

Design and Validation of a Scale for Teacher Educator's Conceptions Regarding Education for Sustainable Development

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Abstract

The current research aimed to design a scale to measure teacher educators' conceptions regarding sustainable development. A systematic review of the relevant literature was conducted to generate and operationalize the initial item pool. Initially, the quantitative scale consists of 54 items in total covering the following four dimensions i.e. environmental, social, economic and moral. After the expert opinion 10 redundant and ambiguous items were deleted from the tool. A total of 44 items were finalized for the scale under four domains with thirteen items under social dimensions, 10 items under economic and environmental dimensions and eleven items under moral dimensions. Through a survey, the scale was administered to 60 teacher educators chosen from 3 public sector teacher education departments of Punjab. The validity and reliability of the scale was statistically tested by computing confirmatory factor analysis and reliability analysis. The values of factor loading were between .973 to 0.512. A total of 07 items were dropped from the pooled items resulting in the retention of 37 items on the final version. The final scale indicates adequate reliability and validity across four dimensions of sustainable development. Theoretically, this scale contributes significantly to the identification of moral dimension of sustainability. The scale for teacher educators' conception regarding education for sustainable development could be a useful for understanding the ways in which teacher educators think about sustainability and could be useful to investigate the relationship between sustainable development conceptions and other variables.

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Introduction

Sustainable development (SD) aims to facilitate an individual to address the issues of environmental safety, economic growth, and social development. In defining these 17 goals, the economic, social and environmental issues can no longer be addressed separately and independently. These goals must be tackled interdisciplinary, taking responsibility from all the stakeholders (individuals, companies, private and public organizations and institutions, and governments). Hence, universities must play an appropriate role in achieving these goals, since they are essential actors for the growth of future people in an integral way (Wiktor-Mach, 2020).

Keeping in view the importance of sustainable development through education, the United Nations had introduced the concept of Education for Sustainable Development (ESD) for achieving SD goals in 2002 (UNESCO, 2015). Subsequently, 10 years from 2005 to 2014 has been declared the "Decade of Education for Sustainable Development" (DESD). Education for sustainable development is aimed at allowing a teacher and students to apply their expertise in a variety of ways to sort out unpredictable circumstances, realistic problem-based learning is one of its requirements (Stein et al., 2020). Students have lacked of opportunities and not able to implement sustainable development practices. However, it is necessary if students think and collectively come up with solutions. Education can use to develop the ability among students to deal with the complexity of sustainable development issues (Kopnina, 2020).

Similarly, it was also acknowledged that teacher education can play a key role to achieve the goals of SD. It was also emphasized that teacher educators should begin addressing ESD in the preservice teacher education program (Shulla et al., 2020). Keeping in view the importance of teacher education, core knowledge about sustainable development is very important for teacher educators. Teacher educators are not only just communicators of information, but they work as a change agent to address sustainability problems (Chisingui & Costa, 2020). For bringing the change in society, teacher educators must have conceptions or knowledge so they can integrate the SD knowledge through teaching practices among pre-service teachers (Bokova, 2015). Conceptions are outlined as the ability of teacher educators that how they understand or perceive phenomena of sustainable development and its dimensions.

Dimensions of sustainable development

Following four dimensions of sustainable development are operationalized for the current scale.

- i. The social dimension is related to social welfare and safety. According to operational definition, social dimension includes society peace, respect for

