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TRANSITION TO E-LEARNING: ONLINE COOPERATIVE LEARNING FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT

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Abstract
Education is a vital entity for the sustainabl development in the modern 21st century. It has the capacity to build the future leaders and citizens of tomorrow, provide solutions to complex global issues, and sustainable development of future generations. Education in the developing countries is robust yet traditional, focuses on conventional face-to-face physical teaching. COVID -19 has an unprecedented effect on the world's political, economical and social dimensions' along with education for sustainability in education, educators made a transition from conventional learning to e-learning. The current study is a holistic approach that brings in the contribution of e-learning: Online Cooperative Learning (OCL) for sustainable development in education on the backdrop of global pandemic COVID-19. The paper focuses on 100 learners of higher education from one of the universities in India and how e-learning and Online Cooperative Learning served the purpose of fulfilling educational goals of learners amid countrywide lockdown in general, and educational for sustainable development in particular amid COVID-19 restrictions.

Keywords: E-Learning, online cooperative learning (OCL). Covid-19 and Educational for sustainable development

1. Introduction

Sustainable development is an important entity; the world has been nurturing to keep the planet safe and conducive for human habitat for the future generations with a focus on three dimensions of sustainable development: ecological dimension, economical dimension, and social dimension (Summers & Childs, 2007; Atkinson, Dietz, & Neumayer, 2007). Sustainable development defined in Brundtland report as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (WCED, 1987). This definition clearly endorses the significance progression of human needs and quality of life without exploiting the environment to meet the current and future needs of the world. The term sustainable development gained further prominence due to COVID-19: the global pandemic that engulfed the whole world and caused unprecedented disruptions in life hardly seen before in the history of humanity (Husain et al., 2020). It affected and destabilized the most powerful economies and democracies severely to bring the life to stand still under complete national lockdown put in place to protect people health care and wellbeing (Chaturvedi, Vishwakarma, & Singh, 2021; AlTameemy & Alrefaee, 2021). It caused unprecedented change in the political, economical, social and cultural lives of the people and education being the part of social and cultural entity affected the most (Andrijasevic, Tomic, & Jovanovic,2021; De Lima et al., 2020; Purohit,2021). COVID-19 hampered the sustainable development in education due to total lockdown of educational institutions to stop the further spread of pandemic in the society (Tadesse, & Muluye, 2020; Loo, Karim,&

Tan,2021). According to UNESCO (2020) 87% of the world's student community is affected by closure of educational institutions due to COVID-19 and education of more than 1.5 billion learner from 195 countries jeopardised by the closure of schools and centres of higher learning.

Education for sustainability is essential to achieve the goals of sustainability of environment and natural resources for the economical and social development of humanity, and also empowers students with sustainable competencies through holistic interdisciplinary course contents and students-centered democratic strategies (Pauw et al., 2015). Developed western countries made transition to e-learning taking the edge of technology in education and past experience of e-learning blended with traditional physical instruction, however a very few educational institutions in the developing countries like India made a transitions to e-learning due to limited access to advance technology, internet and past experience of e-Learning among teachers and learners. However, considering the post effects and challenges of pandemic on education for sustainable development, academic institutions made a slow but gradual transition to e-learning to cater the needs of learners and attain education for sustainable development in limited resourced context (Bashir et al., 2021). Hence this paper focuses on the progression of conventional education to e-Learning (Online Cooperative Learning) by adopting the advancements of technology in education to achieve the goals of education for sustainable development and face head-on the challenges of the 21st century.

2 Online Cooperative Learning (OCL)

Blended learning and online learning allow learners to collaborate and work together with peers (Thomas & Kureethara, 2025; Chuang.et al,2016) so, online cooperative learning(OCL) is one of the learners-centred democratic methods quite popular among teaching and student fraternity, promotes active learning, develops critical thinking and social behaviour among learners (Gillies, Ashman, & Terwel, 2008). Cooperative learning: an effective and popular method based on theory, validated by research and practice has proved its efficacy in diverse disciplines of study (Lien & Sjølie, 2020).Further, Johnson and Johnson (2009) observed a unique correlation between theory, research and practice in cooperative learning studies conducted across the world. Cooperative learning defined as a teaching learning approach allowing students working together to attain group goals collectively, that cannot be obtained by working alone or competitively" (Johnson, Johnson, & Holubec, 1986).

