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Promoting Attitude Towards Chemistry through Emotional Intelligence Intervention

P. Susai Raj[1] & Dr. A. Edward William Benjamin[2]

1. Ph.D Research Scholar, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India.
2. Research Supervisor, Bharathidasan University, Tiruchirappalli, Tamil Nadu, India.

Abstract:

This study assesses the impact of emotional intelligence intervention on the attitude towards chemistry of higher secondary school students. Through simple random sampling, a convenience sample of forty students was selected and randomly assigned to either an experimental group (n=20) or a control group (n=20). The experiment leveraged the ATCLS for measuring attitude towards chemistry to measure student's attitudes using the scale prior to intervention and post engagement with the program. The control group followed the standard curriculum without any intervention whereas the experimental group underwent an Emotional Intelligence Intervention Program for 8 consecutive weeks.

From the analyses conducted after the interventions, it was observed that the experimental group exhibited a marked improvement in their attitudes towards chemistry that was statistically significant when contrasted with the control group. The independent t-tests and ANOVA also revealed large effect sizes ($t = 3.442$, $p < 0.001$, Cohen's $d = 1.001$; $F(1, 38) = 11.849$, $p < 0.01$). These results strongly support the proposed hypothesis that emotional intelligence intervention enhances children's attitude towards the subject and supports the argument that emotional intelligence interventions enhances attitude and engagement with the subject of chemistry.

Keywords: *Students' Attitude Towards Chemistry, Emotional Intelligence (EI) and Higher Secondary Level.*

Introduction:

Chemistry is an essential branch of physical science and its application is vast and diverse, ranging from the production of pharmaceuticals to sustainable energy sources. Chemical knowledge is utilized for ground-breaking innovations for daily use, advance manufacturing progressions, and enhance product quality. As society endures facing global challenges, such as climate change and resource scarcity, the importance of chemistry in finding solutions and driving innovation becomes increasingly apparent. The world needs chemists and the students studying chemistry are in the fall. The number of students picking up chemistry courses at the higher secondary level is in decline as they perceive it difficult and it causes great concern. The chemistry teacher has a big role to play to promote chemistry education at the outset. The chemistry teacher must create an interest in learning chemistry. This study is a finding a way to create interest in

chemistry through an emotional intelligence intervention and measuring in terms of attitude towards chemistry (Nja et al., 2022).

Individuals perceiving chemistry subjects as difficult has been a substantial predictable factor contributing to the decline in students' positive attitudes toward the subject along with the factors such as gender, students' interest, classroom environment and teachers' behaviour (Musengimana et al., 2021). This perception negatively impacts students' interest and demotivates students learning chemistry. These negative emotions are to be dealt with in detail. Emotional intelligence is the way selected for dealing with these negative emotions in this research will certainly provide new ways to improve interest in chemistry education.

Significance of the study:

Emotional intelligence (EI) may significantly impact students' attitudes towards chemistry. Previous investigations have proved that higher levels of EI are correlated with smarter academic results, enhanced interpersonal relationships, and reduced troublesome behaviours (Martínez-Martínez et al., 2020). By including EI interventions, teachers can potentially address the emotional factors and foster students' attitudes towards chemistry.

Existing Knowledge:

There is a dearth of literature that explains the relationship between emotional intelligence and students' attitudes towards chemistry. However, some of the available studies on emotional intelligence have demonstrated positive outcomes concerning its effects on academic performance, acting as a buffer against negative consequences (Martínez-Martínez et al., 2020) such as cyber victimization, which can have detrimental consequences on school success (Martínez-Martínez et al., 2020). EI has been credited with a reduction in disruptive behaviours, improvements in school climate, refined classroom management (Martínez-Martínez et al., 2020), and enhanced teacher-student relations (Wan et al., 2023). Fascinatingly enough, other studies showed EI's mediating role between academic performance and school burnout, assisting in stress and mood management (Jurado et al., 2021). These prior studies imply the potential of an EI intervention to assist students in fostering a more constructive attitude towards challenging subjects such as chemistry.

Knowledge Gap:

Reading through the previous literature following research gaps are found and few of them could be addressed in this study. They are:

- The connection between emotional intelligence and an attitude toward chemistry is infrequently studied due to the lack of understanding of the connection between these concepts.
- There is a knowledge gap regarding the impact of emotional intelligence on one's attitude toward chemistry over an extended period.
- Emotional intelligence's role in alleviating anxiety and negative views of chemistry remains to be studied.
- Still, more researches are required on how emotional intelligence interventions could be integrated into chemistry curricula.

Research Question:

How do emotional intelligence interventions students' attitudes towards chemistry?

Objectives:

- To design and implement emotional intelligence interventions tailored for chemistry education.
- To evaluate the effect of self-constructed emotional intelligence interventions on students' attitudes toward chemistry.

