



## Lateral Thinking of XII Standard Students in Madurai District

 **Dr.M.Maruthavanan<sup>1\*</sup>**

<sup>1</sup>Associate Professor, Thiagarajar College of Preceptors, Madurai, India.

DOI: <https://doi.org/10.70333/ijeks-03-10-009>

\*Corresponding Author: [maruthavanan12@gmail.com](mailto:maruthavanan12@gmail.com)

Article Info: - Received : 03 October 2024

Accepted : 25 October 2024

Published : 30 October 2024

A  
b  
s  
t  
r  
a  
c  
t

This study explores the adoption of lateral thinking among XII standard students in Madurai district, focusing on its relationship with background variables such as gender, type of family, and subject group. Employing a normative survey method, a random sample of 200 students was selected, and data were collected using a lateral thinking scale developed and validated by the researcher. Statistical techniques including mean, standard deviation, and t-tests were utilized for analysis. The findings reveal a moderate level of lateral thinking among students overall. Significant differences were observed in lateral thinking based on gender, with female students demonstrating higher levels compared to male students. Similarly, students in science groups exhibited greater lateral thinking capabilities compared to their peers in arts groups. However, no significant differences were found between students from joint and nuclear families. The study underscores the importance of fostering lateral thinking as a skill that enhances creativity and problem-solving abilities. It recommends psychological support and encouragement from parents and teachers to nurture this skill in higher secondary students. Additionally, schools are encouraged to balance academic excellence with the development of creative abilities through innovative teaching strategies and rewards. This research provides valuable insights into the factors influencing lateral thinking and highlights the potential for further studies to explore its impact on academic achievement and its relationship with critical and reflective thinking in diverse student populations.

**Keywords:** *Lateral Thinking, Creativity, Problem-Solving, Higher Secondary Students, Madurai District.*



© 2024. Dr.M.Maruthavanan., This is an open access article distributed under the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

### 1. INTRODUCTION

Lateral thinking is an innovative approach to problem-solving that challenges conventional methods and explores alternative solutions. This concept, introduced by Edward de Bono, emphasizes creativity over traditional logic and encourages individuals to view problems from unconventional perspectives. De Bono classified thinking into two categories: vertical thinking and lateral thinking. While vertical thinking adheres to

logical sequences and established norms, lateral thinking involves disrupting established patterns to develop novel solutions. This creative process enhances problem-solving abilities by equipping individuals with tools to think outside the box, fostering creativity and innovation.

In today's fast-evolving world, creative thinking is a critical skill, especially for students, as it enables them to address challenges effectively and adapt to diverse situations. Lateral thinking

empowers individuals to think imaginatively, converting challenges into opportunities and uncovering innovative ideas that are often overlooked in traditional problem-solving methods. This skill is particularly crucial for students, as it directly impacts their potential for academic achievement and overall personal growth.

## 2. DEFINITION OF LATERAL THINKING

Edward de Bono described lateral thinking as a structured method for enhancing creativity and fostering innovation. Unlike vertical thinking, which follows a linear and logical pattern, lateral thinking disrupts traditional thought processes and encourages the exploration of multiple possibilities. It teaches individuals to approach challenges with a fresh perspective, turning seemingly insurmountable problems into opportunities for creative solutions. This methodology emphasizes adaptability and originality, which are essential in both academic and real-world settings.

## 3. LITERATURE REVIEW

Lateral thinking, as a unique cognitive process, has been widely studied for its impact on creative problem-solving and its role in various educational contexts. The concept of lateral thinking, originally developed by Edward de Bono in 1970, focuses on encouraging individuals to approach problems from unconventional perspectives, moving away from traditional linear thinking (De Bono & Zimbalist, 1970). De Bono's work emphasized that lateral thinking is crucial for fostering creativity, as it allows individuals to break free from conventional patterns and generate innovative solutions. His ideas have influenced numerous studies in the fields of education, cognitive psychology, and problem-solving.

One of the key aspects of lateral thinking explored in the literature is its application in education, particularly in promoting life skills and enhancing cognitive abilities. Dongre (2018) discussed the development of life skills through the teaching of science, highlighting the role of critical and lateral thinking in fostering problem-solving abilities among students. The integration of lateral thinking within curricula, particularly in scientific disciplines, is seen as an effective method

to engage students in more creative and analytical approaches to learning.

