADHD
- To assess primary education teachers' attitudes toward children with ADHD
- To identify the relationship between the knowledge and attitudes of primary education teachers toward ADHD

METHODOLOGY

The design of this study was quantitative in nature. The quantitative studies' great strengths is providing descriptive and in-depth understanding of the problem (Creswell, 2003). Hence, the main purpose of selecting the quantitative method is the relevance of it to achieve the formulated research objectives.

The population of the study was Grade 1 -2 primary teachers. The teachers were selected (N=391) based on the random sampling method and Western and Sabaragamuwa Provinces were purposively selected to represent Sri

Lanka (Table 01). As highlighted by Patton (1990), the importance of purposive sampling method is, that it directly reflects the purpose of the study and helps to investigate insight deeply.

Under the survey method a self-report questionnaire was used in previous studies (Youssef, Hutchinson & Youssef, 2015) to collect data on teachers' knowledge and attitude towards the children with ADHD. The online questionnaire was modified to suit the Sri Lankan context with the help of subject specialists. The first part of the questionnaire was comprised of questions for inquiring about basic information of the sample while the second part comprised of 25 true-false type items to check teachers' actual knowledge of ADHD. The last part was a case

study intended to measure their perception of ADHD. This third part comprised 16 statements framed according to a Likert scale.

Descriptive statistics was utilized to analyze the research data because it allowed the researcher to explore frequencies and percentage of demographic data as well as to compare information. The mean, median, and standard deviation were calculated for the overall score on the entire survey. Data were further analyzed using Pearson Correlation Coefficient to check whether there was a connection between teachers' knowledge and their perception on ADHD.

Ethical Considerations

In every step of the study, all the ethical values of research were upheld and abided by.

Table 1: Sample of the Research

Province	District	Educational Zone	Medium		Gender		School Type												
			Sinhala	Tamil	Sinhala	Tamil	Sinhala	IC	T2	T3	LAB	IC	T2	T3					
Western 287	Colombo (113)	Colombo (62)	Sinhala	Tamil	Boys	Girls	Mixed	Boys	Girls	Mixed	LAB	IC	T2	T3	LAB	IC	T2	T3	
			59	03	13	17	29	-	03	-	12	16	07	24	02	01	-	01	
			18	-	-	-	18	-	-	-	01	02	06	09	-	-	-	-	-
			33	-	01	03	29	-	-	-	04	13	03	13	-	-	-	-	-
Gampaha (65)	Minuwangoda (65)	Minuwangoda (65)	Sinhala	Tamil	Boys	Girls	Mixed	Boys	Girls	Mixed	LAB	IC	T2	T3	LAB	IC	T2	T3	
			62	03	05	01	56	-	-	-	03	03	06	08	45	-	-	01	02
			60	10	04	-	56	-	-	-	10	03	26	15	16	-	04	01	05
			28	11	02	09	17	-	10	01	05	08	04	11	05	-	01	04	
Sabaragamuwa 104	Kegalla (62)	Dehiowila(14)	Sinhala	Tamil	Boys	Girls	Mixed	Boys	Girls	Mixed	LAB	IC	T2	T3	LAB	IC	T2	T3	
			14	-	-	02	11	-	-	-	-	02	03	01	08	-	-	-	
			28	20	-	01	27	-	01	19	01	11	07	09	06	01	10	03	
			18	01	01	-	18	-	-	01	03	06	06	03	-	01	-	-	
Rafnapura (42)	Rafnapura (42)	Rafnapura (42)	Sinhala	Tamil	Boys	Girls	Mixed	Boys	Girls	Mixed	LAB	IC	T2	T3	LAB	IC	T2	T3	
			23	-	-	-	23	-	-	-	01	07	04	11	-	-	-		
			343	48	26	33	284	-	14	34	35	98	61	149	13	07	14	14	
			343	48	26	33	284	-	14	34	35	98	61	149	13	07	14	14	

RESEARCH FINDINGS

3.1 Basic Information

Before discussing the primary school teachers' knowledge and attitudes toward ADHD it is important to explore the basic characteristics of this sample such as the teaching period as a primary teacher, educational and professional qualifications, gender, etc. It helps uncovering important relationships regarding this study.

Teaching Grades

In the general education system in Sri Lanka, as an educational policy, only one teacher is assigned to teach Grades 1-2. Its purpose is to develop the foundation for formal education by identifying the children's potential and personality traits.

However, within these two provinces it was revealed that out of the 391 schools, only 58% are engaged in teaching both grades 1 and 2 (Figure 1).

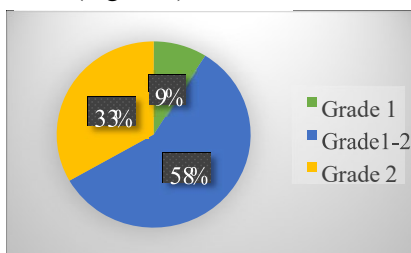


Figure 1: Teaching grades within the sample

Teacher Service: Primary education teachers have more experience with students' behaviour than other teachers. For this, their period of service in teaching is very important. As far as the period of service of the teachers who participated in the study was concerned (Table 2), it was seen that a majority of them were well-experienced teachers and over 50% have a service period exceeding 10 years. Accordingly, it can be assumed that they have a good understanding and experience of children's behaviour patterns.

Table 2: Period of service in teaching

Period of service (years)	%
Above 34 years	1.3
28-34	21.43
21-27	10.54
14-20	21.2
7-13	21.8
4 months - 6 years	25

Educational and Professional Qualifications

Looking into the educational and professional qualifications of the sample, it was found that they ranged from GCE (Advanced Level) to Masters level (Figure 2).

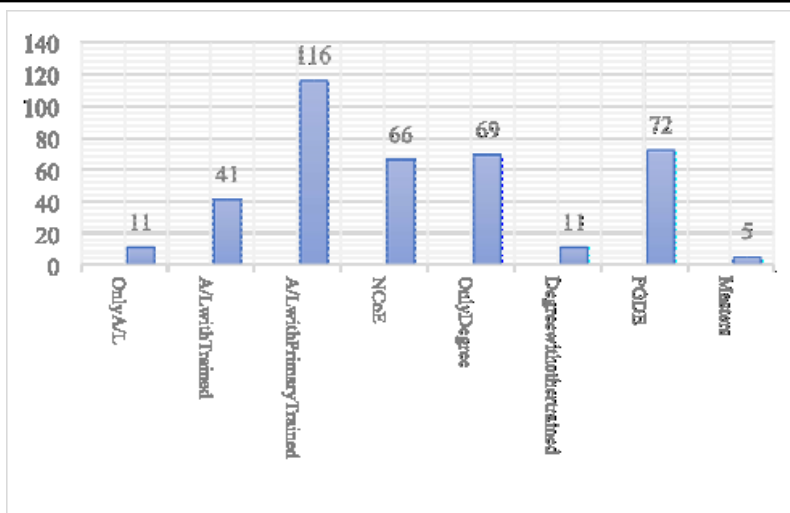


Figure 2: Educational and professional qualifications of the teachers in the sample

As displayed by Figure 2, according to the educational and professional qualifications of the study sample fall into eight categories. These eight categories can be classified into main two types. That is, as primary trained teachers and teachers with other qualifications. Under the category of primary trained teachers, primary trained teachers qualified with G.C.E.(A.L.) (29.7%) and National Colleges of Education (NCoE) qualified (16.9%) could be identified (Here, NCoE qualified all the teachers were considered qualified teachers in primary education). Accordingly, as a whole, the percentage of primary trained teachers was 46.5%. Under the second category, several types of qualified teachers could be identified. i.e. qualified with only G.C.E. (A.L.), trained and with G.C.E. (A.L.) (IT, English, Early childhood, Commerce, Nutrition, Maths, Distance trained, etc.), only

degree qualified, degree with a training in other subjects (Home science, English), PGDE, and Masters qualified. These were 53.5%. Among them, 2.8 % of teachers without any professional qualifications were Advanced Level certified. Despite this wide range of academic qualifications, it was revealed that only 46.5% of the teachers were professionally qualified for primary education.

3.2. Teachers' Knowledge on ADHD

A 25-item questionnaire was used to check the teachers' actual knowledge of ADHD (Kos, Richdale, & Jackson, 2004) each item anticipating a true-false answer. The questionnaire was presented under three sections namely the general knowledge on ADHD, ADHD symptoms/diagnosis, and the knowledge related to treatment. Of the study sample, 58.9% of teachers' answers

were correct, and only 43.4% were incorrect.

Table 3: Percentage of teachers' knowledge on ADHD

	Mean	SD
Correct	58.9	28.63
Incorrect	43.4	28.07

Table 4: Percentage of teachers' responses to knowledge items

Question Number	Correct Answer (%)	Incorrect Answer (%)
Q - 1	96.7 (n=378)	4.1 (n=13)
Q - 2	72.3 (n=233)	27.6 (n=108)
Q - 3	80.5 (n = 313)	19.9 (n=78)
Q - 4	85.7 (n=335)	14.3 (n=56)
Q - 5	75.4 (n=295)	24.6 (n=96)
Q - 6	25.1 (n=98)	74.9 (n=293)
Q - 7	66.2 (n = 259)	33.8 (n=132)
Q - 8	38.1 (n=140)	61.9 (n=242)
Q - 9	20.5 (n=80)	79.5 (n=311)
Q - 10	19.4 (n=76)	80.5 (n=315)
Q - 11	91.0 (n=256)	9.0 (n=35)
Q - 12	38.9 (n=152)	61.1 (n=239)
Q - 13	89.5 (n =350)	10.5 (n=41)
Q - 14	8.7 (n=34)	91.3 (n=357)
Q - 15	76.0 (n=297)	24.0 (n=94)
Q - 16	94.6 (n=370)	5.4 (n=21)
Q - 17	95.7 (n = 374)	4.3 (n=17)
Q - 18	39.9 (n=156)	60.1 (n=235)
Q - 19	72.6 (n=284)	27.4 (n=107)
Q - 20	72.4 (n=283)	27.6 (n=108)
Q - 21	6.6 (n=26)	93.3 (n=365)
Q - 22	56.5 (n=221)	43.5 (n=170)
Q - 23	79.5 (n=311)	20.5 (n=80)
Q - 24	12.0 (n=47)	88.0 (n=344)
Q - 25	62.1 (n=243)	37.9 (n=148)

The 25-item questionnaire, percentages of correct answers for general knowledge of ADHD, symptoms/diagnosis, and treatment were 72.6%, 50.4% and 40%, respectively.