Cooperative learning quite popular in 1970s created a conducive learning environment for active interaction and triggered a learning mechanism (Dillenbourg, 1999; Yusuf, & Novita, 2020), so second language teachers adopted cooperative learning to create an instinctive learning environment to maximize learner achievement through small group interaction collectively for group success unlike individualistic or completive learning (Pintrich & Schunk, 1996; Slavin, 1983; Webb, 1982,). The characteristics of CL: positive interdependence, social interdependence, individual accountability and personal responsibility, and group processing make teaching learning progression efficient and rewarding for students and teaching fraternity (Roy, 2017). For the past five decades, numerous studies on cooperative learning proved experimentally the efficacy over other conventional methods of learning for a plethora of disciplines of studies across domains and context (Arnold, Ducate, Lomicka, & Lord, 2009; Johnson,et al, 1981; Johnson,& Johnson,2002, 2003; Kitade, 2014); however, very few studies have been undertaken on online cooperative learning (OCL) so far, but COVID-19 has increased the impetus for OCL like never before(Knight,2020), to achieve goals of sustainability of education, the current study embarked upon to investigate the efficacy of e-learning blended with OCL to enhance academic achievement of technical students in environmental education course in addition to sustainable development in education amid COVID-19.

3. COVID-19: The Global Pandemic and Impact on Education System

COVID-19 spread quickly all around the world to emerge as a global pandemic. Educational institutes were the hotspots and vulnerable places to get infected with virus, so to address people health-care crises national level lockdown had been imposed in most of the countries across the world (Loo, Karim, & Tan, 2021).

Education for sustainability seems a huge challenge for institutions, teachers, and students to address the global economic crisis, health care; and educational goals at same time. In this backdrop, e-learning has come up as a potential alternative to compensate conventional physical teaching & learning to ensure sustainability of education among developing countries like India.

4. Educational System in Developing Countries

COVID-19 had significantly disrupted the education sector in developing countries amid national wide lockdown. The educational needs of 285 million young learners in Indian subcontinent had undermined the country's economic growth due to the non-availability of adequate e-learning infrastructure, technological resources and skilled teaching fraternity (Chaudhry, 2020).

In the 21st century, sophisticated technologies in education are evolving at a fast rate with the advent of AI-related tools to make teaching and learning learner-centred, more fun and flexible for learners(Gómez Cano & Colala Troya, 2023), but in developing countries teachers generally prefer traditional teacher-cantered chalk and talk methods. The institutions rely on conventional teaching and learning pedagogy with the routine use of outdated information and educational technologies, further large classroom and limited time to complete syllabus forced educator to go for face-to-face instructions to address the educational needs for the past seven decades in Indian sub-continent (Gaikwad, & Randhir, 2016).

Covid-19 and national lockdown hampered traditional learning in education institutions (Loo, Karim, & Tan, 2021). The educational institutions had only few options so the most viable replacements to face-to-face traditional learning process was e-learning to address education for sustainable development (Dhawan, 2020; Loo, Karim,&Tan,2021). E-learning and OCL were totally a new concept not only for learners but also for teachers too so numerous challenges were faced while implementing e-learning. The common challenges: limited technical knowledge among learners and teachers, poor and unstable internet connectivity, limited online material to suit e-learning and frequent power failures (Sayer & Braun, 2020).

5. **Sustainable Development**

Sustainable development is the term originated in the 20th century to address and bring awareness about environmental challenges and strikes a balance between social and economical development (Hattingh, 2002; UNESCO, 2002, 2005). The term sustainability gained momentum after the united nations conference on environment and development (UNCED) held at Rio in 1992, focused on three dimensions of sustainable development: Environmental, Social, and Economical(UNESCO,2016, 2002). All these three dimensions are interrelated: economy depends on society and society depends on the environment (Sinakou et al., 2018). These three dimensions also known as three pillars of sustainable development which lays foundation for global development with a special focus on the wellbeing of the people and planet along with a striking balance between environmental, social and economical concern of the world (UNESCO, 2016).