Hypotheses:

Emotional intelligence interventions will positively influence higher secondary school students' attitudes towards chemistry.

Method:

To evaluate the impact of emotional intelligence interventions on the attitude of higher secondary school students toward chemistry, this study employed a quasi-experimental approach with a single group pre-test and post-test design. A total of 40 higher secondary school students were randomly selected using simple random sampling techniques. This sample was divided into two groups, the experimental group (n=20) and the control group (n=20). The tools used in this study were:

- "Attitude Towards Chemistry Lesson Scale (ATCLS)"- An attitudinal tool measuring students' attitudes about chemistry was used before and after the intervention. The students' responses on the ATCLS measured different components such as enjoyment of theory lessons on chemistry, enjoyment of practical work in the chemistry laboratory, evaluative sentiments towards school chemistry, and behavioural propensities towards the subject of chemistry.
- Emotional Intelligence Intervention Program: This program focuses on emotional intelligence skills relevant to learning chemistry and was carefully crafted.

Every participant was asked to complete the ATCLS in order to determine the baseline attitudes toward chemistry lessons. The Emotional Intelligence Intervention Program was conducted with the experimental group for 8 weeks (Table 1). The control group continued with the rest of the chemistry curriculum and was not subjected to any additional interventions.

Table 1. Week-by-Week Plan

Week 1	Introduction to Emotional Intelligence and Chemistry	Focus on reflecting on past Chemistry experiences both positive and negative
Week 2	Self-Awareness in Chemistry Learning	Focus on linking emotions to performance and attitude toward chemistry
Week 3	Self-Regulation Strategies	Developing strategies to regulate emotions to reduce stress related to chemistry
Week 4	Building Motivation in Chemistry	Strategies to increase intrinsic motivation in chemistry
Week 5	Empathy in Collaborative Chemistry Learning	Enhancing empathy and collaboration skills in chemistry-related tasks

Week 6	Social Skills in Chemistry Discussions	Improving social skills and confidence in group chemistry activities
Week 7	Linking Emotional Intelligence to Academic Resilience	Strengthening Academic Resilience and coping strategies
Week 8	Consolidation and Reflection	Consolidating EI skills and committing to sustaining a positive attitude toward Chemistry

Immediately following the intervention period, all participants will complete the ATCLS again to measure any changes in attitudes towards chemistry. With the collected data independent t-tests and ANOVA were carried out using SPSS

Results

A. Independent sample t-test

Table 2. Independent Samples t-test

Measure 1	Measure 2	T	df	p	Cohen's d
ARS Post-test score	ARS Pre-test score	3.442	38	<0.001	1.001

The t-statistic value of 3.442 indicates a moderate to large effect size. The effect size is moderate to large, indicating that the difference is not only statistically significant but also practically significant. Cohen's d value of 1.001 suggests the impact of the intervention programme has a large effect size.

B. ANOVA

ANOVA - Total

Cases	Sum of Squares	df	Mean Square	F	p
V1	**592.900**	**1**	**592.900**	**11.849**	**0.001**
Residuals	**1901.500**	**38**	**50.039**		

Note. **Type III Sum of Squares**

A one-way analysis of variance (ANOVA) was conducted to examine the differences between group means. The results indicated a significant effect, $F(1, 38) = 11.849$, $p < .01$. The total sum of squares was 2494.400, with 592.900 (23.8%) attributed to between-group differences and 1901.500 (76.2%) attributed to within-group differences.

Discussion:

1. Interpretation of Results:

The notable change of attitude towards chemistry within the experimental group, as depicted by the large effect size, suggests that the emotional intelligence intervention was effective. This is consistent with earlier

studies that highlighted the impact of emotional intelligence on attitudes towards academics and academic performance.

No specific documents detail the emotional intelligence intervention program and its impact on attitudes towards chemistry. The literature concerns emotional intelligence as it relates to academic performance, stress management, and engagement within educational contexts. Still, some relevant conclusions can be made:

Emotional intelligence interventions appear to have a positive impact on several areas of academic performance and the psychological well-being of students. For example, Gomes Da Costa et al. (2021) argue that an educational intervention grounded on experiential learning and positive psychology enhanced students' psychological capital and subsequently, their performance. Moreover, Khorasani et al. (2023) argue that emotional intelligence training enhances students' coping mechanisms with academic stress (Khorasani et al., 2023). EI training delivered online has also been shown to enhance academic engagement among students at the university level (Junça Silva & Almeida, 2023). In the realm of language instruction, applying EI skills within language instruction contexts can foster the development of linguistic and emotional skills in learners (Thao et al., 2023).