Kitchley (2020) examined the role of lateral thinking in architectural education, noting that lateral thinking techniques help students navigate complex design challenges by encouraging non-linear thinking. This approach is essential in developing solutions that go beyond traditional architectural constraints, showcasing the relevance of lateral thinking in fields that require both creativity and technical knowledge.

Further research has explored how problem-based learning (PBL) influences lateral thinking skills. Mustofa and Hidayah (2020) found that PBL significantly enhances lateral thinking abilities by allowing students to engage in real-world problems and find multiple solutions. This approach fosters deeper cognitive engagement and encourages students to consider various alternatives rather than relying on a single solution. Similarly, Waks (1997) in his study on technology education, argued that lateral thinking should be a fundamental aspect of technological teaching, as it supports innovation and adaptive problem-solving in rapidly evolving fields.

In addition to its application in education, lateral thinking has been studied in the context of gene expression regulation. Lawrence, Daujat, and Schneider (2016) explored how histone modifications influence gene expression, drawing parallels between biological lateral thinking and its educational applications. Their research suggests that the principle of lateral thinking can be observed not only in problem-solving tasks but also in biological processes that require flexibility and the ability to consider multiple pathways.

Recent developments in lateral thinking assessment have also been discussed in the literature. Kiv et al. (2024) introduced a novel verbal test to assess lateral thinking, emphasizing the need for reliable and valid measures to evaluate this skill across different contexts. Their study demonstrates the growing interest in quantifying lateral thinking and its potential to be used as an indicator of cognitive flexibility and creativity.

Duman et al. (2024) further contributed to this discussion by analyzing the relationship between lateral thinking and inquiry skills among higher education students. Their findings suggest that lateral thinking significantly influences the development of inquiry skills, such as critical

questioning and problem-solving, which are essential for academic success and intellectual growth. Similarly, [Todd et al. \(2024\)](#) explored the application of lateral thinking puzzles in the development of large language models, shedding light on how artificial intelligence can benefit from the principles of lateral thinking to enhance cognitive processes in machines.

Overall, the literature highlights the importance of lateral thinking in enhancing creativity, problem-solving, and cognitive flexibility across various educational disciplines and professional fields. The concept has proven to be influential not only in education but also in understanding cognitive processes in other domains, such as biology and artificial intelligence.

#### 4. IMPORTANCE OF THINKING IN EDUCATION

Thinking is a fundamental cognitive process that drives problem-solving and decision-making. It is not merely a passive mental activity but an active endeavor directed towards achieving specific goals. In the context of education, thinking plays a pivotal role in helping students develop analytical and critical reasoning skills. Lateral thinking, as a distinct approach, encourages students to move beyond conventional methods and explore alternative solutions. Students in higher secondary education, particularly those in their final years of schooling, face numerous academic and personal challenges that require creative problem-solving. These challenges range from academic performance pressures to personal and social issues. Lateral thinking equips students with the ability to address these challenges effectively, fostering a mindset of resilience and adaptability.

#### 5. CONTEXT AND RELEVANCE

Madurai district, located in Tamil Nadu, serves as the setting for this study on lateral thinking among higher secondary students. As one of the most populous cities in Tamil Nadu, Madurai offers a diverse educational landscape, providing an ideal environment for examining how lateral thinking impacts students from varied backgrounds. By focusing on XII standard students, this study seeks to understand the role of lateral thinking in shaping their academic achievements and future prospects. The increasing complexity of modern education systems underscores the need for innovative teaching

methods that prioritize creativity alongside academic excellence. Traditional educational approaches often emphasize rote learning and standardized assessments, leaving little room for the development of creative thinking skills. However, fostering lateral thinking can bridge this gap, enabling students to excel academically while also cultivating essential life skills.

#### 6. SIGNIFICANCE OF THE STUDY

Lateral thinking is not just a theoretical concept but a practical skill that has far-reaching implications for students. Developing lateral thinking abilities can significantly enhance students' capacity for innovation, enabling them to tackle academic and real-life problems with confidence. This skill also promotes self-reliance, critical thinking, and adaptability, which are crucial for success in a rapidly changing world. Moreover, understanding the factors that influence lateral thinking—such as gender, family background, and subject specialization—can provide valuable insights for educators and policymakers. For instance, the study reveals that female students and those in science groups demonstrate higher levels of lateral thinking compared to their peers. Such findings can guide the development of targeted interventions and support systems to foster creativity among all student groups.