Sustainable development is a dynamic concept, so it can be defined and understood in different ways (Makrakis, 2010). Sustainable development is also termed as an abstract concept to define, though frequently used but difficult to understand from a single perspective (McKeown, 2002), so sustainable development defined in numerous ways as per multifaceted challenges and requirements to address the needs of present generation without undermining the needs of future generations(Agbedahin, 2019).

A prominent definition for sustainable development is given by Brundtland Commission "Our common future sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations" (Brundtland, 1987). World commission on environment development defines sustainable development as "development that meets needs of the present without compromising the abilities of the future generation to meet their own" (WCED, 1987, p 41; UNESCO, 2014). This definition addresses the environment challenges along with economical and social challenges. Thus sustainable development fulfils the primary requirements of the current generation without undermining the basic needs of the future generations.

6. Education for Sustainable Development

Education is the primary tool to transform the livelihood of the people in achieving sustainable development and enhancing the probability to revamp the best visions of society into reality. UNSECO report advocates that "Education is vital for rural transformation and essential for the economic, cultural and ecological vitality of rural areas and communities (UNESCO, 2002).

Education for sustainable development is a dynamic concept intended to empower learners to face challenges, and solve global issues to achieve sustainable future (UNESCO, 2002, 2005, 2014). Further, Education also enables learners to take responsibility and crucial decision to attain environmental integrity, economic viability and social justice for the present and upcoming generations (UNESCO, 2018). UN general Assembly (2010) also stresses that, "Knowledge and education are key factors for sustained, inclusive and equitable economic growth and for the achievement of all the Millennium

Development Goals," so education for sustainability promotes lifelong learning to address concrete, local and global problems by nurturing the habit of sustainability among learners to address global challenges for sustainability (Agbedahin, 2019; UNESCO.2002), Hence education makes a vital augmentation of sustainable development through enhancement of individual and societal behavioural and further strengthens the environmental resilience and awareness on climate change(Bangay,2016)

7. **E-Learning**

COVID- 19 and its effect on education in the world forced educators and curriculum developers to reorient existing education policies, programmes and practices; build concepts and skills, motivation and commitment needed for sustainable development (UNESCO, 2002). E-learning is defined as a process of acquiring and delivering knowledge and skills using digital technologies and gadgets: computer, mobiles, internet connectivity and CD ROM etc. Ajlan and Zedan (2008) defines e-learning as an interactive learning process with content available online for learners to acquire knowledge at own pace and provide feedback on learning process automatically. Today, e-learning has become an indispensible source for education; it is universal, user friendly, and affordable (Alfallaj, 2020; Laurie et al., 2016). It is the most flexible modes of virtual learning, gives learners liberty to learn from where they want, what they learn, when they want at their own pace (Legemza, Sutoova, & Girmanova, 2012). Today, e-learning allows learning accessible to more learners irrespective of demographical differences to acquire knowledge and skills with ease and flexibility unlike traditional learning. Thus, modern education system does not focuses on facts acquisition but rather on developing understanding on what to do with information, how to interpret it by collaborating with others to communicate and synthesise information (Laurie, Tarumi, Mckeown, & Hopkins, 2016)

COVID-19 and imposition of country-wide lockdown confined students' community to houses away from physical classrooms and hampered education (Andrijasevic,Tomic,& Jovanovic, 2021). To impart education continuously for sustainable development, the educational institutions and educators explored various alternatives pedagogies to impart knowledge. The most promising and valid option found to be e-learning coupled with technological advancements in education to curtail the spread of pandemic and address educational needs of students' community. Peters and Romero also advocated "Lifelong learning opportunities are readily accessible through the hybridization of digital learning contexts from formal to informal in today's globally networked knowledge society in the 21st century"(Peters & Romero, 2019). Technological advancements permeated into every human endeavours and education not an exception (Djiwandono, 2019). West (2013) found advancements in hi-tech technology and AI tools redefined the practices students adopt to read and learn, however academic institutions still implement old conventional teaching learning methods in Indian subcontinent.