- everyone, conflict, and violence, gender equality, human rights, human being welfare, health and respect for diversified culture, etc. (Hnedina, 2017; Juliani et al., 2019; Nasirzadeh et al., 2020; Nugraheni et al., 2020).
- ii. The economic dimension of sustainable development focus on the quality of education to reduce poverty, zero hunger and produce a skilled human being. For any country, rising GDP does not simply mean a change in the well-being of all of the inhabitants and consistent and equitable distribution of income between all. Education eliminates inequalities of earnings and in a nation, the middle class gradually increases. The main drivers of equal economic development are universality, accessibility, and quality of education. For scale development, the economic dimension included poverty, market skills, fair distributions, charities for reduction poverty, zero hunger and quality education for all, etc. (Vasylieva et al., 2017; Wichaisri & Sopadang, 2018; Dalevska et al., 2019; Corona et al., 2019).
 - iii. The environmental dimension of sustainable development mainly focuses on environmental issues that concern nations around the world because they impact directly economic growth, agriculture, migration, conflicts, and the welfare of people. For fixing any of these questions, education plays a critical role. Important topics should be taken into account in classrooms, such as ecology, climate change, disaster control, and responsible use. In reality, UNESCO manages various projects and seminars for educators in this field. The current scale address all above mention aspects of the environment (Silvestre & Țirca, 2019; Ahmadvand, Ahmadi & Samadi, 2020).
 - iv. The moral dimension of sustainable development defines as our moral responsibility for our society, everyone has some rights that should be fulfilled. If every individual takes a responsibility to fulfil their rights and responsibility, then the effective implementation of sustainable development will occur. The moral dimension includes rights, duty, individual responsibility, save nature, responsible humans, safe planet, use all effective measures to the safe planet (Pawłowski, 2008; Busoi, 2014; Holden et al., 2017; Keitsch, 2018; Rampasso et al., 2019; Vuong and Nguyen, 2021).

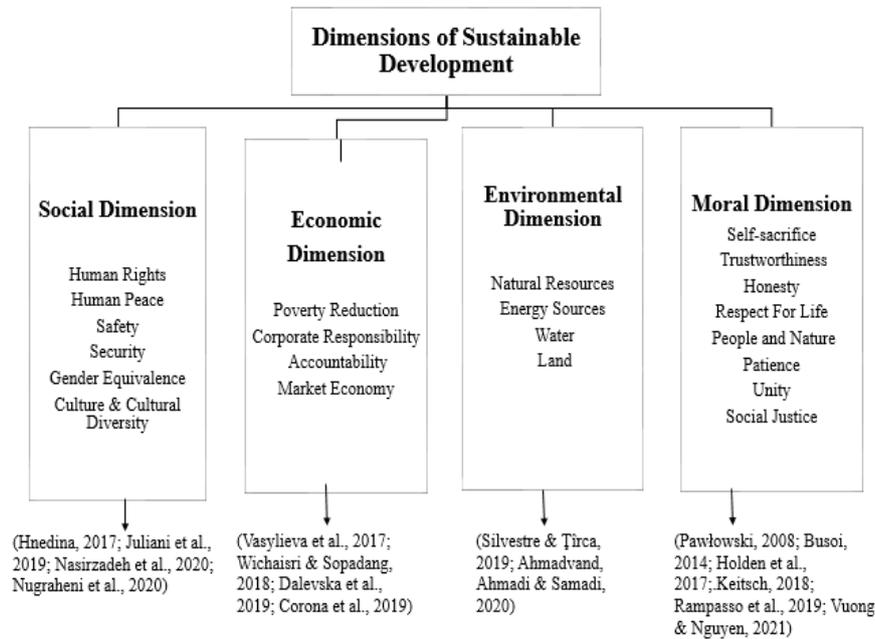


Figure No. 1 Dimensions of sustainable development

Teacher Education and Sustainable Development

Education has been recognized as a mean to achieve the goals of sustainable development, aimed to train future teachers to be sustainable leaders to ensure environmental, social, and economic preservation for the future generation. Moreover, it is notable that highly ranked international organizations have recently reported warnings about the increasing harm to the environment, social injustice, inequality, and poverty problem in the world (Sitsinska et al., 2020). In response to these challenges, the modern progressive discourse is heavily driven by schools and universities to encourage specific paradigm of sustainability and to constantly training and educating students to become more aware about sustainability issue (Kopnina, 2020). After decades of ESD, a little progress has been witnessed on achieving the goals of sustainable development and to resolve the unified economic, ecological, and societal issues.

Teacher education is a dynamic and multi-dimensional area that educates growing generations about what is going on, where we are, where we are going and what we want to create and good, positive and long-term analysis of life. It is one of the important places for testing and executing a variety of new concepts. As well as teacher education is a key space for the implementation of sustainable development (Richter-

Beuschel, & Bogeholz, 2020). It has also been discussed in the literature, that teachers become either a positive example or a poor model for their students due to their abilities or potential level (Bonnett, 2002).