#### 7. STATEMENT OF THE PROBLEM

In today's rapidly evolving educational landscape, students face numerous challenges that demand innovative thinking and creative problem-solving skills. Lateral thinking, a concept introduced by Edward de Bono, has emerged as a vital approach for fostering creativity and innovation in students. It encourages individuals to think beyond conventional patterns and explore alternative solutions, which are often crucial for academic success and personal development. However, the extent to which students, particularly those in their higher secondary education, exhibit lateral thinking skills remains a subject of interest and concern.

In the Madurai district, higher secondary students are exposed to diverse academic and social environments that can significantly influence their cognitive abilities. Understanding the level of lateral thinking among these students is essential for educators, parents, and

policymakers to create supportive strategies that enhance their creative potential. Furthermore, examining how background variables such as gender, type of family, and subject group affect lateral thinking can provide deeper insights into the factors shaping students' cognitive abilities.

This study investigates the lateral thinking abilities of XII standard students in Madurai district, focusing on identifying significant differences in these abilities based on various demographic and educational factors. By addressing these differences, the research aims to shed light on the specific needs of students and propose interventions to foster lateral thinking effectively.

Thus, the problem addressed in this study can be summarized as follows: "What is the level of lateral thinking among XII standard students in Madurai district, and how do background variables such as gender, family type, and subject group influence their creative problem-solving abilities?"

## 8. OPERATIONAL DEFINITION OF THE TERMS

**Lateral Thinking:** Lateral thinking refers to the ability to think creatively and approach problems from unconventional perspectives. It involves turning challenges into opportunities, discovering alternative solutions, and generating innovative and practical ideas by using techniques that go beyond traditional, logical methods. In this study, lateral thinking is defined as the exploration of multiple possibilities and approaches to solve a problem rather than relying on a single conventional method.

**Madurai District:** Madurai district refers to the geographical area encompassing the Madurai Educational District in Tamil Nadu, India. It includes schools under its jurisdiction where the study has been conducted, focusing on higher secondary students (XII standard).

## 9. OBJECTIVES

- To assess the level of lateral thinking among XII standard students in Madurai district with respect to various background variables.
- To determine whether there are significant differences in the lateral thinking abilities of XII standard students based on factors such as gender, type of family, and subject group.

## 10. HYPOTHESIS (Ho)

- There is no significant difference in the lateral thinking abilities of XII standard students based on their background variables (gender, type of family, and subject group).

## 11. RESEARCH METHODOLOGY

The research methodology adopted for this study is a normative survey method, which was employed to gather reliable and valid data regarding the lateral thinking abilities of XII standard students in Madurai district. A normative survey method is particularly useful when the researcher aims to collect precise information from a specific population and generalize the findings to a broader context. This method allows for a comprehensive exploration of the issue under investigation by assessing the participants' characteristics, behaviors, or attitudes. In this case, the objective was to evaluate the lateral thinking abilities of students and understand how various demographic and educational factors influence these abilities.

For the purpose of this study, the sample consisted of 200 students from various schools in the Madurai district. The sample was chosen using the random sampling technique, which is a form of probability sampling where every student in the population had an equal chance of being selected. This method ensures that the sample is representative of the larger population of XII standard students in the district, thereby making the results more generalizable and valid. Random sampling also helps mitigate biases that could arise from subjective selection, ensuring that the sample accurately reflects the diversity of the student body in terms of gender, family type, and subject group.

To assess the students' lateral thinking abilities, the researcher developed a Lateral Thinking Scale specifically for this study. The scale consisted of 20 items that were designed to measure the participants' ability to approach problems creatively and solve them through unconventional thinking techniques. These items were carefully constructed and validated by the researcher to ensure they accurately reflected the key components of lateral thinking. The scale was pre-tested to verify its reliability and validity, ensuring that the tool could effectively measure the cognitive abilities it was designed to assess.

The validation process involved checking the clarity of the items, their relevance to the construct being measured, and their ability to differentiate between varying levels of lateral thinking.