The technological growth is progressive so educators need to upgrade teaching learning practices, adopt innovative practices and use AI tools to address learning challenges of 21st century skills (Zainuddin, et al., 2019). Technology in modern times has made teaching learning experience dynamic, richer and more sophisticated in educational landscapes (AlTameemy & Alrefaee, 2021; Hajan, & Padagas, 2021) and the students' fraternity is tech savvy, so technology and internet connectivity need to be used constructively to impart knowledge in versatile disciplines to students across the world virtually.

E-learning: totally a new learning concept away from traditional classroom instruction followed during COVID-19 in India. The environment and procedure followed in e-learning is quite new not only for learners but also for teachers of different levels of learning, so educational institutions started implementing e-learning to attain goals of learning and education for sustainable development due to total lockdown amid COVID-19.

Studies have shown education played an instrumental role in initiating behavioural change among learners to use knowledge and skill-set gained to attain sustainable development with optimal use of resources to address challenges: environment, economical and societal without undermining rights of the younger generations (Bangay, 2016). However, COVID-19 disturbed the face to face physical education across the globe and threatens the sustainability of education in the entire world specifically in the developing countries, so to attain education for sustainable development educators made a gradual transition to e-learning, so this research reveals how education for sustainable development achieved by implementing e-learning and online cooperative learning (OCL). The paper focuses to address the following questions

1. How transition to e-learning and online cooperative learning (OCL) addressed the education goals among learners at tertiary level?
2. How education for sustainable development achieved through e-learning and OCL?

8. Method

The subjects for study were 100 university under graduates (60 girls and 40 males) majoring studies in Environmental Science within the age group of 17 – 20 years. The researcher adopted a quasi-experimental method to collect quantitative and qualitative data. The formative achievement test was administered to assess the initial knowledge of study group. The e-learning through OCL adopted for teaching study group for three months followed by summative test and semi-structured interviews to record perception and experience of learners on e-learning through online platform: Google Meet.

9. Data collection and analysis

The data collected before and after treating learning group with e-learning and OCL instruction (OCL) through two modes. The first mode collected quantitative data through a formative achievement pre-test administered through Google forms to assess initial academic knowledge on environmental science subject. The second mode collected quantitative and qualitative data through post-test and one-to-one semi-structured interviews taken for study group. IBM SPSS 21 software used for statistical analysis of pre-test and post-test data, data further tabulated for correlations, mean and standard deviation through descriptive statistics. Thus quantitative data analysed to assess change in performance and achievement of students in Environmental Engineering subject in the formative and summative test,

Semi-structured interviews with learners analysed perceptions and learning experiences of learners to find all factors that affected OCL learning different from traditional teaching. The researcher segregated participants' responses based on commonalities: learners' perceptions and experiences of e-learning based on commonalities and analyzed to find out the efficacy of OCL to achieve educational for sustainable development. In order to uphold anonymity, learners were coded as S1 to S100 and learners perceptions and experiences were directly quoted.

10. Findings and discussions

10.1. E-learning and OCL compensated physical face-to-face education and laid foundation for sustainability.

COVID-19 has disturbed and disorganized the total education system across the world. It has not only hampered the education but also endangered the sustainability of education, so reorientation of curriculum and education modes have become eminent for sustainability and optimal use of three pillars of sustainable development in general and education for sustainable development in particular (UNESCO,2002). At this juncture most developing nations made quick transitions to e-learning to impart quality education to individual learners for sustainable development of the society. Delors emphasises "Education must simultaneously provide maps of a complex world in constant turmoil and the compass that will enable people to find their way in it." (Delors et al., 1996).

The current teaching learning method: e-learning through OCL had been a vital mode to impart knowledge and skills to learners confined to houses away from physical classrooms. The performance of learners in summative test showed that, most of the students scored more than 50% marks. Students gained knowledge and awareness on the principles of sustainability by sharing information among learners. The figure.1 graphically compared scores of students' in the formative and summative test obtained after implementing OCL through e-learning.