Similarly, it has been argued that the behaviors of teacher educators influence to a certain extent on practices of pre-service teachers (Schelly et al., 2012). The teaching of ESD enable an individual to analyze their lifestyles and moving into fair-minded communities that are accountable and more environmentally sustainable (Timm & Barth, 2020). An evolution needs to be achieved by educating people and forming educated and engaged residents, contributing to the behavioral alteration of whole cultures and humanities (Ferreira, 2013). Every individual has to focus on their lifestyles and instruction objectively and imaginarily for developing a sustainable society (Ferreira, 2013).

Literature Review

Following the study by Brundtland (1987), several multinational organizations, corporations, societies, and governments (UNESCO) 2014) are working to achieve the sustainable development goals. The researchers have already highlighted the value of education and integrating the SDGs goal into pedagogy, teaching and curricula goals to accomplish the aims of sustainable development (Sterling, 2010). McKeown (2014) stressed that education played a key role in developing the knowledge, skills and attitude regarding sustainable development. The rise of income disparities, capitalist structure of marketplace, biodiversity loss and environmental degradation has also increased the need for ESD (Jickling & Wals, 2012).

To tackle globalized problems, education is used as a tool for awareness and to develop a sense of responsibility among individuals. It has been argued that education systems need sustainable teaching professionals who appreciate and use non-traditional learning activities and interdisciplinary teaching approach to meet the social, economic, and environmental challenges (Marten, 2010; Zhuang, 2014). Role of the teacher education institutes is very important as they take a lead role in training the pre-service teachers. Yet researches i.e. (Huckle & Wals, 2015) have identified that students of higher education have little knowledge and awareness in the field of sustainability.

Sterling (2010) described ESD as "the process to equip students with the skills and attributes they need, to work and live in a way that protects the environment, society and economy, both today and for future generations" (p. 5). In the past three decades, many scholars and researchers worldwide have been involved as community mobilizers of education, in particular teacher education, in fostering healthy living and sustainable growth (Kalsoom & Khanam, 2017; Kalsoom, Khanam, & Qureshi, 2017).

Education for teachers continued to be a significant consideration for achieving the UN 2030 ESD agenda (Leal Filho et al., 2018). Teacher education has a strategic

significance (Ferreira, Ryan, & Tilbury, 2007) which aims to develop knowledge, skills and attitude among student teachers to create a sustainable world (Khan & Khan, 2018). United Nations (2014) has also highlighted teaching as an effective way for the acceptance and application of ESD. However, many research studies have identified that mostly teachers are not well-trained and aware of sustainable development. It has also been highlighted that teachers training institutes provide little material to develop their awareness about sustainability.

However, it has also been noted that in different parts of the world, teachers play a vital part in transforming classrooms and school/classroom culture as a whole (Ferreira et al., 2007). A well-planned and well-designed learning environment play a significant role in developing the right way of thinking and skills among students which may stimulate the social change (Bokova (2015; Burgener & Barth, 2018). Van Poeck and Wals (2018) stated that different initiatives by schools for example setting up the school gardens and certification of sustainable development has helped a lot in changing and developing students' attitude towards sustainable development.

Several studies published by the UN and its descendant institutions such as UNESCO illustrated the role of education in terms of ESD, an effective education, and training for teachers to tackle unsustainability issues (UNECE, 2013; UNESCO, 2014; UNDP, 2015). However, the importance of ESD in the education system at college and higher education levels is very insignificant in Pakistan (Khan, Jamshaid, & Ramzan, 2019; Kalsoom, Qureshi, & Khanam, 2018).

Teacher Educators conceptions about ESD

Scott and Gough (2003) argued that teachers, economists, and policymakers have viewed the term sustainable development differently. The core of the discussion seems to be those who see financial goals and results as dominant compared to those who take a wider approach. For example, Rauch (2002) highlights the criticism of the sustainability debate for "the heavy focus on economic business theory and economic development" (p.52). Elliot (1998) argues that the prevailing view is integral to economic growth and compares it with the focus of the ecologist on ecosystem-bearing productivity levels. In favor of social harmony and the right interaction with nature, the environment is the emphasis (Elliot, 1998).