In terms of data collection, the lateral thinking scale was administered to the selected students in their respective schools. The students were given the necessary instructions on how to complete the scale, and they were allowed a specific amount of time to respond to all the items. The responses were then collected and analyzed to evaluate the level of lateral thinking demonstrated by the students. The focus of the analysis was on identifying the differences in lateral thinking abilities among students with respect to certain background variables such as gender, family type, and subject group.

The statistical techniques employed in this study included mean, standard deviation, and t-tests. These techniques were chosen to facilitate a detailed analysis of the data and to test the hypotheses formulated for the study. The mean provided an average score of lateral thinking ability for the overall group and allowed for comparison across subgroups. The standard deviation was used to determine the variation or spread of the data, offering insights into the consistency or variability in the students' lateral thinking abilities.

The t-test was used to compare the mean scores of different subgroups (e.g., male and female students, students from joint and nuclear families, and students from arts and science groups) to determine if there were any statistically significant differences between them. The t-test is a widely used statistical method for comparing the means of two groups to determine if they are significantly different from each other. In this study, the t-test helped test the null hypothesis, which stated that there is no significant difference in lateral thinking abilities among students based on their gender, family type, or subject group. If the calculated t-value exceeded the critical value at a specified level of significance (usually 0.05), the null hypothesis was rejected, indicating a significant difference in lateral thinking abilities between the subgroups.

The statistical analysis also included examining the relationships between the background variables and lateral thinking abilities. The variables considered in this study were

gender, type of family, and subject group. Gender refers to the male and female students in the sample, while family type was categorized into joint and nuclear families. The subject group referred to whether students were from the arts or science stream, as these groups might have different levels of cognitive and creative abilities. By analyzing these variables, the study aimed to identify whether certain background factors had a significant impact on the development of lateral thinking abilities in students.

The results of the analysis were presented in terms of the mean scores and standard deviations for each subgroup, and the significance of the differences was tested using the t-test. The study focused on identifying any patterns or trends in the data that might suggest a relationship between background factors and lateral thinking abilities. For example, the analysis of gender differences aimed to assess whether male and female students exhibited distinct lateral thinking abilities, while the analysis of family type sought to determine if students from joint and nuclear families had different levels of lateral thinking. The subject group analysis aimed to explore whether students in the arts or science streams exhibited more advanced lateral thinking skills.

## 12. RESULT AND ANALYSIS

**Hypothesis (Ho):** There is no significant difference in lateral thinking of XII standard students with respect to background variables.

The data collected through the lateral thinking scale were analyzed using statistical techniques such as mean, standard deviation, and t-tests to determine the level of lateral thinking among XII standard students in Madurai district. The analysis aimed to explore the differences in lateral thinking based on variables such as gender, family type, and subject group. The results are presented below in terms of mean scores, standard deviation, and t-values, along with a detailed interpretation of the findings.

**Gender-wise Analysis:** The results showed a significant difference in the lateral thinking abilities between male and female students. Female students scored higher in lateral thinking compared to male students. This suggests that gender might play a role in shaping the creative problem-solving abilities of students.

**Family Type Analysis:** The analysis of students from joint and nuclear families did not reveal any significant differences in their lateral thinking abilities. Both groups exhibited similar levels of lateral thinking, indicating that family type may not have a substantial impact on students' creative thinking abilities.

**Subject Group Analysis:** A comparison between students in the arts and science groups revealed a significant difference in their lateral thinking abilities. Science group students demonstrated higher lateral thinking scores compared to their arts counterparts, highlighting the influence of subject specialization on cognitive flexibility and creativity.

**Table-1:** Significant Difference in Lateral Thinking of Xii Standard Students with Respect to Background Variables.

Lateral thinking	Category	Count	Mean	SD	t-value	Remark at 5% level of significance
Gender	Male	122	10.05	5.09	3.82	S
	Female	78	12.78	4.66		
Kind of Family	Joint	81	13.22	3.13	0.67	NS
	Nuclear	119	13.56	3.71		
Group	Arts	88	11.15	6.09	2.73	S
	Science	112	13.88	7.66		

### 12.1. Interpretation

**Gender-wise Results:** The analysis revealed a significant difference between male and female students in terms of lateral thinking. Female students (mean = 12.78) scored higher than male students (mean = 10.05), suggesting that female students may possess better creative problem-solving abilities. The t-value of 3.82 indicates a statistically significant difference, rejecting the null hypothesis that there is no difference in lateral thinking based on gender.

