Decade of Action, SDGs and Building Sustainability through Educational Games, and Hands-on Activities

Anant Bhaskar Garg, Director, HaritaDhara Research Development and Education Foundation (HRDEF) (corresponding author)
anantgg@yahoo.com | www.hrdef.org
(91) 9412989631
10 Vishnu Road, Near D.B.S. College,
Dehradun, Uttarakhand, India - 248001
Dr. Manisha Agarwal, Director, HRDEF,
Miss Prayanshi Garg, Youth Coordinator, HRDEF

Abstract

HaritaDhara Research Development and Education Foundation (HRDEF) addressing promising developments for accelerating progress towards the SDGs and sustainability of our planet Earth. Building an inclusive and effective path for the sustainable future with SDGs require inclusive, quality education. HRDEF committed to establish processes aimed at educating for sustainable development (ESD), management of environment, water, energy, waste, climate change, and transport issues through involving children, youth, and elders using ICT. HRDEF conduct workshops, courses for teachers, students, community members, professionals, and an after-school program. In this regard, learning, engagement with games and hands-on activities is very important, and our work showed that students, youth, community understand, take action for climate change, SDGs. HRDEF is developing Educational Games and Hands-on Activities kits and conducting workshops to teach a specific topic related to sustainability such as climate change, water cycle, energy increased player's motivation towards science and sustainability.

Games foster collaboration, problem-solving, behavior change, and computational thinking (21st Century Skills). Our focus on how can games introduce various topics (learning experience - climate change, water cycle, energy, waste management), and improvement in learning through games playing. HRDEF inculcate, motivates learners for science, technology, engineering, arts and design, mathematics (STEAM) for 21st Century Sustainable living through intelligent interactive learning systems. HRDEF is working on educational Games for Learning Sustainability Concepts, Sustainable Development Goals (SDGs) by Youth and Community for couple of years and presented our work at the TECH 2017, 2018 UNESCO MGIEP Global conference, UNESCO ESD 2021, and UN HLPF side event 2021, 2022, STI 2022. We designed, developed games, hands-on activities for understanding difficult concepts related to sustainable development in an interactive way. We discuss use of games for students and youth in different settings for advancing SDGs, building sustainability concepts for Healthy Planet, and Decade of Action. HRDEF inculcate, motivates learners for STEAM for 21st Century Sustainable living. Apps on SDGs, prevent disasters, COVID-19, hands-on activities, quiz, model making, projects and other creative forms of expressions increased players motivation towards science, SDGs, and sustainability. Thus, through ESD and Greening Education, we are providing transforming learning environments, building capacity of educators, engaging, enabling, and empowering youth.

1   Introduction

Beginning with 21st century the United Nations (UN) started Millennium Development Goals (MDG) and decade of Education for Sustainable Development (ESD) (2005-2014) that highlighted vibrant role of education towards sustainable development for saving our planet as world witnessed extreme events due to climate change. Further, the UN adopted the 17 Sustainable Development Goals (SDGs) in September 2015 to advocates for SDG 4 that provide inclusive, equitable quality education and promotes lifelong learning opportunities for all to build sustainable, inclusive and resilient societies. SDG 4.7 targets that by 2030 all learners acquire the knowledge, skills needed to promote sustainable lifestyles, human rights, gender equality, peace, non-violence, global citizenship, and cultural diversity (UN, SDSN Reports).

Through education we transfer knowledge, values, and skills across generation to facilitate societies to build the foundation for sustainable future. But many barriers to education access, outcomes, and monitoring of progress are main challenges that need to be addressed for achieving SDG 4. The global climate education and the concept of ESD are unable to provide radical transformation of education systems needed to guard against climate change. Five roadblocks identified in a Brookings report needed to resolve in a time of climate change (Kwauk, 2020). India's Philosophy of 'One World', Global Partnership, and culture of support is known for centuries. Uniting all stakeholders for their role in shaping the 2030 Agenda and the SDGs on three pillars of economy, social, environment with culture based on the principles of equality and humanity was very important for the global society.