Sauve (1996) argued about the typology of sustainable development concepts, central planning, and technological emphasis contrasted with concepts that promote standards values to develop sustainable societies and promote indigenous growth (Sauve, 2002). However, still different understanding is under discussion. The literature shows that a conceptualization of sustainable growth in three dimensions, environmental, economic, and social, must be at least possible. Although, these three dimensions are not focused equally. Gough (2002) claims that we cannot expect to distinguish our environment and

socio-economic relations. Luke (2001) believes that the abstract distinction between ecosystem and industry/culture/population needs to be eliminated and a holistic influenced on all three dimensions should be emphasized.

A lot of studies have been done during and after the era of DESD in the context of ESD. Mostly international studies conducted in developed countries i.e., Japan (Nomura & Abe, 2010; Kitamura & Hoshii, 2010), USA (Darling-Hammond, 2011); Germany (Jokmin, 2010; Holst et al., 2020; Rieckmann, 2020), China (Lu, & Zhang, 2014) and UK (Bamber, Glover & McCann, 2016). These studies have mainly focused on environmental education and pre-service teachers' understanding of environmental aspects. Most studies have been conducted under a quantitative approach for measuring the environmental sustainability and attitude of teachers towards ESD.

Moreover, it has been noted that various researchers have found that teacher educators focused more on the environmental dimension of SD and less focused on economic and social dimensions (Rampasso, 2019). Leal Filho (2019) advocated environmental aspects overshadow on social and economic aspects. Different quantitative scale (Gericke et al., 2019; Chen et al., 2018) has been used to examine the understanding of teacher educators. Most of the scales have highlighted or emphasized the environmental dimensions. Although, Arthur Pawłowski (2007) stated that there is a lack of moral dimension in the definition of SD. Busoi, (2014) argued that teacher educators could not promote sustainability among pre-service teachers without focusing on the moral dimension because these three dimensions of SD are interlinked with an ethical perspective. Thus, not a single scale available that measures teacher educator's conceptions about SD dimensions in an ethical and holistic way.

The main aimed of this research study was develop a tool for measuring teacher educator conceptions related to ESD. Although, literature found mostly environmental education and less focused on the economic and social dimension. Moreover, it is identified a lack of moral dimension of SD. In the present study, the researcher included a moral dimension as the fourth dimension of SD.

Research Objective:

1. Design the validated instrument to measure the attitude of teacher educators towards education for sustainable development.

Significance of this study

As mentioned above, that in the literature the concept of sustainable development has focused on economic and environmental aspects and most often social and moral aspects are ignored (Rampsoo, 2019). Sometimes social and economic aspects are not considered a part of sustainable development. Hence, there is a need to tackle the social, economic, and environmental problems through holistic way. At the same time, there is a

need to understand the conceptions of teacher educators regarding sustainable development. The conceptions of teacher educators regarding sustainable development would help to identify the ways how their understanding can be broadened and skills can be enhanced in the field so that they can act positively in achieving the sustainable development goals. The current study aimed to design an instrument that would measure the conception of teacher educators regarding the environmental, economic, social, and moral dimensions of sustainable development.

Development of Research Scale

The core purpose of this research study is to design and validate the research scale that measures the conceptions of teacher educators toward sustainable development dimensions, i.e., social, economic, environmental, and moral. Social, economic, and environmental are the three dimensions universally recognized. Here researchers add a moral dimension. Without moral conceptions, we cannot attain the goals of sustainable development. The researcher discussed all dimensions in the introduction section.

The development of the scale of the conception toward environment, social, economic, and moral dimension was carried out in different stages: (i) Preliminary analysis of literature was carried out to operationalize and generate the item pool. A systematic review of the relevant literature was conducted to generate and operationalize the initial item pool. Initially, the quantitative scale consists of 54 items in total covering the following four dimensions i.e. environmental, social, economic and moral. (ii) secondly, a validation process was carried out with the help of experts. One international expert and two locals have reviewed an ESD Conceptions scale. They (experts) examined and recommended small-scale correction. After the expert opinion 10 redundant and ambiguous items were deleted from the tool. A total of 44 items were finalized for the scale under four domains with thirteen items under social dimensions, 10 items under economic and environmental dimensions and eleven items under moral dimensions. The questionnaire was again set for experts to review. (iii) At the final stage, a refined scale was consisted of 44 items in total.

