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An Evaluation of the Online Course on Climate Change and Emotion

Anurag DEEP*, Aditi PATHAK & Nandini CHATTERJEE
UNESCO MGIEP, 35, Firozshah Road, New Delhi - 110001 India
*a.deep@unesco.org

Abstract: Education possesses the potential to enable people to understand the causes and consequences of climate change, make informed decisions and take appropriate actions to address it. Behavioral research shows that decision-making is a cognitive-emotional process. Therefore, any intervention to enable appropriate actions for climate change must include the knowledge and skills necessary to enable sustainable living. Based on such an integrated model, an online interactive course was designed for middle school learners in the age group of 12-15 years. Here, we present the design of the course and a pilot study conducted (N=52) to investigate the efficacy of the course. Efficacy was assessed through a self-reported pre-post Sustainable Development Self-Efficacy (SDSE) questionnaire. A paired sample t-test between the post-and pre-test SDSE questionnaire scores revealed a significantly increased score ($p < 0.05$). Specifically, increased scores were seen on the subscales of "Influence of environment" ($p < 0.05$) and "Economic welfare" ($p < 0.05$). This study provides preliminary evidence of an online course to build knowledge of climate change and mindsets to affect pro-environmental action to mitigate its impact.

Keywords: Climate Change, Social and Emotional Learning (SEL), Sustainable Development Self-Efficacy (SDSE) questionnaire

1. Introduction

Climate change is now recognized as a grave challenge to the present and future of humanity. A serious consequence is rise in the earth's temperature by 1.5 degrees. The earth's temperature has varied dramatically during its 4.5-billion-year history, but the current rapid warming is not natural. These changes will grow and become more severe and inescapable with time. To mitigate the challenges ahead, humanity must learn to live sustainably (Osbaldiston & Schott, 2012). Accumulating evidence points to the fact that the effects of climate change can only be addressed and mitigated by altering human behavior (Mogensen & Schnack, 2010). In fact, emerging research shows that learning about climate change "*is not only a cognitive endeavor but also involves cultivating skills to manage emotions evoked by the seriousness and complexity of these problems."* (Ojala, 2012). The Action for Climate Empowerment (ACE) recognizes that including climate change in curricula is crucial in solving the complex challenges presented by climate change. There is an urgent need to not only develop courses on climate change for all ages but also ensure that any climate change-related curriculum should address cognitive and emotional learning domains.

An internet search revealed that while many courses that provide information about climate change exist, there were hardly any courses that combined knowledge of climate with emotional skills. To address this gap, an online course on climate change that combined knowledge with social and emotional learning (SEL) was developed. SEL can be defined as the process of developing the competencies, abilities, and attitudes necessary to recognize and control emotions, develop caring and concern for others, form positive relationships, make responsible decisions, and deal with challenging situations (Payton et al., 2000; Greenberg et al., 2003; Weissberg et al., 2015). Embedding SEL competencies structured around the **EMC^2** framework (Singh & Duraiappah, 2019): **E**mpathy, the ability to understand how someone is feeling. When students become empathetic towards nature and the environment, they no longer see global issues such as climate change, refugee crisis, discrimination and racism as externalities but are ready to act and engage in pro-social behavior. **M**indfulness is the ability to be present in the moment, acknowledging our thoughts without judgment. Mindfulness tools help

learners understand the knowledge and information about climate change with strategies to recognize the emotional reaction to this change and ways to cope and manage one's emotions through mindfulness exercises. **C**ompassion happens when our empathy makes us want to help. A compassionate learner is more likely to take climate action. **C**ritical Inquiry is the ability to think clearly, rationally, identify, analyze, and find ways to solve problems. This skill helps learners critically analyze their 'ideas'.