As per data from various studies, quality, climate education, and 21st century skills are ignored in mainstream education. To bridge this gap, HRDEF provide quality skillful education that enhance problem solving, creativity, communication, design and computing skills of learners. Building capacity for citizenship, Climate Action, and Sustainable Development Goals (SDGs) among students and youth so that they are able to tackle future challenges.

HRDEF is using games, project, and hands-on approach for interactive learning. HRDEF conduct teachers, student's development programs for capacity building on ICT, SDGs, climate change, disasters, STEAM, and work towards Sustainability, Green Swachh, (Hindi word for Clean) and Sustainable Campus in government schools. Students, youth of our after-school GOAL program become motivated, equipped with self-confidence to excel in life and creating sustainable future. As systemic changes required continuous working and time for visible performance. Change, transformation will come through working gradually taking a step-by-step approach.

2   Why need Transformative Learning for ESD, Climate Change Education

As per UNICEF study, 50 % of Indian Students don't have 21st Century Skills required for Jobs and around 15 Crore school students lack job skills by 2030 published in 2019. 21st century skills such as critical thinking, inquiry based learning, collaboration, communication, and SDGs, sustainability, and hands-on learning are missing in school educational institutions. School education system require maker spaces, DIY (Do it yourself), smartphone, tablets, relevant software, and computers for successfully implementing STEAM education. Yale University research on climate change communications pointed out that 65% of the Indian population is not aware of climate change published in 2016 that is also findings from recent reports from UNESCO. Thus, everyone urgently needs to include climate change and ESD in a radical way to address future challenges.

3   Experiential, Embodied Learning for Sustainable Development

How do we learn? As a child we learn by exploring, by touching things, moving things and taking things apart. This is really an experiential way of learning i.e. learning by doing. But in school's classroom, we sit down quietly, without moving, talking or playing. Making as a construction, DIY process provides various insights, knowledge about our surroundings, and actively participates in enjoying transformative learning. Playing games, making provide entertaining, fulfilling experience of doing, creating new things, have many advantages for students, as it makes the player, a decision maker, facts investigator, evaluating strategy, prioritizing their actions and abilities.

Integrated, hands-on, project, game based learning that incorporates technology is crucial for the 21st Century Skills. MAKER (Manufacturer, Author, Knowledge analyst, Exhibitor, Recycler), Project, Game based learning provides new emerging way to understand difficult concepts and further it provide opportunities for students, learners to experience the phenomena. Therefore, it promote interactive, experiential learning that help learner to develop curiosity, creativity, critical thinking, collaboration, and problem solving that are essential for the 21st Century skills. Thus, to learn a concept, its understanding, and practice involve different steps such as exploration, curiosity, asking question, discussion, create, design thinking, making model, games, role play, drama, story, and present (Scott, 2015). Students of our GyanDhara Opportunities for All with Learning (GOAL) program worked, developed miniature, presentations, played board games, card games for embodied, immersive learning related to climate change, and sustainability concepts as given below in case study. Figure 1 describes experiential learning for biodiversity concepts in the field.

FIGURE 1 Experiential Learning for Biodiversity in the field

4   Quality Skillful Education: Games for SDGs, Sustainability

Games require players to think systemically and consider relationships instead of isolated events or facts for sustainability and sustainable development (Stommen et. al., 2016). Some games are external designed while we designed games keeping in mind Human Work Interaction Design approach through studying work settings and embedding screenplays, rules for better understanding (Clemmensen et.al., 2005), (Campos et. al., 2009). Games need not be restricted to educating schools or colleges, but on learning new things, may be cooking virtually, learning yoga, explaining and teaching complex problems such as climate change, and sustainable development (Katsaliaki et. al., 2012). In figure 2 students playing energy board game to understand concepts such as electricity conservation, renewable energy.