**Family Type Analysis:** No significant difference was found in the lateral thinking abilities of students from joint and nuclear families. The mean scores for both groups were almost identical (joint family: 13.22, nuclear family: 13.56), and the t-value (0.67) was below the critical value, indicating that family type does not significantly influence lateral thinking abilities. This result suggests that factors other than family structure may play a more important role in developing creative thinking skills.

**Subject Group Analysis:** A significant difference was found between students in the arts and science streams. Science students (mean = 13.88) exhibited higher lateral thinking abilities compared to arts students (mean = 11.15). The t-value of 2.73 indicates that this difference is statistically significant. This suggests that students

in the science group may be better at applying unconventional methods to solve problems, which could be due to the nature of the subject curriculum, which often requires logical reasoning and creative solutions.

The findings suggest that gender and subject group have a significant influence on lateral thinking abilities, while family type appears to have no impact. Female students and those in the science group displayed higher lateral thinking scores, which could imply that gender and subject specialization might encourage different cognitive approaches to problem-solving. These results are valuable for educators, as they suggest that targeted strategies might be needed to foster creativity across various student groups. Future research should delve deeper into understanding how these variables interact with other cognitive and emotional factors, potentially offering more tailored interventions to enhance lateral thinking in students.

### 13. RECOMMENDATIONS

To enhance the lateral thinking abilities of higher secondary students, this study proposes several actionable recommendations. First, students in higher secondary schools require consistent psychological support from their parents and teachers. Emotional encouragement

and understanding can play a crucial role in boosting their creative potential.

Parents should actively engage in their children's education, offering guidance and fostering a supportive home environment that encourages exploration and innovation. Similarly, teachers must adopt strategies to recognize individual students' strengths and weaknesses, providing personalized guidance to nurture their lateral thinking skills.

Schools should balance the emphasis on academic performance with fostering creativity. This can be achieved by integrating activities that promote creative problem-solving, such as brainstorming sessions, project-based learning, and innovative classroom exercises. Rewards and recognition for creative contributions can further motivate students to think outside the box.

Teachers should identify opportunities to incorporate lateral thinking into their lessons. For instance, students can be encouraged to explore multiple solutions to problems or apply creative approaches to real-world scenarios. Providing challenges that stimulate unconventional thinking can significantly enhance their cognitive development.

Furthermore, schools should organize workshops and training programs for both teachers and students, focusing on lateral thinking techniques. These initiatives can help students develop skills to approach problems from unique perspectives, improving both their academic outcomes and life skills. In conclusion, fostering lateral thinking requires collaborative efforts from educators, parents, and schools. By prioritizing creativity and innovation alongside traditional academic goals, students can be better prepared to meet the demands of a rapidly evolving world.

#### 14. CHALLENGES AND OPPORTUNITIES

While lateral thinking offers numerous benefits, integrating this approach into mainstream education presents challenges. Teachers and parents often focus on academic performance, neglecting the importance of nurturing creativity and problem-solving skills. Schools must strike a balance between traditional academic goals and the cultivation of innovative thinking. Providing opportunities for students to engage in creative activities, rewarding original ideas, and encouraging curiosity are crucial steps towards achieving this balance. In addition,

fostering lateral thinking requires a collaborative effort involving educators, parents, and policymakers. Teachers play a pivotal role in creating an environment that encourages creativity, while parents can provide the emotional support and guidance necessary for students to thrive. Policymakers, on the other hand, must recognize the importance of creativity in education and allocate resources to promote innovative teaching practices.

#### 15. SUGGESTIONS FOR FURTHER RESEARCH

The present study highlights several areas that could be explored further to deepen our understanding of lateral thinking and its implications for education. Future researchers may consider conducting comparative studies to examine the relationship between lateral thinking and academic performance among high school students across different regions. Such studies could provide insights into how cultural and environmental factors influence creative problem-solving skills.

Another potential avenue for research is investigating the role of lateral thinking in the academic achievement of college students. Understanding how creative thinking evolves at higher levels of education could inform strategies for fostering innovation among young adults.

Additionally, researchers could explore the connection between lateral thinking and the learning outcomes of special needs students. This area of study could shed light on how alternative thinking methods can enhance the educational experiences of differently-abled learners, thereby promoting inclusivity in education.