2. About the course

The course entitled **Climate change: Understand, Reflect, Empathize, and Act** was designed for middle school learners and focused on two aspects (a) information on key climate change-related concepts such as carbon footprint, the science of climate change, causes, impacts, adaptation, and mitigation (2) the role of self-awareness, emotional regulation, critical inquiry, perspective-taking, and compassion to address the impact of climate change. The course is hosted on the digital learning platform Framerspace (www.framerspace.com/course/climate-change), available free of cost to all learners above the age of 13 years. The duration of the course is 20 hours and is offered in English. The course could be integrated into the regular teaching-learning practice and embed concepts from math, science, and social science. The specific learning outcomes of the course are

1) Understanding varying and often conflicting points of view around the issue of climate change.
2) Noticing and becoming aware of one's emotional response to global issues such as climate change.
3) Critically evaluating and inquiring about various aspects related to climate change.
4) Practicing mindfulness activities and learning to be mindful of one's emotional and cognitive state throughout the course and beyond.
5) Understanding the knowledge and information about climate change with strategies to recognize the emotional reaction to climate change and ways to cope and manage one's emotions through mindfulness exercises.

The online course uses the Libre pedagogical framework (Rautela, & Singh, 2019) that encourages the use of multiple pedagogies to cultivate learning, namely 1) Reflection; 2) Discussion; 3) Inquiry; 4) Storytelling; 5) Simulations and Games. The use of reflective practice encourages learners to reflect on issues related to climate change or introspect and self-evaluate their values, beliefs and attitude related to the topic. Discussion activities enable learners to learn different perspectives, express their opinions, and engage with multiple points of view. In the course, tools of inquiry are used to help learners investigate and explore the difference between fake and real news and information related to climate change. Storytelling explains the concept of trade-offs and synergy in the context of low carbon emissions alternatives, which not only helps in simplifying complex topics but also makes the module engaging. Simulations and games are used to investigate the economic impact of pro-environmental decisions by policymakers.

3. Evaluation of the Course

A single group pre-post research design was implemented to evaluate the impact of the course on learning, usability, and its efficacy in building competencies to take appropriate decisions for climate change. Figure 1 below presents the study design.