Of the 25 questions on ADHD, 11 were general knowledge questions. Except for two of these questions, more than 50% of the remaining questions were answered correctly. Among these, more than 90% of the

teachers responded correctly to the following questions.

Q.1 - The term ADHD is used as a shorthand to describe inattentive and hyperactive children

Q.11 - Approximately 5% of school- aged children in Sri Lanka have ADHD

Q.16 - There are sub types of ADHD

Q.17 - ADHD affects male children only

From the general knowledge questions, whether or not a person suffers from ADHD is decided by doctors (20.5%), and ADHD cause of occurrence is not yet found (39.9%) where the questions for which participants gave minimum correct answers.

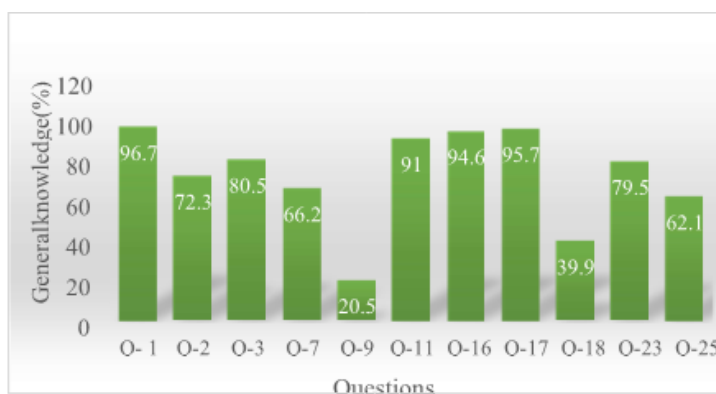


Figure 3: Percentage of correct answers for questions relating to general knowledge on ADHD

Of the 25 questions, nine questions were based on symptoms/diagnosis of ADHD. Among those questions, the highest number of correct answers were received for these items: ADHD can be inherited by gene (89.5%); All children with ADHD are hyperactive (76%); ADHD children are born with biological vulnerabilities toward

inattention and poor self- control (75.4%); If a child can spend a lot of time on computer games, he/she will not fall a victim to ADHD (72.4%). Meanwhile, the children suffering from ADHD cannot sit in a certain place for a long time and pay attention (6.6%) and children with only mother or father, suffer from ADHD (12%) recorded low percentages of correct answers.

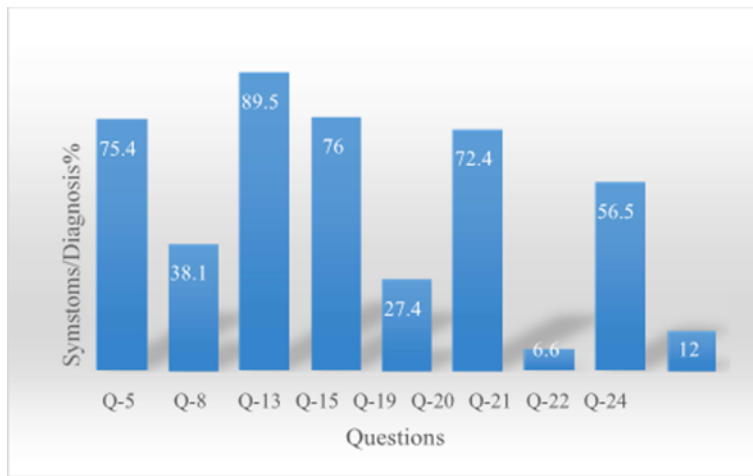


Figure 4: Percentages of correct answers relating to symptoms/diagnosis of ADHD

With regard to the five questions asked in the treatment section, higher scores were observed for: If medical treatment is provided, the intervention of educational treatment is not necessary for these children (85.7%); Diets are usually not helpful in treating most children with ADHD (61.1%).

If a child responds to stimulants medications, then he or she probably has ADHD (25.1%), children with ADHD always need a quiet environment to concentrate (19.4%), and medication is a cure for ADHD (8.7%) were the relatively poorly responded areas.

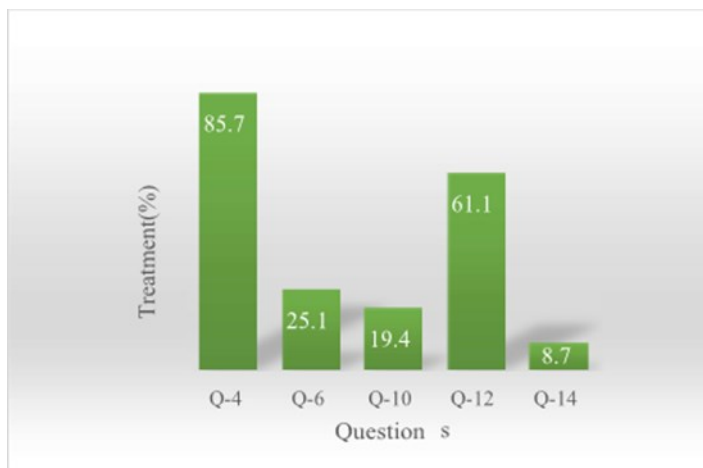


Figure 5: Percentages of correct answers relating to the treatments of ADHD

Hence, overall general knowledge of ADHD was found to stand above compared to symptoms/ diagnosis and treatment sections.

3.3. Teachers' Perceptions on ADHD

The primary teachers in the sample were given statements through a case study to investigate into their perceptions on ADHD. The questions were asked under three sections namely ADHD behavior characteristics, how to intervene for behavioral characteristics of ADHD and medical treatments using a Likert scale questionnaire.

Teacher perceptions were gleaned using a 1-9-point Likert scale

consisting of 16 statements to which the respondents expressed their degree of agreement or disagreement as given below.

1 Strongly Disagree

2- 5 Somewhat Agree

6 - 8 Agree

9 Strongly Agree

Figure 6 shows how teachers responded to the 16 Likert scale statements given. The mean of the answers given to the statements was 11.7%. 1 to 9 are presented below on a scale ranging from strongly disagree to strongly agree.

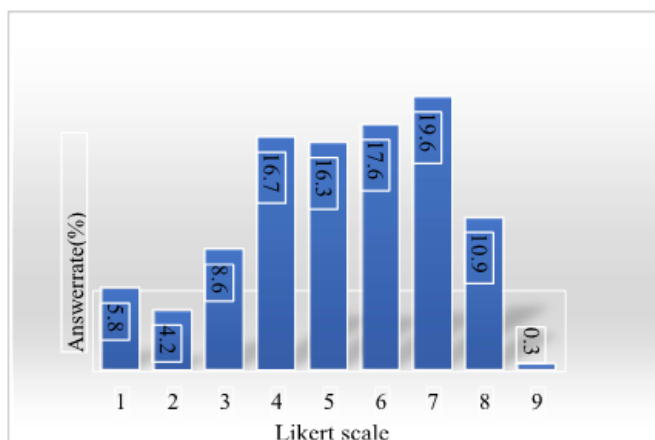


Figure 6: Answer rate for the Likert scale statements

According to Figure 6, 5.8% of the teachers in the sample disagreed with the statements given in the questionnaire, while 45.8% agreed somewhat, 48.1% agreed, and 0.3% agreed strongly.

The mean percentage of the respondents who strongly disagreed

was 8.8%. When searching about ADHD behaviour characteristics and how to intervene for behavioural characteristics of ADHD and medical treatments, it was revealed that the percentages of the strongly disagreed were 16.1% over diet and nutrition, 12.3% in

food control and 7.4% in unrecognized learning problems.

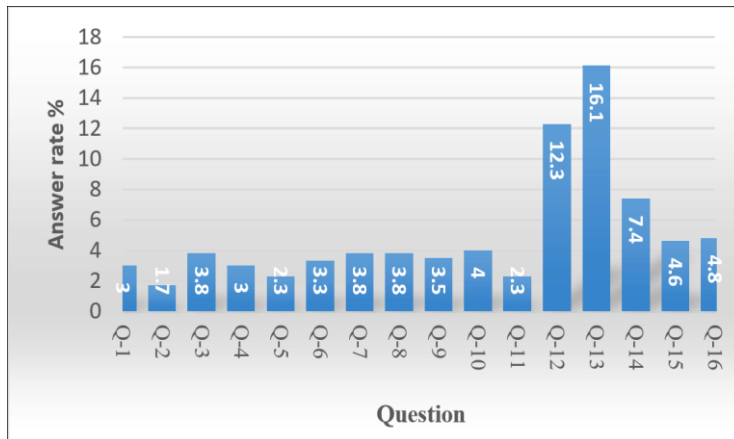


Figure 7: Rate of the respondents strongly disagreeing with the statements on ADHD

Somewhat Agree

Here the mean was 68.5%. More than 40% agreed with the six statements given below.

- Q.10.1 In your opinion, Chamika's behaviour is attributed to poor diet and nutrition
- Q.1 As you think how serious is Chamika's behavior?
- Q.8 In your opinion, how much effective is having Chamika in the classroom?

- Q.9.4 In your opinion, how effective is diet as a treatment?
- Q.10.3 In your opinion is Chamika's behavior caused by neurobiological problems?
- Q.6 How confident are you that you could implement effective class interventions for Chamika?

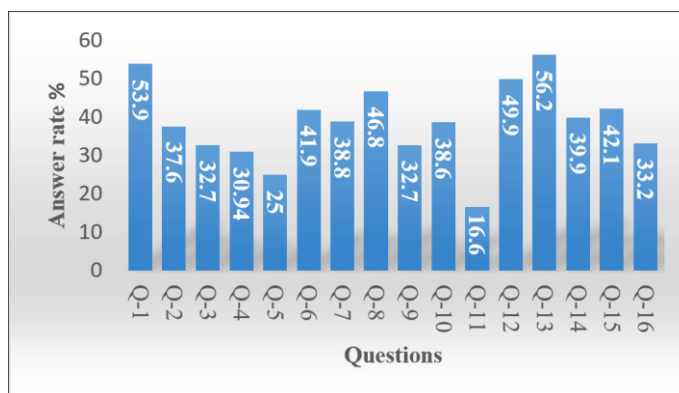


Figure 8: Rate of respondents somewhat agreeing with the statements on ADHD

According to data, it is emphasized that Chamika's behaviour is significantly bad, keeping her in the classroom is a problem, and needs to be intervened as a teacher, and it is clear that the cause is poor diet and neurobiological factors.