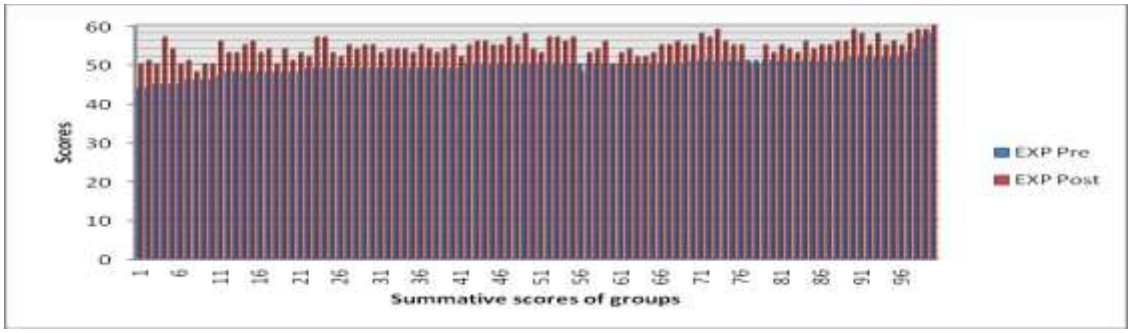

Figure 1. The performance of students in the formative and summative achievement test.

The figure 1 shows significant change in the pre and post-test scoring rate of learner prior to and after implementation of OCL through e-learning. The result of study clearly stated that, study

group gained academic knowledge on Environmental science when subjected to e-learning and OCL: a technology enhanced blended learning method; however, to prove scientifically the efficacy of the current method, a single group paired sample t-test administered on experimental group pre and post-test data.

Table 1. Pre and Post-test groups' statistics of Experimental Group, N, Mean, Standard Deviation with reference to students' achievement in Environmental Science course

	Mean	N	Std. Deviation	Std. Error Mean
Exp_post	54.3600	100	2.50865	.25087
EXP_Pre	49.6500	100	2.19906	.21991

Table 1 describes the descriptive summary of statistical data obtained after administrating a paired sample t-test. Independent variable (OCL) and non-linguistic variable (e-learning experience) clearly affirmed the efficacy of e-learning and OCL in environmental science class. Furthermore, to prove scientifically, Table 1 shows difference in learners' pre and post-test scores in terms of Mean and Standard Deviation after implementing e-learning and OCL.

Table 2. The group statistics of paired sample t-test administered on pre & post-test data of experimental group *after adopting OCL for teaching*

Paired Samples Test (Experimental Group)

	Paired Differences							
				95% Confidence Interval of the Difference				
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig. (2-tailed)
Post Test - Pre Test	4.71000	2.13813	.21381	4.28575	5.13425	22.029	99	.000

*P<0.05

To prove scientifically, the significant difference in the summative and formative scores of study group after implementing e-learning through OCL, a paired sample t-test administered on the pre and post test data of the study group. The Table 2 shows t-test value, T (99) = -22.029, degrees of freedom = 99, and significant value p=.000<0.05. The significant value α = 0.05assumed; p<0.05, so p is very much significant. Thus, Null hypothesis rejected and a significant difference in learning observed in group performance after implementing e-learning and OCL via Google Meet. Thus the statistical evidence proved the efficacy of e-learning and OCL for educational sustainability among experimental group learners as shown in Table 2. The results of current study favours sustainability in education, when researcher adopted e-learning and OCL to sustain the teaching learning process collectively online and impart the necessary knowledge and skills to all the learners connected virtually. The performance of 100 students' states that students' achievement is significant in the summative achievement test due to effective delivery of content in Environmental Engineering subject through e-learning and OCL.

The researcher implemented technology in education, OCL and internet connectivity to bring learners close to one another virtually and imparted technical knowledge, enhanced skills and capacity of learners to think and learn collectively and independently. Some of the experiences of learners during e-learning through OCL are as follows

"E-learning and OCL imparted knowledge on environmental science to all the students who are confined to houses amid COVID-19 just like normal face to face classroom teaching" (S1,S5, S15,S39,S53.S99,S95)

The above perceptions of the student clearly state, that e-learning and OCL collectively imparted knowledge to all the learners despite being confined to houses amid complete lockdown of centres of learning across the country.