As it may be expected, the efficacy of emotional intelligence interventions appears to be differentiated among various competencies. Only the student's self-awareness and self-regulation were in his or her control for academic performance (Fernandez-Perez & Martin-Rojas, 2022). This finding may be important for possible effects on attitudes toward subjects such as chemistry (Fernandez-Perez & Martin-Rojas, 2022). Although EI interventions have positive outcomes in many areas, including improved attention and increased life satisfaction and resilience in adult education (Delhom et al., 2020). In nursing curricula, they assisted with the development of strategies informed by socio-demographic variables (Almansour, 2023).

Nonetheless, the direct effects of emotional intelligence interventions on attitudes towards chemistry remain inconclusive. The overarching benefits of EI interventions on academic performance, stress management, self-emotional regulation, and academic participation imply that there could be some influence of EI on learners' attitudes towards more difficult subjects like chemistry.

Emotions in science education are a necessary area to deal with for they contribute to learning (Pierson et al., 2023).Positive emotions like interest and surprise give way to academic performance and success while negative emotions like anxiety may lead to poor learning experiences. For instance, students comprehending their weaknesses and working on improving their strengths set a valuable learning environment for themselves (Madsgaard et al., 2022). The level of difficulty, emotional arousal, and psychological safety leads to a state of flow that results in greater performance and academic confidence. Here it is hypothesized that the emotional intelligence intervention likely fostered more positive emotions towards chemistry, leading to improved attitudes and the results do prove the same. The large effect size obtained in the results proves the theory proposed for this study.

The results proved that it has potential consequences for curriculum construction and teaching strategies in chemistry education. The study also acknowledges the potential limitations of this study for its relatively short intervention duration and suggests exploring specific components of emotional intelligence significantly influence attitudes towards chemistry.

Educational Implications:

1. **Incorporating EI in Curriculum**: This intervention can enhance students' self-awareness, and interpersonal skills, which may positively influence students' attitudes toward chemistry.

2. **Teacher Training Programs**: EI training can foster a supportive learning environment and build stronger teacher-student relationships that would improve more appropriate student engagement towards chemistry.

3. **Personalized Learning Strategies**: With the knowledge of students' strengths and weaknesses the teachers can construct a specific instructional strategy.

4. **Holistic Development**: This intervention goes beyond educational achievement would focuses on the well-being and training of their minds for future challenges.

5. **Policy and Practice**: Educational policymakers should suggest and design workshops at the higher secondary level for both the teaching faculty and the students to improve attitudes toward challenging subjects like chemistry.

Limitations:

1. **Small Sample Size**: The study was conducted with only 40 students, which hinders generalizability.

2. **Short Duration of Intervention**: The 8-week duration of the Emotional Intelligence Intervention Program may not be sufficient to produce long-term attitudinal changes. A longer duration may yield more conclusive results.

3. **Lack of Longitudinal Follow-up**: The study did not include a follow-up phase to assess whether the positive changes in attitude towards chemistry were sustained over time.

4. **Context-Specific Findings**: The intervention and its outcomes are based on a specific educational context in Tamil Nadu, India, which may not be applicable across different regions or educational systems.

5. **Single Subject Focus**: The intervention targeted only chemistry. The effects of EI on attitudes toward other subjects or overall academic performance were not explored.

6. **Self-Report Bias**: The data collection depended on self-reported scores (ATCLS), which may not fully capture students' true attitudes.

7. **No Assessment of Individual EI Components**: The study does not differentiate the impact of specific emotional intelligence competencies (e.g., self-awareness vs. social skills), which could be relevant for targeted interventions.

Recommendations:

1. **Teacher Professional Development**: Chemistry teachers should be trained in emotional intelligence strategies to create emotionally supportive classroom environments that foster better student engagement and motivation.

2. **Personalized Instructional Design**: Teachers should use insights from EI assessments to tailor instructional methods to students' emotional and cognitive needs, thereby promoting positive academic experiences in challenging subjects like chemistry.

3. **Scaling and Institutionalizing EI Programs**: Schools and educational policymakers are encouraged to implement EI programs not just in chemistry but across other STEM subjects to enhance overall student well-being and academic performance.

4. **Longitudinal Implementation**: Future interventions should be implemented over a longer period and evaluated continuously to examine sustained changes in attitude and performance in chemistry and other subjects.

5. **Policy-Level Initiatives**: National and state educational policies should recognize the significance of emotional intelligence in learning process and allocate resources for curriculum innovation and teacher training in this area.

Conclusion:

The study proves that emotional intelligence interventions can significantly improve higher secondary school students' attitudes toward chemistry. Students with enhanced EI express a higher level of interest, reduced anxiety, and a more positive attitude toward chemistry. This potential impact of EI programs in fostering both academic resilience and subject-specific enthusiasm needs in-depth exploration. Future research in EI-related components and in exploring long-term effects and generalizability in various academic disciplines are the need of the hour.

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