Agree

An average of 73.6% agree with the given statements. It could be emphasized that out of the 16, more than 40% agree with 10 statements mentioned below.

Q.2 To what extent does Chamika's behaviour affect day-to-day tasks?

Q.3 How much does her behaviour affect those around her?

Q.4 How much does Chamika's behaviour affect her family?

Q.5 How much would Chamika's behaviour problem interfere with her peer groups/ classroom

Q.6 How much can you intervene in Chamika's problems as a teacher?

Q.7 To what extent are you worried about Chamika's behaviour during your teaching?

Q.9.2 In your opinion, how far are medical treatments effective?

Q.9.3 Making behavioural changes in the classroom and at home

Q.10.3 In your opinion, the reason for Chamika's behaviour are neurobiological issues

Q.10.4 In your opinion, the reason for Chamika's behavior are family issues

And the least agreed-upon question was: In your opinion, how effective is the diet as a treatment (29.1%)?

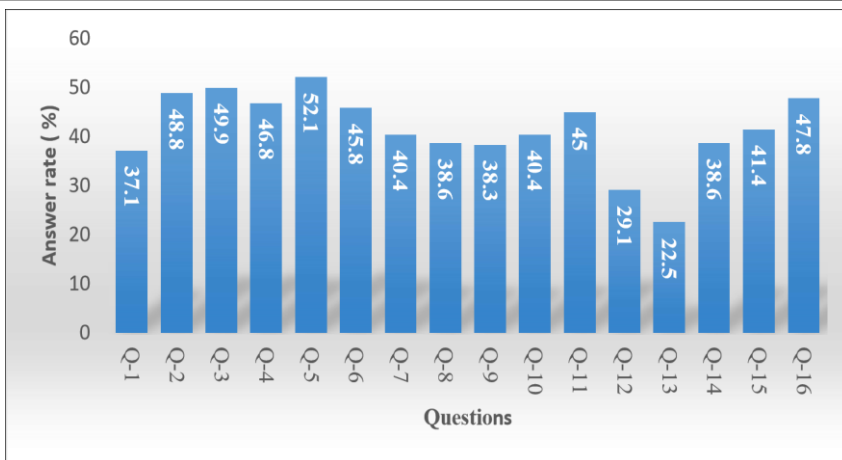


Figure 9: Rate of respondents agreeing with the statements on ADHD

Strongly agree of the responses given to the questions can be identified from Figure 10. 'As you think how serious is Chamika's behavior?' (Q-1). Its mean was 0.2. As a whole, the nature

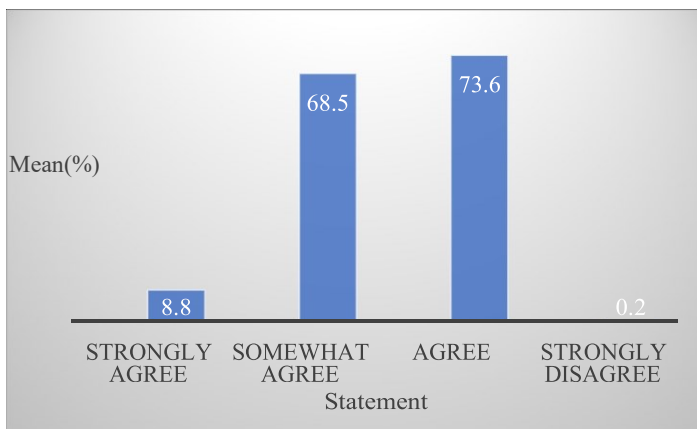


Figure 10: Percentage of answer rate for the Likert scale

Thus, teachers' perceptions reveal that more than 68% somewhat agree and agree for all questions.

3.4. Connection between Teachers' ADHD Knowledge and Perceptions on ADHD

When analyzing the relationship

between teachers' knowledge and their perception of ADHD, the Pearson's Correlation Coefficient ($r = 0.67$) indicates a moderate positive relationship, but it does not suggest a strong significant correlation.

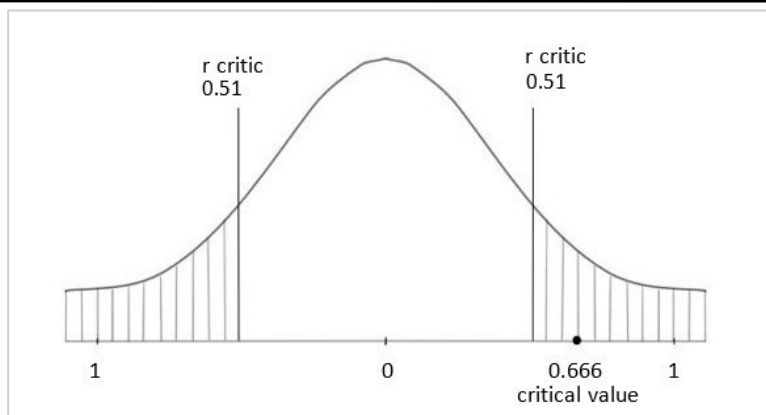


Figure 11: Connection between teachers' knowledge of ADHD and their perceptions

DISCUSSION

Identifying student behaviours from a psychological background and formally assessing the students' skills, interests, personality types and guiding students in the right direction in academic performance is the main role of primary education teachers.

Research reveals that every regular classroom has at least one student with ADHD. ADHD is a significant problem specially at home and in the classroom for students and, on the other hand, for teachers as well. Children with ADHD have an increased risk of academic failure due to the lack of attention for academic work and troublesome characteristics in the classroom. On the other hand, many teachers cannot make classroom activities successful due to a lack of time.

Research conducted by Menikdiwela (2017), Rodrigo & et al. (2017) highlights that there is not enough knowledge of ADHD

among the primary education teachers. Further research reveals a lack of attention paid by educators when preparing the policy in this regard. Nanzeelan and team (2021) point out the need for school-based screening to identify and refer children early.

Concerning the local background situation of ADHD, several key points can be emphasized. The place given to special education and Counselling in primary education needs to be further discussed.

One of the things that has been discovered is that much attention is not given to such special matters in raising awareness of primary education teachers. Although it was discovered that there is some awareness about students with special educational needs during the primary education In-service Advisor (ISA) training, it is not certain whether this knowledge is obtained in a way that the teachers engaged in primary education.

The school is a new experience with different social and cultural backgrounds for Grade 12 students. On the other hand, primary classrooms tend to have larger numbers of students than the prescribed limits. Due to practical problems such as the presence of a large number of students, primary teachers should pay more attention to the need to complete the classroom teaching and learning in a formal manner. With this background, primary education teachers have a limited scope available to focus on things such as ADHD. Further, Grade 1-2 teachers should have some specific knowledge and experience on ADHD student behaviors, mentality and adaptation techniques for the classroom. According to the study conducted, it appears that although teachers have some level of knowledge in ADHD, they lack adequate knowledge about the treatment/ symptoms and medications.

CONCLUSION AND RECOMMENDATIONS

The school is a first-hand experience for elementary students who come from different social and cultural backgrounds. Approximately one child with ADHD spends their day in a classroom setting with primary education teachers. During school, a child suffering from ADHD faces many difficulties in social as well as academic performances. Hence, within the teaching and learning process, primary education teachers

should have a vital role in the early detection and referral of the child.

By exploring ADHD knowledge and perception among primary education teachers, the analysis revealed that 65% of teachers had teaching experience of more than 20 years, and among them, only 46.5% were directly professionalized for primary education. Their general knowledge of ADHD was higher (58.9%) than their knowledge of symptoms/ diagnosis, and treatments. Further, their perception of ADHD moderately agreed with ADHD behavioral characteristics, intervention, and medical treatments. According to Pearson's Correlation Coefficient, there is no significant relationship (r value = 0.51 is less than the r value 0.6) between teachers' knowledge on ADHD and their perception.

Still, ADHD is one of the unattended areas in the education system of Sri Lanka. According to the study findings, several major suggestions can be presented. First and foremost, of them is the need for proper awareness of educational policymakers, and curriculum developers on this theme. Secondly, the need for a well-structured educational programme for teachers to raise awareness and the need to train them on how to formally intervene with children with ADHD in the classroom is underscored. Thirdly, the need for an effective psychological counselling approach is recommended.

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Identifying the Effectiveness of Online Language Learning: Teaching Japanese Language via Zoom in Junior Secondary Schools in Sri Lanka

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ABSTRACT

The purpose of this study was to find out the effectiveness of Online Language Learning using Self-Learning Modules. Furthermore, this study investigated student perceptions towards online Japanese language learning and the challenges associated with learning via synchronous online platforms. The target population was the students in grade 8,9 and 10 in the junior secondary schools in Sri Lanka. The sample was 92 students who voluntarily registered for the Japanese Language online course conducted for three months. The research method included surveys and an achievement test to assess students' levels of satisfaction, perceptions, and learning outcomes. The questionnaire utilized a 4-point rating scale that ranged from "strongly agree" to "strongly disagree" to assess students' perceptions and level of satisfaction towards online Japanese language learning and to identify the difficulties and challenges in online language learning as well. The data were analysed using descriptive statistics in SPSS software. Findings revealed that the participants expressed overall satisfaction with online Japanese language learning conducted through Zoom technology, acknowledging successful class delivery and the acquisition of expected learning outcomes. Additionally, students demonstrated positive attitudes towards both the self-learning module and online classes. The results show that nearly 50% participants have scored above 75% and they have achieved the expected learning outcome in a satisfactory level. Despite encountering challenges, participants overcame barriers to meet their learning objectives. These findings will be supported for language teachers, curriculum developers, and teacher trainers in education sector in Sri Lanka. The findings and methodology of this study can be applied to enhance the mode of delivery of foreign languages in the general education system in Sri Lanka.

Keywords: *Online language learning, Self-learning module,
Synchronous online platform, Student perception, Junior
secondary schools*

INTRODUCTION

Foreign language learning has become an integral part of lifelong learning in the 21st century, with billions now pursuing foreign languages and many of them moving abroad to study in native environments (IALC Report, 2016). This trend is driven by globalization, which has made multilingual proficiency essential for trade, investment, diplomacy, and international relations. Beyond economic benefits, learning foreign languages enriches students' academic and life experiences, opening doors to diverse career opportunities. The global economy's increasing diversity has heightened the demand and desire for foreign language education. As a result, learning foreign languages is universally significant for engaging with the global community (Lin, 2013). The rising importance of language proficiency in maintaining relationships across communities has led to a gradual increase in the number of people learning foreign languages annually. Additionally, foreign language knowledge supports social, cultural, economic, and technological developments, although it is not a guaranteed pathway to better job opportunities (Yurtseven, Bülent, Alci, & Karatas, 2014). Effective communication with the global community often relies on a shared language, facilitating intercultural understanding and cross-cultural communication.