The research instrument/tool consisted of two parts. In the first part, demographic variables were asked. Gender, designation, age, academic qualification, total teaching experience, and university teaching experience. Second phase had four dimensions of SD (social = 13 items, economic = 10 items, environment = 10 items, and moral = 11 items).

Piloting Phase

To design a valid scale, pilot testing is a critical phase (Abowitz & Toole, 2010). Reliability and validity are the two most important and fundamental features in the

evaluation of any measurement instrument or tool for a good research (Mohajan, 2017). In this stage, researcher decide how to use the scale to assess and achieve the objective. Reliability and validity show how well something measures a process, method, or test. Confidence is about calculation quality, and validity concerns measurement precision. This research aims to develop a questionnaire/scale that determines teacher educator's conceptions regarding SD dimensions. For record response, researcher used a five-point Likert type scale. After the development of the research instrument, data was collected from 60 teacher educators to ensure the reliability of the scale. Collected data entered in SPSS 24. For measuring the internal consistency of items, Cronbach alpha test was applied. The researcher found a reliability value $\alpha=0.967$ that was good.

Table: 1 **ESD Conceptions Scale**
Reliability Statistics

Cronbach's Alpha	N of Items
.967	44

Data Analysis and Results

The received value of Kaiser-Meyer-Oklin was 0.920, which exceeded 0.6. The statistical significance was seen in Bartlett's Sphericity Test.

Table: 2 **KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.920	
Bartlett's Test of Sphericity	Approx. Chi-Square	Df	Sig.
	11272.760	3670	.000

Factor Analysis

Factor Analysis (FA) is a technique of data reduction that assesses the effectiveness of the variable for evaluating the latent variable proposed. Factor Analysis recommended in literature is the technique most widely used for multi-factor scale (Khan & Adil, 2013).

Exploratory Factor Analysis (EFA)

In a situation where the researchers had no reasonable assumptions or relatively incomplete association structure, exploratory factor analysis was performed. If the

researcher doesn't know the predictions about the number of the whole factor, the researcher uses the study of the exploratory factor. Unique factor represents the score section of measured variables that are not described by common factors. The exploratory factor analysis used a statistical package for social sciences (SPSS-24). Data was analyzed of a total of 44 items, these items related to the social, economic, environmental, and moral dimension of ESD. These dimensions analyze conceptions of ESD holistically. For the appropriateness of the study, the data were examined. Most matrix of correlation The positive association has been exposed 0.05 and above. Overall, the analysis showed that the four dimensions driving the ESD were moderately coherent internally. Out of forty-four, seven items were removed. For the final instrument, thirty-seven items were identified after administering the questionnaire and analyzing the reliability of the exploratory factor analysis.

Table: 2

Rotated Components Matrix				
Key Variables	1	2	3	4
SO3	.973			
ECO	.973			
SO5	.973			
ECO12	.973			
SO2	.973			
SO6	.973			
SO11	.973			
ECO15	.973			
MOR28	.973			
SO10	.973			
SO1	.973			
ENV19	.972			
ECO13	.972			
SO4	.971			
ENV22	.971			
ECO16	.973			
MOR30	.973			
ECO14	.973			
MOR33	.973			
ENV20		.972		
ECO17		.727		
MOR29		.727		
ENV26		.670		

ENV24	.663	
MOR32	.663	
ENV21	.627	
ECO18	.626	
MOR35		.594
MOR31		.593
ENV25		.579
MOR37		.577
SO8		.570
ENV23		.553
MOR34		.553
SO7		.539
MOR36		.528
SO9		.512