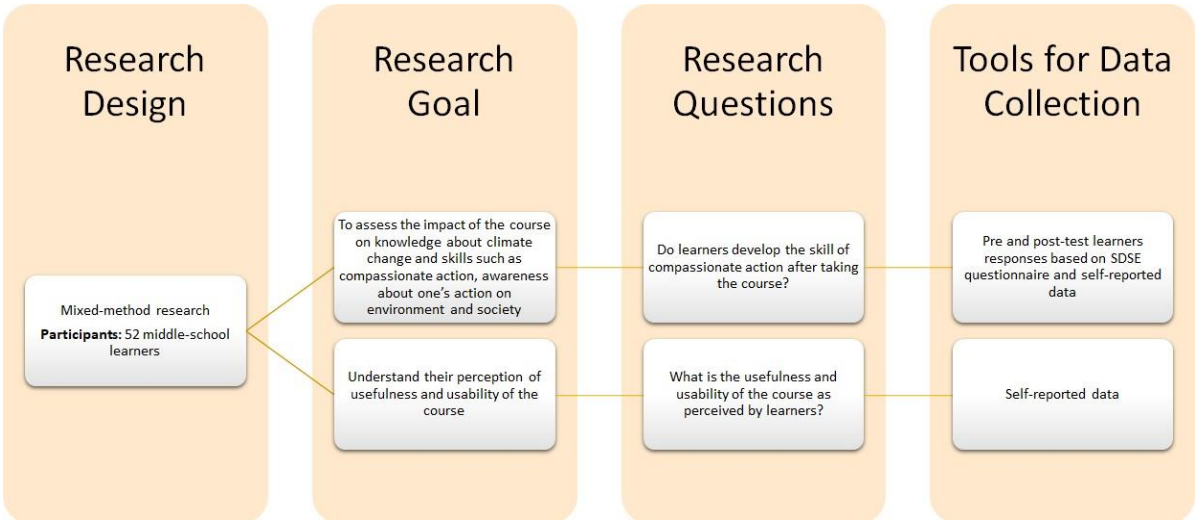

Figure 1. Study design for evaluation of the course

3.1 Participants, Study Procedure, Data sources and Analysis Technique

A total of 52 participants (N=52) were recruited from three urban schools in India from grades 7 and 8. Before the start of the course, a workshop session was conducted for the teachers to introduce them to the course, steps involved in the research study followed by the workshop session for the learners. For the first research goal the Sustainable Development Self-Efficacy (SDSE) questionnaire (Hanss, & Böhm, 2010) was used. The 20 SDSE questions were divided into 3 groups: **Influence on the environment** (reflects beliefs about the influence of one's actions and of humans in general on the environment), **Economic welfare** (represent beliefs about one's capability to contribute to a socially fair distribution of resources and economic welfare) and **Influence on others** (represents beliefs about whether one's actions to foster sustainable development motivate others to do the same). Example items included: Influence on the environment ("I believe my actions have an influence on global warming and climate change."), Economic welfare ("With my everyday consumption and buying behavior I can contribute to a socially fair distribution of resources around the world."), Influence on others ("My actions to reduce the effects of global warming and climate change in my community will encourage others to do the same."). Learners responded to the SDSE questionnaire before and after interacting with the course by choosing the Likert scale responses, which had options from "strongly disagree" to "strongly agree".

For the second research goal, self-reported questionnaire was used to evaluate usability and usefulness of the course. These questions evaluated learners' perceptions of the contribution of the course to learning - "Level of skill/knowledge at start/end of course". There were other questions regarding feedback on the course organization, learning objectives, workload, and participation. Besides this, open-ended questions such as, "What aspects of this course were most useful or valuable for you?" and "What can be improved/added in the course to be more beneficial to you?" were included.

3.2 Results

3.2.1 Quantitative Analysis

A paired t-test between the post-and pre-test SDSE questionnaire scores was conducted to assess the learning gain after interacting with the course material. Overall, there was a statistically significant difference between the post-and pre-tests ($p < 0.05$) (Figure 2). Statistically significant differences were found in questions that evaluated learners' understanding of the influence on the environment ($p < 0.05$) and in the construct of economic welfare ($p < 0.05$), which focused on a socially fair distribution of resources.

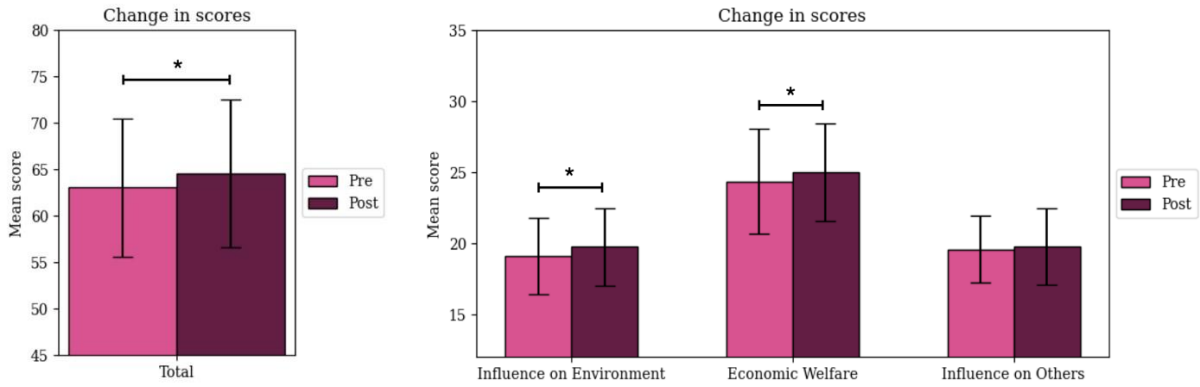

Figure 2. SDSE Questionnaire Mean Score Variation Across Pre-and post-test: Total, Influence on Environment, Economic Welfare and Influence on Others

Data analysis of the self-reported questionnaire on usability and usefulness of the course revealed a statistically significant difference ($p<0.01$) in the perception of the level of knowledge before and after the course.

3.2.2 Thematic Analysis

Data analysis of the responses to feedback on the course organization, learning objectives, workload and course participation revealed that 91% of the learners agreed that the course content was well organized, well planned and had clear learning objectives. Moreover, 88% of the learners agreed that the course workload was appropriate and allowed them to participate fully.