In Sri Lanka, the need for foreign language education has become

more pronounced due to the country's integration into the competitive global economy. Over recent decades, the popularity of learning foreign languages in Sri Lanka has grown, driven by economic benefits, tourism, employment opportunities, and scholarships for higher education abroad. The government has responded by introducing few foreign languages into the secondary education curriculum, offering most popular and useful languages such as Hindi, Arabic, German, French, Russian, Chinese, Korean, and Japanese etc. Among these, Japanese and Korean are particularly popular due to their associated economic advantages, including career and educational opportunities. One of the primary objectives of the government is to reduce the unskilled category in the labour force to 10% by 2025 (National Policy Framework, 2019) and send more skilled workers to the countries such as Japan, Korea and European countries. Hence, it has become more important to know other languages more than mother tongue in order to be able to open the way for this skilled workforce. Therefore, the need for Sri Lankan students to learn a foreign language is more essential today since the Sri Lankan economy has been opened to the competitive world. Sri Lanka's current economic crisis has highlighted the importance of foreign employment as a source of foreign currency. Countries like Japan and South Korea have offered significant job opportunities for skilled workers, emphasizing the need for proficiency in their

respective languages. The Sri Lankan government aims to reduce the unskilled labour force and increase the number of skilled workers proficient in foreign languages to meet global labour market demands (National Policy Framework, 2019).

The increasing demand for foreign language learning in Sri Lanka has prompted the government to enhance foreign language education. The Ministry of Education (MoE) and the National Institute of Education (NIE) in Sri Lanka, recognize the importance of this development. Financial support and facilities from countries like Japan, China, Korea, and Russia also contribute to improving the quality of foreign language education in Sri Lanka. However, despite these efforts, the foreign language education system in Sri Lanka is still in its initial stages due to various challenges, including a lack of resources, qualified teachers, and economic constraints. Despite the introduction of foreign languages in school education, only a limited number of Sri Lankan students have access to foreign language learning due to resource limitations. The recruitment of foreign language teachers is infrequent and insufficient to meet current needs. To address this, an alternative solution is necessary to provide equitable foreign language learning opportunities. Digital learning platforms in a distance learning mode can overcome these barriers, allowing students to learn at their own pace without direct teacher interaction (Sagitova, 2014).

The COVID-19 pandemic has accelerated the shift to digital education, with online teaching becoming a new norm. This transition has opened up education to many more people, offering flexibility and accessibility. Online learning environments are interactive, learner-centered, and flexible, utilizing various digital technologies (UNESCO, 2020). Self-learning through digital platforms has become increasingly popular, providing an alternative to traditional classroom-based education (Aretio, 2020). Online education offers two main modes: asynchronous and synchronous. Asynchronous learning allows students to interact and learn at their own pace, while synchronous learning involves real-time communication through video conferencing platforms like Zoom (Nurieva & Garaeva, 2020). These modes provide flexibility and accessibility, making education more inclusive (Nuryanto, 2021).

In Sri Lanka, where foreign language learning resources are limited, distance learning through online platforms can serve as an effective alternative. This approach can also be applied in emergency situations, such as the COVID-19 pandemic. Adopting alternative teaching methodologies is crucial to maximize foreign language learning opportunities and align with global educational trends. However, challenges such as internet connectivity and access to online facilities must be addressed to ensure equitable participation in digital learning (Sequeira, 2014).

Therefore, the current study investigated the students' perception towards online language learning and the limitations of learning a foreign language using a self-learning module via synchronous online platform. The findings will support to make better decisions regarding the development of foreign language education under the new curriculum reform with the suggestions for introducing self-learning approach for overcoming the current barriers in the system in Sri Lanka.

LITERATURE REVIEW

The role of education in enhancing the quality of human capital is pivotal for sustainable national development, requiring a focus on diverse aspects that enhance the learning process (Rahmawathi, 2019). Modern learners must gather information from various sources and engage in lifelong self-education to remain competitive in the global labour market. Encouraging learner autonomy and active engagement in self-education is a primary challenge in contemporary education. Lifelong learning and self-education are critical needs for today's learners. The shift from teacher-centered to student-centered education is increasingly recognized, emphasizing learners' responsibility for identifying objectives and planning their learning activities. This approach caters to each student's interests, abilities, and learning preferences, promoting active and independent participation in discovery learning (Sagitova, 2014). Many countries have adopted

policies to foster self-directed learning, recognizing that such learners achieve more and develop greater responsibility compared to passive learners.

Self-learning modules are an effective strategy for promoting self-directed learning. These methodically structured tools include learning materials, strategies, goals, and outcomes, allowing students to assess their learning. Self-learning modules offer flexibility in learning time, pace, and location. Studies have shown that students using self-learning modules outperform those taught by traditional methods (Dishner, 1975; Kryspin, 1974; Padmapriya, 2015). Despite their benefits, the consistent development and use of these modules remain limited.

The ever-growing globalization has significantly boosted the use of information and communication technology (ICT) in the educational sector, transforming the methods of learning, training, and teaching. The COVID-19 pandemic has transformed education, accelerating the shift to online and digital platforms. E-learning has become a necessity, with many online learning platforms providing free or reduced-cost services to meet the high demand. The widespread adoption of various digital technologies, combined with other suitable learning materials, has fostered an interactive, learner-centered, open, and flexible online learning environment. The effectiveness of online learning as a teaching and learning method has attracted the

attention of language educators and practitioners, broadening their perspectives on creating student-oriented and open-ended learning environments.

Educational technology in the 21st century optimizes learning outcomes through various modern media, practices, and materials. Self-learning modules and computer-assisted learning facilitate critical thinking, curiosity, and individualized learning. These approaches promote skills such as conceptualizing, applying, analysing, synthesizing, and evaluating information (Padmapriya, 2019). The pandemic has popularized alternative learning approaches such as self-learning and virtual learning, which offer flexibility and convenience. Online learning now thrives in an interactive, learner-centered environment, utilizing synchronous and asynchronous platforms like Microsoft Teams, Google Hangouts Meet, and Zoom. Zoom, in particular, supports extensive virtual group meetings and has become essential for real-time educational communication (Son, 2007; Nurieva & Garaeva, 2020). Based on their primary functions and features, the online tools have been categorized into twelve groups: learning/content management systems, communication tools, live and virtual worlds, social networking and bookmarking platforms, blogs and wikis, presentation tools, resource sharing tools, website creation tools, web exercise creation tools, web search engines, dictionaries and concordances, and

various utilities (Jeong-Bae Son, 2011).

Despite the advantages, there are significant challenges in online learning, including technical issues, limited social interaction, and insufficient control (Taghizadeh & Hasani Yourdshahi, 2020). Effective online teaching requires instructors to adeptly use technology to foster interaction and motivation (Wright, 2014). While digital platforms can enhance learning opportunities, disparities in technology access remain a concern.

In conclusion, promoting self-directed learning through self-learning modules and leveraging educational technology are essential for modern education. Despite challenges, the shift to online and digital learning offers significant opportunities for enhancing the quality of education and ensuring students' competitiveness in a globalized world. The ongoing evolution of educational practices must address these challenges to maximize learning outcomes and provide equitable learning opportunities.

2.1. Research Objectives

1. To identify the students' satisfaction and perceptions towards online Japanese language learning using self-learning modules
2. To find out the effectiveness of online foreign language learning
3. To identify the difficulties and limitations of online foreign language learning.

METHODOLOGY

The survey method was used as the research methodology, with a questionnaire employed to collect data to achieve objectives 1 and 3. Additionally, to achieve objective 2, an achievement test was conducted to determine whether students had achieved the expected learning outcomes after participating in online classes for three months. The students in the sample group learned the Japanese language using self-learning modules through a synchronous digital platform (Zoom) provided by the researcher. The target population was the students in grade 8,9 and 10 in the junior secondary schools. The sample group of the study was selected from the students who participated a survey related to identify the current demand of learning foreign languages in randomly selected schools in all provinces which are currently offer foreign languages. 92 students were included in the sample who voluntarily participated the online Japanese language course for three months.

A questionnaire was designed on identifying the learners' level of satisfaction and perception towards online language learning. Students were also asked to mention the difficulties and the challengers during the online language course. A google form shared to collect the data. Further an online assessment test conducted to assess whether the students have achieved the expected learning outcomes of the module.

Statistical Package for the Social

Sciences (SPSS 28) and Microsoft Excel were used for data analysis, with descriptive statistical methods applied to analyze the data. The online lessons were conducted once a week per one hour during the three-months' period considering the content of the module. After the given period, an online assessment test was given and scores were analyzed and interpreted by using mean and standard deviation through the use of statistical package SPSS and Microsoft Excel. The data were analysed through descriptive statistics analysis.

RESULT AND DISCUSSION

This study investigated students' perceptions towards online Japanese language learning using self-learning modules and the effectiveness of online language learning. The study included weekly one-hour Zoom lessons and a self-learning module over three months, followed by an online assessment to measure achievement levels. Part I of questionnaire consists demographic information such as school, grade, province, district and gender. Part II comprises the background details of foreign languages such as whether their school offers the foreign languages and what languages offers by the school, their willingness to learn a foreign language. The next section was mainly focused on the students' opinion on the self-learning module and the perceptions on Japanese language learning using zoom. Finally, students were asked to state their overall satisfaction towards the online class based on their

experience and the challenges they have faced during the three months' period.

The sample comprised 32.6% male and 67.7% female students. They represent 60.5% the Western province, 15.1% Southern province, 8.1% Central province, 3.5% North Western province. Also 5.8% Sabaragamuwa, 2.3% Uva and 4.7% North Central province and non from the other Provinces have participated. In the second part of the questionnaire, students were asked to state their willingness to learn a foreign language as an additional subject in addition to the compulsory subjects in their school curriculum using online platform. 96.1% students mentioned that they prefer online language learning and 3.9% said that do not wish to learn a language through online. Also, the participants were asked to prefer an appropriate online learning method for them to select from three given options of Synchronous or asynchronous online methods listed below.