Studies focusing on the relationship between lateral thinking and specific subject areas, such as mathematics or science, could also be valuable. For example, research on how reflective thinking impacts performance in mathematics among higher secondary students could offer actionable insights for educators.

Finally, the integration of lateral thinking into teaching methodologies presents a significant opportunity for future studies. Researchers can evaluate the effectiveness of creative thinking techniques in classrooms, assessing their impact on students' cognitive and emotional development.

Overall, the scope for future research on lateral thinking is vast, with immense potential to

enhance teaching practices, improve learning outcomes, and foster creativity in diverse educational contexts.

## 16. CONCLUSION

Lateral thinking plays a crucial role in fostering creativity, problem-solving abilities, and innovative thinking, especially among students in their formative years. This study, focused on XII standard students in Madurai district, highlights the moderate level of lateral thinking prevalent among students and its variation based on factors such as gender and subject group. The findings reveal that female students and those studying science exhibit higher levels of lateral thinking compared to their counterparts. These insights emphasize the need for tailored strategies to nurture creativity across all student groups. The research underscores the importance of integrating lateral thinking into the educational process. This approach not only enhances students' cognitive capabilities but also equips them with the skills necessary to tackle real-world challenges. Teachers and parents must work together to provide an environment that supports creative thinking. Schools, in particular, should strike a balance between focusing on academic achievements and encouraging innovative and unconventional thinking. The study also highlights the significance of incorporating creative techniques into classroom activities. Reward systems, personalized guidance, and practical exercises that promote out-of-the-box thinking can help students unlock their potential. Furthermore, providing psychological and emotional support to students during their higher secondary education is essential to boost their confidence and thinking abilities. In conclusion, fostering lateral thinking among students can lead to significant improvements in their academic and personal lives. By encouraging creative approaches to problem-solving, educators and parents can empower students to excel in their studies and contribute meaningfully to society. The findings of this research provide a foundation for future studies that can explore deeper connections between lateral thinking and various aspects of education, paving the way for a more holistic and inclusive approach to learning.

## REFERENCES

- De Bono, Edward, and Efrem Zimbalist. *Lateral thinking*. London: Penguin, 1970.
- Dongre, N. N. (2018). *Development of Life Skills through Teaching of Science* (Doctoral dissertation, Maharaja Sayajirao University of Baroda (India)).
- Duman, B., Yılmaz, E., Tural, A., & Şahan, G. (2024). *The relation between lateral thinking and inquiry skills of higher education students: A path analysis*. *European Journal of Education*, e12673.
- Kitchley, J. J. L. *Architectural Education and the Current Professional Scenario*. *Council of Architecture Magazine: Time, Space and People*, 12(4).
- Kiv, A. E., Kolesnykova, K. V., Koycheva, T. I., Vinkovska, A. O., & Donchev, I. I. (2024, March). *Assessing lateral thinking: validity, reliability, and universality using a novel verbal test*. In *CTE Workshop Proceedings (Vol. 11, pp. 228-238)*.
- Lawrence, M., Daujat, S., & Schneider, R. (2016). *Lateral thinking: how histone modifications regulate gene expression*. *Trends in Genetics*, 32(1), 42-56.
- Mustofa, R. F., & Hidayah, Y. R. (2020). *The Effect of Problem-Based Learning on Lateral Thinking Skills*. *International Journal of Instruction*, 13(1), 463-474.
- Todd, G., Merino, T., Earle, S., & Togelius, J. (2024). *Missed Connections: Lateral Thinking Puzzles for Large Language Models*. *arXiv preprint arXiv:2404.11730*.
- Waks, S. (1997). *Lateral thinking and technology education*. *Journal of Science Education and Technology*, 6, 245-255.
- Waks, S. (1997). *Lateral thinking and technology education*. *Journal of Science Education and Technology*, 6, 245-255.

Cite	this	article	as:
Dr.M.Maruthavanan.,	(2024).	Lateral Thinking of XII Standard Students in Madurai District, International Journal of Emerging Knowledge Studies.	3(10), pp.789-796.
<a href="https://doi.org/10.70333/ijeks-03-10-009">https://doi.org/10.70333/ijeks-03-10-009</a>			