Table 1: *Themes and Respective Sample Excerpts*

Theme	**Instance of response from participant's artefacts**
What aspects of this course were most useful or valuable for you?	
Pro-environmental Behaviour	"Actions are taken by the people in the world to stop climate change, students can also have their contribution for stopping climate change." "The aspects were that it encouraged me a lot to do something about climate change."
Course Content	"The videos and articles were very useful to me because they helped me gain a full understanding of the topics." "Aspects of videos and chart or poster making activities more useful."
What can be improved/added in the course to be more beneficial to you?	
Live Sessions	"Live interaction with students for solving climate change problem"
Adding resources and activities	"The course was very effective in teaching, but if there were more articles in the course that would benefit me more."
Availability in another language	"Make it in different languages so that people around the world can understand it more clearly"

4. Discussion

The purpose of this study was to evaluate the efficacy of a course on climate change. Analysis of the result shows that overall, there was a significant difference between the pre-and post-tests which had SDSE questions. This could be attributed to the reflection activities done by learners across modules of the course. Since participants had to reflect on varying and often conflicting points of view around the issue of climate change, we conjecture that the course helped learners take compassionate action and understand that one's actions and of humans in general influence the environment. Additionally, a statistically significant difference in the questions on economic welfare, which evaluates learners' beliefs about one's capability to contribute to a socially fair distribution of resources, was also found. This finding may be attributed to the use of inquiry in the course that helped learners critically evaluate and inquire about various aspects of climate change.

Thematic analysis of open-ended responses indicated that this course helped learners to identify their influence on the environment and motivated them to act for pro-environmental behaviors. An excerpt from the participant's response "Actions are taken by people around the world to stop climate change, students can also have their contribution for stopping climate change" led to the triangulation of the findings from the SDSE quantitative analysis, where we found overall significant difference along with the significant difference in the theme of influence on the environment and influence on others. Furthermore, learners recognize that interaction with the course helped them to understand the knowledge and information about climate change. Also, learners perceive that the course is highly usable and useful for the learners. It is recommended that longitudinal research based on a quasi-experimental research design must be conducted to assess and evaluate the long-term impacts of such an intervention.

References

Greenberg, M. T., Weissberg, R. P., O'Brien, M. U., Zins, J. E., Fredericks, L., Resnik, H., & Elias, M. J. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional, and academic learning. *American psychologist*, *58*(6-7), 466.

Hanss, D., & Böhm, G. (2010). Can I make a difference? The role of general and domain-specific self-efficacy in sustainable consumption decisions. *Explaining sustainable consumption. Findings from cross-sectional and intervention approaches*.

Mogensen, F., & Schnack, K. (2010). The action competence approach and the 'new' discourses of education for sustainable development, competence and quality criteria. *Environmental education research*, *16*(1), 59-74.

Ojala, M. (2012). Regulating Worry, Promoting Hope: How Do Children, Adolescents, and Young Adults Cope with Climate Change?. *International Journal of Environmental and Science Education*, *7*(4), 537-561.

Osbaldiston, R., & Schott, J. P. (2012). Environmental sustainability and behavioral science: Meta-analysis of pro environmental behavior experiments. *Environment and behavior*, *44*(2), 257-299.

Payton, J. W., Wardlaw, D. M., Graczyk, P. A., Bloodworth, M. R., Tompsett, C. J., & Weissberg, R. P. (2000). Social and emotional learning: A framework for promoting mental health and reducing risk behavior in children and youth. *Journal of school health*, *70*(5), 179-185.

Rautela, R., & Singh, N. C. (2019). Libre—Nourish the Brain So the Future Can Flourish. *Childhood Education*, *95*(5), 34-43.

Singh and Duraiappah. (2019). EMC2 – a social and emotional learning framework to build human flourishing. Position paper, UNESCO MGIEP.

Weissberg, R. P., Durlak, J. A., Domitrovich, C. E., & Gullotta, T. P. (2015). Social and emotional learning: Past, present, and future.