- i. Self-learning with the use of asynchronous online platform to learn foreign language such as You tube.
- ii. Use synchronous online platform to learn foreign language such as Zoom under the guidance of a teacher.
- iii. Self-learning with the use of asynchronous online platform to learn foreign language such as You tube using supported self-learning materials.

20.2% participants selected option I, 51.3% selected option II and 28.5% motioned the preferred method as option III. Also 77.9% participants believe that learning a foreign language should be a compulsory subject and 22.1% sated that they do not agree.

Also, the participants were asked to state their reasons for choosing learning a foreign language. The majority of them were willing to learn a foreign language considering the job opportunities of local and foreign job market. Secondly, they believe that the proficiency of the foreign language will be benefited to their life in future. The next reason was they love the culture of the countries which the foreign language they are willing to learn. Also, the higher study opportunities and the scholarships offered by the foreign countries have mentioned by many participants. The influence of parents and the friends are the least mentioned reasons.

In the part III of the questionnaire, students rated their level of agreement towards the six statements regarding the self-learning module. The students' perceptions towards each statement are given in Table 1.

Table 1: The students’ perceptions towards self-learning module

Item No	Statements	Percentage of the Level of Agreement			
		Strongly Agree	Agree	Disagree	Strongly Disagree
1	The module is attractive	58%	42%	-	-
2	Instructions given in the module are simple and clear	58%	31%	1%	-
3	Module is well organized in an attractive way which keep the students hooked from the beginning to the end.	62%	36%	2%	-
4	Exercises given under each unit are sufficient enough	30%	58%	12%	-
5	Internet links for exploring additional details are useful	57%	41%	2%	-
6	This module can be learnt without the guidance of a teacher with the support of Internet	33%	42%	26%	-

The next section of the questionnaire focused on identify the perception of students towards the online language learning based on the experience of learning Japanese language through

zoom platform. The students were rated their perception using 4-point Likert scale on given 20 items and the statistics are given in Table 2.

Table 2: The students’ perceptions towards online learning

Item No	Statements	Percentage of the Level of Agreement			
		Strongly Agree	Agree	Disagree	Strongly Disagree
1	The knowledge gained by participating to 3 months of online language classes are sufficient enough.	21%	58%	17%	3.5%

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2	Learning one hour per week is sufficient since this language is learned additionally to compulsory subjects of the school.	19%	7%	20%	5%
3	Learning through zoom is easy because of a self-learning module has been provided.	41%	50%	7%	2%
4	Learning foreign languages is not easy through online.	13%	31%	45%	11%
5	Learning through zoom is convenient when gaining additional knowledge from internet.	21%	62%	13%	5%
6	Learning through zoom is better if a teacher is not available in the school.	55.8%	36%	5.8%	2.3%
7	The teacher give sufficient time to ask questions regarding the unclear matters	51.2%	43%	5.8%	-
8	Self-learning was done through the module and the internet even after the class in the leisure time.	40.7%	54.7%	4.7%	-
9	Explored additional facts from the links provided by the module	39.5%	58.1%	1.2%	1.2%
10	Learning through zoom using self-learning modules is better than learning in the traditional classroom	26.7%	47.7%	22.1%	3.5%
11	From now onwards I would like to continue Japanese language learning through zoom	59.3%	33.7%	7%	-
12	Learning a foreign language is unsuccessful through zoom	7%	14%	53.5%	25.6%
13	I would like to learn more languages through zoom	46.5%	36%	14%	3.5%
14	I attended to the classes every time I could	67.4%	30.2%	2.3%	-
15	After this online class I believe that I can learn a foreign language from the	32.6%	53.5%	11.6%	2.3%

	internet even without a teacher				
16	I would like to continue learning Japanese language through the internet and self-learning modules here after.	55.8%	36%	7%	1.2%
17	It is important to provide such online learning facilities to the schools where language teachers are not available.	72.1%	26.7%	1.2%	-
18	The teacher taught Japanese in an easy, simple manner.	73.3%	25.6%		1.2%
19	The knowledge given by the class and the methodology of teaching was not impressive.	4.7%	11.6%	44.2%	39.5%
20	After joining to this Japanese class I always use the internet to learn Japanese language and its' culture.	55.8%	41.9%	1.2%	1.2%

In the next section of the questionnaire was focused on finding out how the students have achieved the expected learning out comes of the module. The students were rated their opinion using 4-point Likert scale. The statistics are given in Table 3.

Table 3: The students' perceptions towards the level of achievement

Item No	Statements	Percentage of the Level of Achievement			
		Excellent	Good	Average	Poor
1	Can greet using basic Japanese greetings	64%	34.9%	1.2%	-
2	Can write words and sentences in Hiragana	27.9%	38.4%	31.4%	2.3%
3	Can read words and sentences in Hiragana	22.1%	37.2%	37.2%	3.5%
4	Can understand the classroom instructions and respond.	30.2%	50%	16.3%	3.5%
5	Can do a self-introduction using correct expressions	61.6%	29.1%	8.1%	1.2%

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6	Can count from 1-10000 in Japanese	29.1%	36%	26.7%	8.1%
7	Can make simple sentences using verbs relevant to day today activities	22.1%	40.7%	32.6%	4.7%
8	Can call family members using correct expressions and introduces family members to others.	40.7%	44.2%	14%	1.2%
9	Can make five or more sentences about yourself and family members	2.6%	38.4%	29.1%	7%
10	Can do present and past verb formation	16.3%	36%	34.9%	12.8%

Finally, students stated their overall satisfaction towards the online Japanese language learning based on their experience and the challengers they have faced during the three months' period. All participants agreed that the zoom class was successful (Table 4).

Table 4: Overall satisfaction towards online learning

Perception	Frequency	Percent	Valid Percent	Cumulative Percent
Successful and satisfied	86	100.0	100.0	100.0

Finally, the students stated the main challengers they faced during the zoom classes. The challengers are summarized as follows.

1. Signal issues
2. Power cut
3. Connection issues due to bad whether
4. Sometimes no fixed date and time for the class
5. Sometimes have to participate other classes when conduct the online class
6. Sometimes the recordings were not shared
7. Sometimes many students trying to ask questions from the teacher at the same time
8. Interference of unnecessary sounds
9. No direct interference of teacher for practicing and correcting some parts of the language
10. Less activeness and liveness as physical class
11. Less individual attention on practising

These opinions show that some students have faced technical issues during the classes which effect the continues participation for the classes. It indirectly influences their achievement. However, Participants have tried to cover the lessons by following the recordings while doing self-studies using the module

provided. Also, they have been guided to refer the internet links for the additional knowledge when necessary.

Results of the Achievement Test

At the end of the three months' period, the online achievement test was given. The following content were covered in the online class.

1. Basic Japanese greetings
2. Hiragana alphabet
3. Basic classroom instructions
4. Self-introduction
5. Counting from 1-100000
6. Verbs and expressing day today activities using learnt verbs
7. Introduce family members
8. Culture-Greetings manners, Calling Japanese people,

importance of learning Japanese, basic factors of Japan and its' culture

The achievement test was designed covering the all topic taught at the zoom class except cultural facts. 50 items were included in the test paper and 45 minutes were given for the test.

Only three students got 100% and the range of the score report is 78 ranging from 22-100. The standard deviation is 16.968 and mean is 72.37 while the median is 72. Highest frequency score is 78 marks. The bar chart shows the variance of the scores.

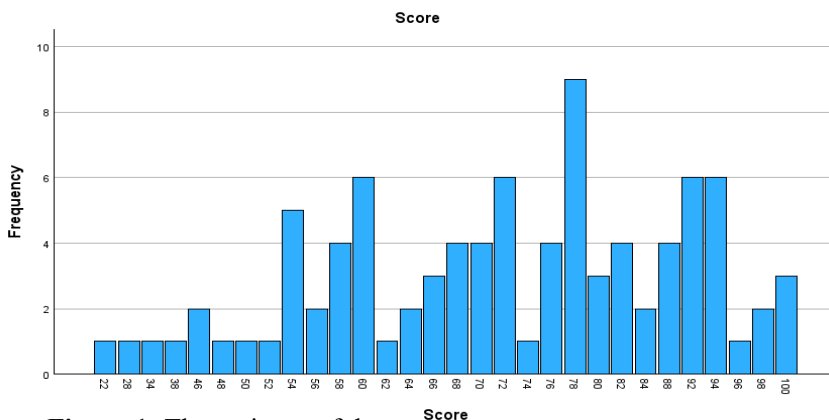


Figure 1: The variance of the scores

7.7% students have obtained marks below 50 and 48.4% students got more than 75 marks. The results show that nearly 50% participants have scored above 75% and they have achieved the expected learning outcome in a satisfactory level. Also, it can be said that they have maximally used the online learning opportunity to learn a language.

CONCLUSION AND RECOMMENDATIONS

The findings of the study show that the participants' overall satisfaction towards the online Japanese language learning through zoom technology was good as all of them have agreed that the online class conducted successfully and they

could learn basic Japanese through this method. Also, they have positive attitudes towards the self-learning module and the online learning class. Further participants agreed that they have achieved the expected learning outcomes. Although the participants have faced few challenges and practical issues during the classes they have overcome the barriers and challenges to achieve the targets.

Despite the benefits of Zoom, online learning has several disadvantages. These include insufficient student engagement, delayed feedback, limited opportunities for language skill improvement, challenges with group work, and a lack of technological proficiency. Additionally, during extended live sessions, teachers may struggle to keep students engaged. To enhance the effectiveness of teaching foreign languages, it is crucial to use a variety of teaching techniques. Zoom offers features such as polls and surveys, which can engage students and gather their opinions, perceptions, and ideas, serving as valuable tools for formative assessment. Limiting the number of students to around 30 in a Zoom class is also recommended to ensure teachers can provide individual attention, helping to maintain the class's vitality. The following recommendations are based on the findings.

1. Implementing asynchronous online learning methodology is better when the targeted crowd is large. Though it is better to provide supported learning materials. Also, it is necessary to conduct an online assessment

system periodically under the government supervision.

2. A synchronous online learning is appropriate for small groups and when it is expected to develop language skills as it is necessary to give attention to all students to develop skills such as speaking.
3. Teacher should maintain the interaction with students always by receiving and giving feedback, answers or acknowledgement and also should use the facilities and functions such as breakout room, screen sharing, record meeting, chatting, interactive whiteboard, virtual background, combining video conferencing, collaboration between students and teachers, etc.