"E-learning is flexible to students to learn and gain knowledge at own pace and place without being risking lives, moreover it is replayed numerous times to recollect the information during learning," (S21,S80,S91S99…).

E-learning provides scope for flexibility to both teachers and students. It allows students to learn at own pace without being stressed to learn and comprehend at teachers pace, moreover students

can learn from home without risking health unlike face to face classroom. Further class recording enables slow learners to go through the same class again for better comprehension.

"E-learning through OCL creates democratic environment for learners to explore knowledge and participate actively during the classroom learning unlike conventional classroom. It also creates scope for sustainability of learning" (S1,S11, S16,S9)

Teachers applying e-learning through OCL method create a democratic learning environment for learners to interact, initiate stimulations, give feedback and meet the educational goals all students in the virtual classroom and in turn lays a strong foundation for social equity: a key concept for sustainability (UNESCO, 2012, p15).

"Education is vital to enhance the living standards of people in the society and e-learning has addressed the challenges of COVID-19 that endangered the social development in the society."(S 23,S11, S29,S39…)

Social development addresses the challenges of better standards of living for the current and future generation in the society, further social development is directly related to economic development (Badea et al., 2020), so to attain sustainability, education should be imparted uninterruptedly.

"Teachers play a crucial role in e–learning OCL classroom; bring awareness among learners about the importance of achieving educational goals in environmental science through e-learning for sustainability of future generations" (S29,S11,S22,S91,S41…).

The above statement states that the efficacy s of e-learning and OCL class depends on the creativity of teacher. The teacher creates conducive learning environment by bringing awareness among learners about the importance of education through OCL for sustainability of future generations along with academic knowledge in environmental science.

"E-learning through OCL addressed real life problems encountered by the world and intern promoted gradually higher order thinking"(S8.S50,S69.S96…)

The above perception of students clearly highlights that e-learning and OCL encourages collaborative students-centred learning to nurture higher order critical thinking to address real world problems society is facing amid pandemic, thus challenges for sustainability addressed through e-learning and OCL for future generation to attain equity in economical, social and environmental dimensions(Atkinson, Dietz, & Neumayer, 2007, Badea et al., 2020; Grosseck,Tîru, & Bran, 2019)

"E-learning is carried through minimal use of gadgets like mobile, tablet and sometimes laptop at learners place so educational institutions can save lot of money in terms of electrical bills and water utilization, further it is economical for students also, it saves lot of time and money spend on transportation."(S30,S50,S89,S75,S90…)

The above experiences of students clearly highlights the economical benefits the educational institutions and student community get due to e-learning. Thus, the current pedagogy promotes the fundamental principles of sustainable development in the society and teachers facilitate learners to be aware of the educational goals in moulding the course for the future generations along with sustainability. E-learning and OCL nurture stimulation and promote equity by engaging learners in visual, auditory and kinaesthetic learning modalities; addresses real life problems of communities; and promotes higher order thinking among learners (UNESCO, 2012. p16)

10.2. E-Learning promoted Education for sustainable development

As said by Nelson Mandela "Education is the most powerful weapon you can use to change the world" this definition is a corner stone in highlighting the importance of education to achieve sustainability and development of the world (Nelson Mandela Foundation, 2003). Education is the humanity's most transformative force (Agbedahin, 2019), helps in gender equality, poverty eradication, and reduces disparities in standards of living across globe to achieve sustainable development and peace(Duncan,2013). Education is crucial for enhancing the abilities and potential of leaders and citizens of tomorrow to sort out critical problems and find more avenues for future sustainability (UNESCO, 2012; Vladimirova, & Blanc, 2016). The world in the past has faced many crises and successfully overcome them in due course of time; the current global pandemic: COVID-19 has affected huge population; however people would draw lessons from the previous experience to solve the current problem through education only. Delora advocated that "Education must simultaneously provide maps of a complex world in constant turmoil and the compass that will enable people to find their way in it."(Delora et al., 1996) For sustainability, educated community has a special role to play in bringing awareness and preparing for lifelong learning, thus in this dire time, e-learning and OCL addresses the educational goals and prepare learners for lifelong learning for sustainable future.