FIGURE 2 Students playing energy board game to understand concepts

Educational game is a form of social interaction, as learners tries to map out situations that will encourage solving compelling problems. For example, to learn about climate change and sustainability problems, learners team-up for gathering and discussing information in a project way (Garg et. al, 2017). Such games foster effective learning habits to change our lifestyle for sustainable living as described in fireworks example later on.

5   Transforming Education to create "Sustainable Consciousness"

We need more focus on skill development, innovation, decision-making, and problem solving through establishing Centre of Excellence with focus on 21st century skills. With the advent of sustainable consciousness, our GOAL program youth decided to reduce pollution during Diwali celebration, thus some children haven't burn any crackers to save environment and others burned 60 to 70% less firework as per previous years based on student and parents stories. Further, they saved Rs. 200 to Rs. 600 that made them very happy. Some senior students decided to devote time for providing quality education to poor students. Now, same students dream is to become a doctor, IAS, IPS, Judge, dancer, cricketer, banker, lawyer, army officer, and teacher (maximum girls dream) rather than focusing on their social background as most of them come from low income group.

Thus, we are doing capacity development programs for 21st century skills, STEAM, and Sustainability through:

- Teacher development programs designed to develop and teach students for SDGs, climate change, and 21st century skills
- Focusing on employability, skill development and entrepreneurship with industry orientation and linkages
- Learning science, technology, engineering, arts, mathematics (STEAM) linking with SDGs with hands-on, game and problem based approach
- Establishing learning centers with community to imbibe responsibility, accountability, global citizenship, gender equality, values

Therefore, ESD is crucial for the SDGs awareness and success for all. Education in school and higher education institution (HEI) play key role as prevalent in our golden time, e.g., Nalanda, Takshila Universities in India. Schools (Ashrams), universities happen to be not only seat of learning but also providers of solutions to humanity's problems; however, modern schools, universities are not very well connected with their local communities and the environment.

6   Conclusion

Using games to teach a specific curriculum topic related to sustainability such as climate change, water cycle, energy, biodiversity, associated concepts such as light, plants identification, disaster management, and renewable energy increased players motivation towards science and sustainability. Besides this, learners showed interest for English, personality development, and improved their leadership skill.

Games and makerspaces can motivate students to turn to textbooks with the intention of understanding rather than memorizing. Learning occurs not just in the game play but other kinds of making activities that encourage collaboration among participants, thus provide a context for peer-to-peer teaching and for the emergence of communities of Learners. It will go a long way in nurturing spirit of inquiry, fostering creativity and developing culture of innovation among students; equipping them with skills and competence to create equitable and sustainable future.

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About Authors

Anant Bhaskar Garg, Director, HRDEF, Engineer and Educator with 26 years of exp. in various capacities in academia, industries. Published two books, 71 papers in Intl. Journals, Seminars, 2 chapters in Springer's book, Invited Speaker at 98th ISC, member of Prof. Societies IEI, ACM, CSI, ISCA, IETE, ISTE. Global Teacher Excellence Award 2022, App Inventor Foundation, Senior Member 2011 of ACM, USA. Climate Reality Leader, #MentorofChange, AIM, NITI Aayog, MIEE. Organized various seminars, faculty, and student development prog. Learned best practices on education, environment through visiting Denmark, Sweden, Switzerland, USA, involved in community services for computer, and sustainability.

Manisha Agarwal, Director, HRDEF, Educator having done M. Sc. (Botany), PhD (Forest Botany) Forest Research Institute University. MBA in Education Management. 19 years of research experience in the field of Botany, Wood Anatomy, medicinal plants, papers in international, national journals, member of Indian Botanical Society, ISCA, Climate Reality Leader, Society of Wood Science and Technology, USA – 2013-14, Involved in environment education, climate action, STEAM teaching, raising awareness and skills development

Prayanshi, Youth Coordinator, She has developed apps on Youth4SDGs, Eight Elements of Sustainable Living, COVID 19 information, Climate Change, Prevent Disasters and health.