SUGGESTIONS FOR FUTURE RESEARCH

To overcome the limitations of self-reported data and integrate the findings, observational data may be used in future investigations. Therefore, an experimental study can be done for the better understanding related to research objective. Also, it is recommended to conduct a longitudinal study including a variety of data sources. Further research on this issue should be aimed at finding the best methods and techniques online language learning.

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A Comprehensive Review of Cutting-Edge Advances in Social and Emotional Learning

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ABSTRACT

In response to the rapidly changing landscape of the 21st century, characterized by the increasing importance of social-emotional skills alongside academic prowess, Social and Emotional Learning has emerged as a vital component for individual and societal success. This comprehensive review synthesizes recent research findings, aiming to examine the efficacy of various Social and Emotional Learning interventions and their impact on student outcomes and overall well-being. Drawing on diverse methodologies and disciplines, the study critically analyzes the effectiveness of Social and Emotional Learning approaches, identifies best practices, and explores the potential for Social and Emotional Learning to extend beyond classrooms into communities. The review also delves into the integration of neuroscience and technology in Social and Emotional Learning program development, highlighting the promise of personalized interventions and real-time feedback through innovations like virtual reality simulations and wearable sensors. Methodologically, this study adopts a descriptive analysis approach, leveraging secondary data to fulfill its objectives. Finally, the review underscores the importance of ethical considerations in technological advancements and emphasizes the need for culturally sensitive approaches to ensure the accessibility and effectiveness of Social and Emotional Learning programs across diverse global contexts. Ultimately, embedding Social and Emotional Learning within broader socio-economic and educational frameworks, and prioritizing it in national and international policies, can pave the way for inclusive, equitable, and emotionally intelligent communities worldwide, shaping a brighter future for generations to come.

Keywords: Social and emotional learning, Efficacy, Student outcomes, Technological integration, Cultural sensitivity

INTRODUCTION

The 21st century presents a landscape of accelerating change, demanding individuals to navigate complex social interactions, effectively manage emotions, and make sound decisions. Traditionally viewed as separate from academics, these skills are now recognized as fundamental for success. The World Economic Forum's 2020 Future of Jobs Report emphasizes the growing importance of "soft skills" such as emotional intelligence, critical thinking, and collaboration, highlighting their crucial role in thriving in the ever-evolving workplace (Ramos-Monge *et al.*, 2023). Social and Emotional Learning (SEL) has emerged as a powerful response to this need, equipping individuals with the tools to flourish in this dynamic environment. This comprehensive review, titled "A Comprehensive Review of Cutting-Edge Advances in Social and Emotional Learning (SEL)," delves into the latest advancements in this critical field. The urgency of this exploration stems from the growing body of research highlighting SEL's multifaceted benefits. Studies by organizations like the Collaborative for Academic, Social, and Emotional Learning (CASEL) demonstrate that SEL programs not only foster positive social-emotional development but also lead to improved academic achievement, reduced behavioral problems, and enhanced mental health (LaBelle, 2023). A meta-analysis by Durlak *et al.* (2011) found that on average, SEL interventions produced an

effect size of 0.18 for academic achievement, indicating a positive impact on student learning outcomes. Additionally, Greenburg *et al.* (2003) found that school-based SEL programs led to a significant decrease in student delinquency and depression. Given the far-reaching impact of SEL on individual and societal well-being, a critical examination of its advancements is essential.

This review aims to achieve several key objectives. The first objective is to synthesize current research findings on SEL interventions, drawing on diverse methodologies and disciplines. This will involve a comprehensive review of recent scholarly articles, meta-analyses, and program evaluations. The review will explore the effectiveness of various SEL approaches, including mindfulness-based programs, social-cognitive skill training, and collaborative learning activities. Furthermore, the review will delve into the integration of neuroscience and technology in program development. Recent advancements in brain research are providing valuable insights into the development of social and emotional skills. Additionally, technology offers promising tools for delivering personalized SEL interventions and measuring student progress. The second objective is to critically analyze the effectiveness of various SEL approaches, assessing their impact on student outcomes and overall well-being. This analysis will consider factors such as program design, implementation fidelity, and participant demographics. The

review will identify best practices and emerging approaches with the strongest evidence base for promoting positive social-emotional development. The third objective is to explore the potential of SEL to extend beyond classrooms, fostering positive social and emotional development within communities. While schools play a vital role in SEL implementation, a comprehensive approach requires collaboration with families and community organizations. The review will examine successful models for community-based SEL programs, such as those offered by after-school programs and youth development organizations. By fostering a culture of social and emotional learning across various settings, we can maximize the impact of SEL on individual and societal well-being.

By achieving these objectives, this review aspires to serve as a valuable resource for educators, researchers, and policymakers seeking to leverage the power of SEL in unlocking individual and societal potential. Educators will gain insights into effective SEL practices and how to integrate them into their classrooms. Researchers will be guided in identifying promising areas for further investigation. Policymakers will benefit from a comprehensive understanding of the research base supporting SEL and its potential to improve educational outcomes and overall well-being. In conclusion, this review aims to provide a timely and critical examination of advancements in Social and Emotional Learning. By

delving into the latest research findings, exploring emerging trends, and evaluating the effectiveness of various approaches, this review seeks to inform and empower educators, researchers, and policymakers in leveraging the power of SEL to unlock individual and societal potential in a dynamic and demanding world.

METHODOLOGY

This review employs a descriptive analysis approach to assess the efficacy of various Social and Emotional Learning (SEL) interventions and their impact on student outcomes and overall well-being. The study systematically synthesizes recent research findings from diverse methodologies and disciplines to provide a comprehensive overview of SEL programs. Secondary data sources, including peer-reviewed articles, reports, and case studies, are utilized to gather information on SEL interventions. These sources are selected based on their relevance, rigor, and contribution to the understanding of SEL efficacy. A thorough search of academic databases such as JSTOR, PubMed, and Google Scholar is conducted to identify relevant studies and reports on SEL interventions. Keywords such as "Social and Emotional Learning," "SEL interventions," "student outcomes," "well-being," and "neuroscience in SEL" are used to ensure a comprehensive search. The selected studies are then assessed for their relevance to the objectives of this review.

Relevant data from the selected studies are extracted, focusing on the methodologies, outcomes, and effectiveness of different SEL programs. This includes analyzing quantitative data (e.g., improvements in academic performance, emotional regulation, and social skills) and qualitative findings (e.g., student and teacher experiences, program implementation). Each study is critically evaluated to assess its methodological quality, including the robustness of research design, sample size, and data analysis techniques. This evaluation helps identify best practices and areas for improvement in SEL program development. The review explores how recent advancements in neuroscience and technology are integrated into SEL programs. Innovations such as virtual reality simulations and wearable sensors are examined for their potential to provide personalized interventions and real-time feedback. The integration of these technologies is assessed for their effectiveness in enhancing SEL outcomes.

Ethical considerations in the application of technology in SEL programs are emphasized, highlighting the importance of ensuring that technological advancements do not compromise student privacy or equity. Additionally, the review stresses the need for culturally sensitive approaches to ensure that SEL interventions are accessible and effective across diverse global contexts. Finally, findings from the analysis are synthesized to provide a

comprehensive overview of the effectiveness of SEL interventions. The review identifies key trends, best practices, and recommendations for embedding SEL within broader socio-economic and educational frameworks. By adopting this methodology, the study aims to offer valuable insights into the impact of SEL interventions, propose strategies for enhancing SEL programs, and contribute to the development of inclusive, equitable, and emotionally intelligent communities.

RESULTS AND DISCUSSION

3.1. Promoting 21st century skills and student wellbeing: The critical role of social and emotional learning (SEL)

The 21st century presents a landscape of constant flux, demanding individuals to be not only academically proficient but also adept at navigating complex social interactions, effectively managing emotions, and making sound decisions. Social and Emotional Learning (SEL) has emerged as a powerful force in equipping individuals with the tools necessary to thrive in this dynamic environment (Gueldner *et al.*, 2020). SEL encompasses a wide range of competencies, including self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. By fostering these competencies, SEL programs promote the development of essential life skills that contribute to academic achievement, positive social-emotional development, and overall well-being (Feuerborn &

Gueldner, 2019; Gimbert *et al.*,2023). success in collaborative work environments (Edwards, 2023).

3.2. The connection between SEL and 21st century skills

Critical thinking and problem-solving

Neuroscientific research by Zelazo & Carlson (2002) demonstrates that self-regulation skills, nurtured through SEL programs, are positively correlated with executive function, a crucial component of critical thinking (Semenov *et al.*,2020). Students with strong self-awareness and self-management can reflect on their thought processes, identify challenges, and develop effective solutions. This aligns perfectly with the demands of the 21st century workplace, where employees must be adaptable and capable of solving complex problems in real-time (DeMink-Carthew *et al.*,2020; Shatroubi, 2023).

Collaboration and communication

Effective teamwork and communication are essential for success in virtually every domain. Meta-analyses by Cartmell *et al.*, (2021) highlight the positive impact of SEL programs on social awareness and relationship skills. Through a focus on these competencies, SEL programs foster effective communication, empathy, and conflict resolution – all of which are crucial for collaboration. Students learn to navigate group dynamics, communicate assertively, and resolve disagreements constructively – essential skills for

Creativity and innovation

Creativity and innovation are key drivers of progress in our rapidly evolving world. Baumeister *et al.*, (2007) posit that self-regulation skills, a core component of SEL, contribute to creative problem-solving. Students with strong self-awareness and self-management are empowered to take risks, explore new ideas, and persevere in the face of challenges. They learn to embrace feedback, adapt to changing circumstances, and think outside the box – exactly the skillset needed to thrive in an era of constant innovation (Bond, 2022).

3.2.1. Positive impact on students' well-being and SEL

The benefits of SEL extend beyond academic achievement and by addressing students' social and emotional needs, SEL creates a sense of belonging, reduces anxiety and depression, and promotes positive mental health. This translates into greater student engagement, improved classroom climate, and a stronger sense of self-worth (Gueldner *et al.*,2020). Implementing effective SEL programs and integrating them into the curriculum can enhance student learning and teaching effectiveness. In addition, effective SEL programs integrate seamlessly with existing academic standards, ensuring a cohesive learning experience. SEL develops social awareness and relationship skills and enables students to build positive relationships with peers and

educators and reduces feelings of isolation and loneliness, thereby reducing the potential for anxiety and depression (Cefai *et al.*,2018). Similarly, by teaching students' self-awareness and self-management skills, SEL equips them with the tools to effectively identify and manage emotions. Techniques such as mindfulness, relaxation strategies, and healthy coping mechanisms can help students navigate challenging situations, reduce stress, and promote emotional well-being. SEL programs that focus on goal setting, persistence, and positive self-talk empower students to believe in their abilities and develop a sense of self-efficacy. Conversely, when students experience success in managing their emotions and social interactions, their self-esteem is strengthened, leading to increased confidence and overall well-being (Dvořáková *et al.*,2019; Long *et al.*,2021).