E-learning focuses on four major areas to attain education for sustainable development as follows:

10.2.1. Access and retention to basic quality education or learning outcome

Transition to e-learning and OCL provided access to basic quality education to huge population of learners' community across the globe amid closure of educational institutions. E-learning was essential for achieving the goals of sustainability for the future generations, and providing quality education by fulfilling the purpose and aims of education. E-learning proved its efficacy and effectiveness of educational goals set for learning in the study (Laurie et al., 2016).

"The transition to E-learning and OCL made students to get access to basic education amid lockdown of educational institutions across the country."(S5,S9, S34,S66..)

"E-learning and OCL helped students to keep zeal for learning alive despite confined to homes amid pandemic" (S15,S21, S13,S47,S77…)

"Education is vital for sustainability and social development so I feel e-learning and OCL contributed its best to fulfil the goals of education sustainability due to national lockdown of educational institutions."(S29,S67, S89,S90,S10…)

"E-learning and OCL empowers learners to take responsibility of learning virtually to meet the needs of the present and future generations to achieve societal transformation" (S 11,S3, S15,S26S,S35,S48,S59,S68,S94…)

The above perceptions and experiences of students clearly state, that learners profited the benefits of e-learning and OCL to get access to basic quality education amid closure of educational institutions. E-learning focused on providing learners basic knowledge, skills, values, sustainable livelihood and support society for sustainability. E-learning and OCL sustained learning among the desired learners and teachers with in depth knowledge of the subject (Borg et al., 2014) as done earlier in face to face classroom. Education for sustainability enhanced the cognitive, social and behavioural dimensions of learning, that were achieved through e-learning (UNESCO, 2012; Pauw et al., 2019; Khan et al., 2020) Further, retention of knowledge and skills gained through education addressed the future challenges of sustainability and education for sustainability.

10.2.2. Transition and Reorientation of Existing pedagogies to Address Sustainability

"Education must simultaneously provide maps of a complex world in constant turmoil and the compass that will enable people to find their way in it."(Delors et al., 1996). Amid COVID-19, to address the sustainability and education for sustainability, educators and teachers adopted novel methods of teaching and learning and, e-learning through OCL found to be one of the most viable options to address the educational goals. To address sustainability, reorientation and transition of education system from primary to higher levels of education, e-learning and OCL proved experimentally a viable solution for teachers and learners confined to houses.

"Continuity of education and learning is possible only with transition to e-learning and OCL from physical classroom teaching due to closure of educational institutions"(S13,S12,S19,S29,S34,S47,S58…)

"To make transition to e-learning and OCL teachers have played a bigger role and adopted educational pedagogies that grab the interest of students for a longer time in learning to solve the future challenges of education for sustainability for the growth and development of the society as a whole"(S23,S11S52,S42,S46,S58,S89,S100)

"E-learning through OCL is a student-centred learning method so, it involves an active participation of all the learners in the virtual teaching and learning process due to which knowledge and skills acquitted could be retained for a longer period of time"(28, S12,S19,S29,S34,S47,S58)

The above experiences of learners in e-learning classroom clearly stated that, teacher played a vital role in e-learning and addressed the educational needs of the learners. Teachers developed a clear cut objectives about what is taught, how is taught and what is assessed at the end of course to achieve the goals of sustainability in education. Further e-learning and OCL involved learner actively in the teaching learning process, and gained knowledge and skill-set retained for longer time to face the challenges in education. Thus transition and reorientation focused on future goals of sustainability and prepared learners to address the future challenges through creativity and problem solving skills.

10.2.3. Increases Awareness and Public Understanding for Societal transformation

To achieve the goals of sustainability in general and education for sustainability in particular learners need to have knowledge about sustainability and continuously contribute in the best possible way to achieve the goals of sustainability without undermining the rights of the future generations.

"E-learning and OCL compensated education and learning of students amid lockdown. It brought awareness and understanding among students about the importance of education to address the future challenges and real life problems confidently" (S7,S10,S32,S63…)

"E-learning and OCL require collaboration of teachers and students to achieve common educational goals

through interactive teaching and learning" (S3,S52,S45,S89,S100…)

"E-learning and OCL help students in achieving all the goals of sustainable development through continues learning" (S12, S48, S59, S77, S89, S96…)

The above perceptions of student highlighted awareness developed among learners through continuous learning during OCL and e-learning. E-learning and OCL allowed culturally diverse learners to interact virtually to meet the individual and collective needs of the society for sustainability (Laurie et al., 2016). Students also experienced that e-learning and OCL fulfilled all the motives of sustainable development to build a more sustainable world.

To achieve education for sustainability, students and teachers need to interact and share information on a common goal. E-learning through OCL results in large scale community learning and provides scope for critical thinking, participatory decision making, and multi-method strategies unlike conventional learning (Björneloo, 2004; Corney, & Reid, 2007; Winter, & Firth, 2007), amid the global pandemic to prepare learners to face the complex challenges of education for sustainable development and lifelong learning.

10.2.4. E learning: Fulfil all the characteristics Education for Sustainability

The current study proved that e-learning compensated face to face learning prevailing in the developing countries and at the same time addressed all the characteristics of education for sustainable development. First of all, e-learning proved to be an ideal learning mode to address local as well as global educational needs of diverse learners.

"Education brings a behavioural change among learners and prepare them for facing challenges for sustainable development in education" (S6,S9,S11,S15,S16,S95…)

"Education for sustainability is very crucial for sustainability as it brings awareness among learners about environmental, social and economical development and the interrelationship among these three pillars of sustainable development. (S24,S15,S22,S53,S68…)

The perceptions of students stated that researcher in e-learning through OCL adopted variety of novel pedagogical techniques to boost collaborative learning and higher order thinking along with behavioural change and acceptance of responsibility for lifelong learning, goal setting and crucial decision making during learning process (Laurie et al., 2016; Bangay, 2016). It laid foundation and promoted lifelong learning among learners with a focus on three dimensions of sustainability: environment, economy and society in general and education for sustainability in particular. Further, e-learning promoted both formal and informal learning to address the content with an eye on context, local priorities and global challenges for sustainability.

11. Conclusion

COVID-19: global pandemic had totally interrupted education and education for sustainable development across the world. To address public safety and health care governments closed all educational institutions of learning from primary to tertiary level across the world, and this deprived students and teachers of educational and academic development. Sustainable development of education is vital for overall development of a society, so educators, curriculum developers, and teachers explored novel ways of imparting knowledge to learners confined to homes by tapping the technological advancements in education.

21st century is known for its sophisticated technological advancements in education and vast internet connectivity across the globe, so teachers made a gradual transition to e-learning and OCL for sustainable academic development of learners. Technologically advanced countries successfully implemented e-learning for sustainable development of education by utilizing the technology in education, ICT infrastructure, knowledge of computers, and teachers earlier experience of e-learning, however, developing countries lack both infrastructure and ICT knowledge apart from limited previous experience of e-learning needed for implementing e-learning by teachers, thus a digital divide created by COVID -19 between technologically advanced developed countries, and developing countries. The current study highlighted that e-learning and OCL emerged as an appropriate solution to address sustainable academic development among learners of Indian-subcontinent confined to houses and away from physical face-to-face instruction, so educational institutions made a gradual transition to e-learning and OCL by utilizing the available technology in education, ITC knowledge, internet connectivity, and limited past experience in online learning and material. E-learning platforms used by students and teachers to get connected virtually to address academic educational goals (environmental science) were Google classrooms, Zoom app and Microsoft teams.

Hence, COVID-19 could be treated as a blessing in disguise for learners and teachers to adopt and make transition to e-learning: an advance learner-centred learning pedagogy blended with OCL and technological advancements to cater educational

needs and achieve goals of education for sustainable development for learners across the globe.

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