By promoting empathy, conflict resolution skills, and positive communication, SEL fosters a more positive and supportive classroom environment. This ripple effect contributes to a more positive school culture overall, benefiting not only students but also educators and the wider community. This decrease in peer conflict and increase in mutual respect creates a safe space for learning and social interaction, ultimately benefiting the mental and emotional well-being of all students (Ferreira *et al.*,2020). On the other hand, widespread implementation of SEL programs in schools requires the support of all stakeholders' educators, administrators, families, and community support are

important. Regular assessment of SEL programs allows for continuous improvement and ensures alignment with student needs. In turn, educators play a key role in implementing SEL strategies while providing them with the necessary skills and knowledge by providing continuing professional development opportunities (Gimbert *et al.*,2023).

Finally, prioritizing SEL is no longer an option but an imperative in preparing students for the demands of the 21st century. By nurturing 21st century skills and fostering student well-being, SEL empowers students to not only succeed academically, but to become well-rounded, adaptable, and resilient individuals who are ready to positively impact the world.

3.3. Neuroscience, technology, and the future of SEL interventions

3.3.1. Harnessing the power of neurofeedback and biofeedback for optimal well-being

Advances in neuroimaging technology allow researchers to better understand the neural correlates of emotion and social behavior. Neurofeedback techniques enable individuals to monitor and modulate their brain activity in real time, improving self-regulation and emotional resilience. Similarly, biofeedback devices measure physiological signals such as heart rate variability and skin conductance, providing insight into one's emotional state and facilitating self-awareness (Dolcos *et al.*, 2011;

Alsharif *et al.*,2021). Neurofeedback (NF) is a form of brain training that allows individuals to monitor and regulate their brain wave activity in real time. It usually uses electroencephalography (EEG) sensors placed on the scalp to detect electrical activity in the brain. Through visual or auditory feedback, individuals learn to modulate their brain wave patterns, such as increasing the amplitude of certain frequencies associated with focus and relaxation while reducing susceptibility to stress or distraction (Marzbani *et al.*, 2016). Neurofeedback has been applied in a variety of contexts including attention-deficit/hyperactivity disorder (ADHD), anxiety, depression, post-traumatic stress disorder (PTSD), and peak performance training for athletes and musicians (Tosti *et al.*,2024; Gruzelier *et al.*,2014). Research suggests that neurofeedback can lead to improvements in attention, self-regulation, mood, and cognitive function, with effects often lasting beyond the training period (Da Silva & De Souza, 2021; Reiner *et al.*,2018).

Biofeedback involves measuring and visualizing physiological signals such as heart rate, skin conductance, muscle tension, and respiration rate to provide real-time feedback to individuals about their physiological processes (Alneyadi *et al.*,2021; Yu *et al.*,2018). By becoming aware of these physiological responses, individuals can learn to consciously control them, leading to improved stress management, relaxation, and overall well-being. For example,

heart rate variability (HRV) biofeedback focuses on optimizing the variability of the time between heart beats, which is associated with adaptive stress responses and emotional regulation (Deschodt-Arsac *et al.*,2018). Skin conductance biofeedback measures changes in sweat gland activity that may reflect emotional arousal and stress levels. Correspondingly, muscle tension biofeedback is also known as electromyography (EMG) biofeedback. Helps individuals recognize and release muscle tension often associated with stress and anxiety. Respiratory biofeedback, on the other hand, involves regulating breathing patterns to promote relaxation and reduce symptoms of anxiety and panic (Brown & Ryan, 2003; Rosenberg & Hamiel, 2021).

3.3.2. Applications of neurofeedback and biofeedback

Neurofeedback and biofeedback are techniques that use real-time data about physiological processes to help individuals regulate their physical activity and mental states. Biofeedback typically involves monitoring physiological parameters such as heart rate, skin conductance, or muscle tension, while neurofeedback focuses specifically on brain activity, often measured via EEG (Electroencephalogram) (Schwartz & Andrasik, 2017). These techniques empower individuals to learn self-regulation skills by providing immediate feedback on their bodily responses. Applications range from managing stress, anxiety and pain to improving cognitive function and treating conditions such as Attention Deficit Hyperactivity

Disorder (ADHD) and Post-traumatic stress disorder (PTSD) and the data are shown in table 01 below.

Table 1: Applications of neurofeedback and biofeedback

Application	References
Both neurofeedback and biofeedback techniques have been applied in clinical settings, educational environments, and corporate wellness programs to enhance self-awareness, self-regulation, and emotional resilience.	Thompson & Thompson, 2021
Neurofeedback is used to change the amplitude or speed of specific brain waves in particular brain locations to treat ADHD, anxiety, and insomnia.	Marzbani <i>et al.</i> , 2016
Hemoencephalographic (HEG) neurofeedback provides feedback on cerebral blood flow to treat migraine	Toomim & Carmen, 2009
Functional magnetic resonance imaging (fMRI) stands as the latest form of neurofeedback utilized for modulating brain activity, drawing from feedback signals originating from deep subcortical regions of the brain.	Perronnet, 2017 ; Thibault <i>et al.</i> , 2015
Low-resolution electromagnetic tomography (LORETA), utilizing a set of 19 electrodes for monitoring phase, power, and coherence, is applied in neurofeedback for treating addictions, depression, and obsessive-compulsive disorder.	Simkin <i>et al.</i> , 2014
Employed in the management of insomnia, live Z-score neurofeedback involves continuously evaluating brain electrical activity against a structured database to provide ongoing feedback.	Pérez-Elvira <i>et al.</i> , 2021
Biofeedback empowers individuals to manage stress naturally and without medication by providing feedback on heart rate variability (HRV) and muscle tension, teaching relaxation techniques.	Brown & Gerbarg, 2012
Biofeedback helps chronic pain sufferers gain control over muscle tension and pain perception, potentially reducing reliance on medication.	Driscoll <i>et al.</i> , 2021

Biofeedback can strengthen pelvic floor muscles, improving bladder and bowel control in conditions like incontinence.	Hite et al., 2021
By regulating muscle tension and blood flow, biofeedback can be a valuable tool in managing headaches, including migraines.	Nestoriuc <i>et al.</i> ,2008
Athletes and performers are currently delving into neurofeedback to sharpen focus, enhance cognitive function, and optimize their performance.	Schwartz & Andrasik, 2017

3.3.3. Advantages of biofeedback and neurofeedback

Biofeedback and neurofeedback offer a host of advantages in promoting self-awareness and self-regulation of physiological and mental processes. By providing real-time information about bodily functions or brain activity, these techniques empower individuals to recognize and control their responses

to stressors and stimuli (Jerath *et al.*,2023; Dupee, 2016). This fosters improved emotional regulation, reduced anxiety, and enhanced overall well-being. Moreover, biofeedback and neurofeedback can be tailored to target specific issues, making them versatile tools in addressing conditions such as chronic pain, ADHD, and anxiety disorders.

Table 2: Advantages of neurofeedback and biofeedback

Advantages	References
Both techniques are non-invasive, meaning they do not require surgery or medication.	Marzbani <i>et al.</i> ,2016
Biofeedback and neurofeedback offer drug-free alternatives for managing various health conditions.	Hung <i>et al.</i> ,2021
These techniques provide personalized interventions tailored to each individual's unique physiological or neurological responses.	Tosti <i>et al.</i> ,2024
By providing real-time feedback, biofeedback and neurofeedback empower individuals to learn how to consciously control their physiological or brainwave activity.	da Costa, 2021
Biofeedback and neurofeedback can be used to address a wide range of conditions, including stress, anxiety, chronic pain, migraines, ADHD, autism spectrum disorders, depression, and traumatic brain injuries.	Tolin <i>et al.</i> ,2020
Neurofeedback can enhance cognitive function, focus, and attention, making it beneficial for improving academic or professional performance.	Da Silva & De Souza, 2021

These techniques complement traditional medical treatments and psychotherapy, offering holistic approaches to health and wellness.	Micoulaud-Franchi <i>et al.</i> ,2015
Neurofeedback training can lead to lasting changes in brain function and behavior, providing enduring benefits beyond the duration of the intervention.	Orndorff-Plunkett <i>et al.</i> ,2017
Biofeedback and neurofeedback promote self-awareness by helping individuals gain insight into their physiological or neurological functioning.	Crockett <i>et al.</i> ,2017
There is a growing body of research supporting the effectiveness of biofeedback and neurofeedback for various health conditions, contributing to their credibility as evidence-based interventions.	Melnikov, 2021

3.4. Advancements in social-emotional learning (SEL) interventions: Leveraging neuroscience and technology for personalized growth

convergence of neuroscience and cutting-edge technology presents boundless opportunities to revolutionize Social-Emotional Learning (SEL) interventions (Figure 1).

In the ever-evolving landscape of mental health interventions, the

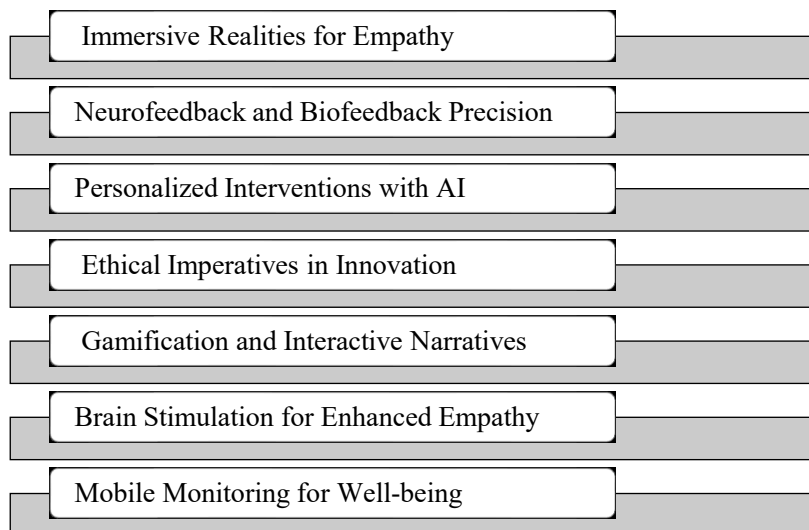


Figure 1: Advancements in social-emotional learning (SEL) interventions

Unlocking the mysteries of the mind, neurofeedback and biofeedback offer personalized insights into emotional regulation and cognitive processes. Enhanced standardization ensures reliability, while interdisciplinary collaboration fosters innovation. Step into

another's shoes with Virtual Reality (VR) and Augmented Reality (AR), where empathy becomes an experience. VR/AR simulations pave the way for safe exploration of social dynamics, redefining intervention for conditions like social anxiety and autism (Hiran *et al.*,2024). Through realistic scenarios, users learn, grow, and connect in ways never before possible. Enter the era of tailored support. Machine learning sifts through vast datasets, deciphering behavioral cues and emotional nuances. This means SEL interventions can adapt in real-time, catering to individual needs and preferences. With personalized feedback and dynamic adjustments, progress is not just tracked it's accelerated. With smartphones as constant companions, emotional well-being is always within reach. Wearable sensors and mobile apps offer real-time insights, intervening seamlessly in moments of distress or uncertainty. Through continuous monitoring and actionable feedback, individuals chart their own paths to resilience and fulfillment (Mair *et al.*,2022; Washington *et al.*,2022).

Journey into the realm of non-invasive neuro stimulation, where brainwaves pave the way to empathy. Techniques like Transcranial magnetic stimulation (TMS) and Transcranial direct current stimulation (DCS) fine-tune neural pathways, amplifying the effects of SEL interventions (Fan,

2024). Yet, as we pioneer these frontiers, safety and efficacy remain steadfast priorities. Learning becomes an adventure with gamified SEL interventions. Through interactive narratives and engaging challenges, users embark on a journey of self-discovery and empathy. Immediate feedback fuels motivation, fostering a sense of mastery in navigating complex social landscapes (Diamandis *et al.*,2020). As we forge ahead, ethical considerations guide our every step. Transparency, consent, and fairness are non-negotiable in the design and implementation of SEL technologies. Through collaborative efforts, we ensure that innovation is not just groundbreaking it's responsible. With these advancements, the future of SEL interventions shines bright, empowering individuals of all ages to thrive in a world where emotional intelligence is the ultimate currency (Govindarajan & Trimble, 2010; Stein & Book, 2011).

3.4.1. Expanding the impact of SEL from classrooms to communities

Extending the impact of social-emotional learning (SEL) from classrooms to communities involves a multidisciplinary approach that recognizes the interconnectedness of individuals in different social contexts (Sauve & Schonert-Reichl, 2019), which can be identified as Figure 2 below.

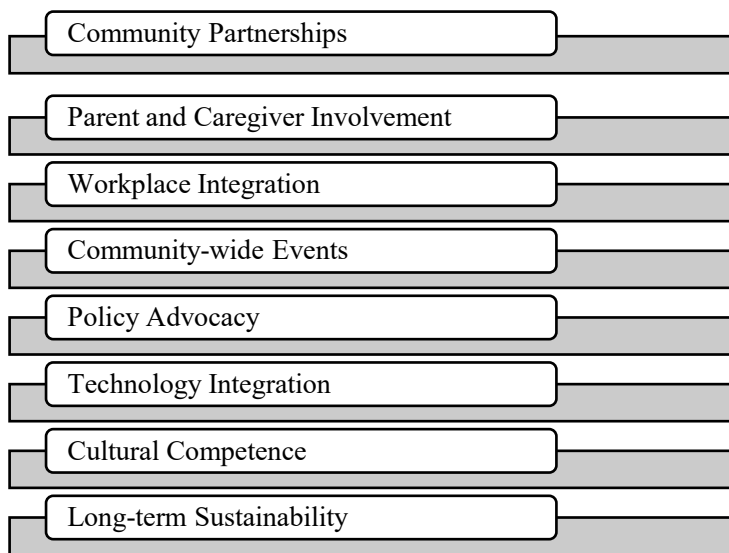


Figure 2: Ways of building resilient communities through expanded social-emotional learning initiative

Expanding the impact of Social-Emotional Learning (SEL) from classrooms to communities involves a multifaceted approach that recognizes the interconnectedness of individuals within various social contexts (Jagers *et al.*,2019). This expansion entails forging strong partnerships with local organizations such as community centers, libraries, and youth groups to integrate SEL into their existing programs, thereby reaching a broader demographic. Moreover, engaging parents and caregivers in SEL practices through workshops and support networks empowers them to model positive behaviors at home and within the community, reinforcing lessons learned in educational settings (Gueldner *et al.*,2020). Extending SEL principles to workplaces and businesses fosters a positive organizational culture, enhances employee well-being, and improves

interpersonal dynamics. Additionally, organizing community-wide events focused on SEL themes creates opportunities for individuals of all ages and backgrounds to come together, fostering social connection and emotional awareness (Kim-Ju *et al.*,2024). Advocating for policies that prioritize SEL implementation at local and state levels ensures sustained support and resources for community-wide initiatives. Leveraging technology platforms and digital tools expands the reach of SEL interventions, particularly for individuals facing barriers to in-person participation. Ensuring cultural competence in SEL initiatives acknowledges diverse perspectives and identities within the community, promoting inclusivity and relevance. Ultimately, embedding SEL principles into the fabric of community life creates

lasting positive change that extends far beyond individual classrooms, fostering healthier and more resilient communities (Eden *et al.*,2024).

3.5. Culturally responsive approaches to advancing social-emotional learning in global contexts

contexts requires a nuanced understanding of cultural considerations and international perspectives to ensure relevance and effectiveness (Hayashi *et al.*,2022). Some strategies for incorporating SEL across different cultural settings are illustrated in Figure 3 below

Advancing Social-Emotional Learning (SEL) in diverse global

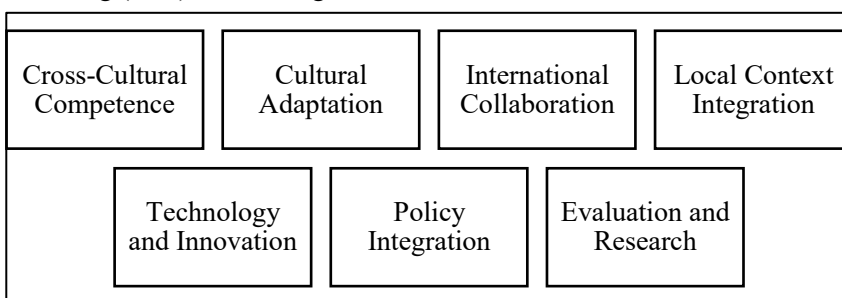


Figure 3: Strategies for incorporating SEL across different cultural settings

Advancing Social-Emotional Learning (SEL) within diverse global contexts necessitates a nuanced approach that integrates cultural considerations and international perspectives to ensure both relevance and effectiveness (Schonert-Reichl, 2019). One fundamental strategy involves cultural adaptation, wherein SEL programs are sensitively tailored to resonate with the specific norms, values, and languages of diverse populations. This process entails consulting with community stakeholders, including educators, parents, and cultural experts, to inform curriculum content, teaching methodologies, and assessment tools (Mahoney *et al.*,2021). Moreover, educators and facilitators must be

equipped with cross-cultural competence through training programs that emphasize cultural humility, empathy, and effective communication. This enables practitioners to navigate cultural differences sensitively and build trust and rapport with individuals from varied backgrounds, thereby enhancing the impact of SEL interventions (Marsiglia *et al.*,2021; Gimbert *et al.*,2023).

Furthermore, fostering international collaboration is paramount in advancing SEL globally. By establishing networks and partnerships across borders, educators, researchers, and policymakers can share best practices and insights, enriching the

collective understanding of social and emotional development within diverse cultural contexts (Tan *et al.*,2021). Additionally, embedding SEL initiatives within broader socio-economic, political, and educational frameworks is essential for addressing systemic challenges and disparities (Donahue-Keegan *et al.*,2019). This integration acknowledges the interconnectedness of social and emotional well-being with factors such as poverty, inequality, and access to resources. Leveraging technology and innovation can further overcome barriers to SEL implementation, particularly in remote or resource-constrained areas, while rigorous evaluation and research are critical for assessing effectiveness and refining SEL programs to meet the needs of diverse populations. Ultimately, by prioritizing SEL within national and international education policies, policymakers can advocate for its role in fostering inclusive, equitable, and resilient societies worldwide (Rogers *et al.*,2012).

CONCLUSION

In conclusion, the convergence of cutting-edge technologies with social-emotional learning (SEL) principles marks a transformative juncture in our collective journey. Integrating neuro feedback and biofeedback gives individuals personalized insight into their emotional regulation and cognitive processes, empowering them to navigate life's complexities with greater resilience and self-awareness. Furthermore, advances such as virtual reality simulations,

wearable sensors, and machine learning algorithms hold the promise of tailoring SEL interventions to individual needs in real time, ensuring maximum effectiveness and relevance. However, as we move forward into this new frontier, it is critical to maintain a firm commitment to ethical principles. Also, we must ensure that innovations are not only revolutionary but also protect the dignity and rights of every individual. By prioritizing responsible innovation, the full potential of technology can be harnessed to serve as a catalyst for positive change in the field of socio-emotional development.

Furthermore, expanding the reach of SEL beyond the confines of the classroom requires a comprehensive, culturally sensitive approach. This includes building strong partnerships with local organizations, actively engaging parents and caregivers, and integrating SEL principles into a variety of community settings, including workplaces and businesses. By fostering a collaborative ecosystem of support, we can create a ripple effect of positive change that extends beyond individual interactions. Moreover, community-wide events, policy advocacy efforts, and strategic use of technology platforms can further amplify the impact of SEL initiatives, ensuring they resonate with diverse populations and address systemic challenges. Culturally responsive strategies based on empathy and understanding are essential to ensure that SEL

programs are accessible, inclusive, and effective across global contexts. Ultimately, embedding SEL in broader socio-economic and educational frameworks, and prioritizing it in national and international policies, can foster inclusive, equitable and resilient communities worldwide and enable us to shape a brighter, more emotionally intelligent future for generations to come.

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