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

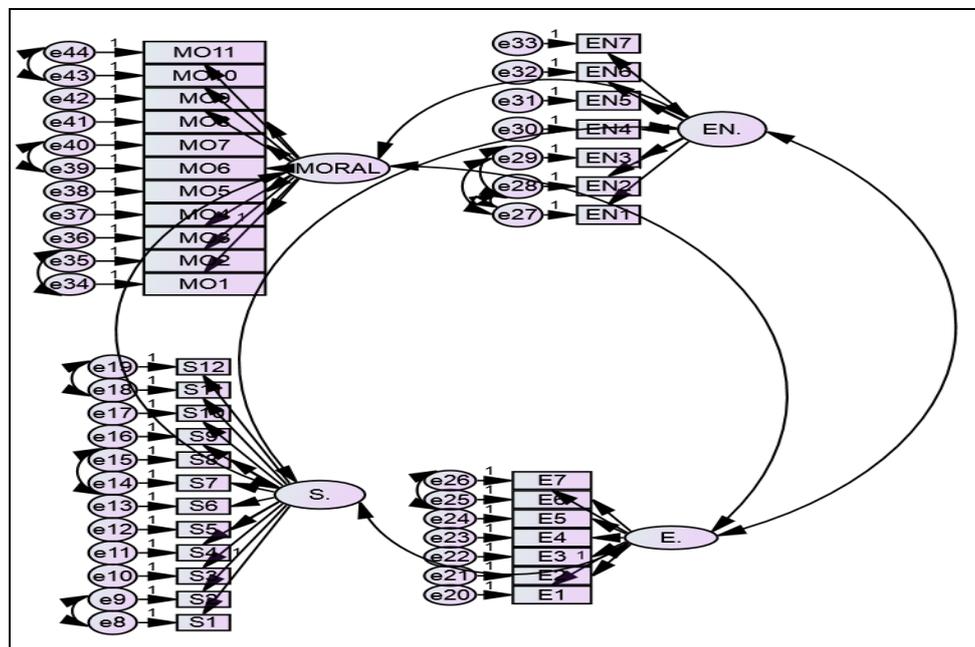
Initial screening of the data was done. The validity of the proposed model was evaluated by factor analysis. The rotated factor values ranged between .973 and .512, as reported in Table 2.

In the second phase, exploratory and confirmatory factor analyses were carried out after a brief descriptive review. All 44 items were analyzed using SPSS version 24 for exploratory factor analysis (EFA). The appropriateness of data was evaluated for factor analysis. The correlation matrix analysis showed the presence of a large number of .5 and higher coefficients. Normality was measured, and the researchers assessed the missing data and outlines, which were compulsory for the factor analysis. Data normality was an SEM analysis main requirement. For analysis of data normality Kolmogorov-Smirnov test ($p > .05$) was applied. The Kaiser-Meyer-Okline value (.930) was greater than the suggested value of .6. Bartlett's Test of Sphericity showed statistical significance. Oblimin rotation was done. The rotated solution showed basic structure (Thurstone 1947), with a range of high loading components and all variables loaded significantly on four components. The final scale development consisted of 37 items that were highly correlated and seven items removed due to ($r = -.38$) poor negative association.

Confirmatory Factor Analysis

According to Khan (2013), the factors accomplished by Varimax rotation were independent. The screen plot has been used for originally accepted factors of the ESD

conceptions scale. Four factors were derived with the help of confirmatory factor analysis. The rotation method was an appropriate set of Varimax with Kaiser Normalization. The findings of the ESD conceptions scale after EFA and sample were assessed for factor analysis was appropriate. The appropriates showed that all items have a suitable association. The Kaiser-Meyer-Oklin value for an ESD conceptions questionnaire was .92. The findings suggested that the value was above Kaiser (1970, 1974), and the statistical importance was taken from Bartlett's Sphericity Test (Pallant, 2007), which also confirmed the correlation matrix's factorability.



Fit Index	Thresholds	CFA
CMIN/D.F.	≤5	2.158
GFI	≥.80	.80
CFI	≥.80	.80
RMSEA	≤.08	.067

Discussion

In the last three decades, Education for Sustainable Development has been implemented progressively into the field of education, at every institution, college, and higher education level. This paradigm gives us an understanding of how can we make sustainable planet. Also, it offers the possibility to learn and build expertise to address diverse issues related to the environment, economic growth, social sustainability.

University training programs around the world have also begun preparing primary and high school teachers to adopt ESD successfully. Regarding conventional scientific, humanities, and social sciences disciplines, prospective teachers need to have clear knowledge for effective teaching. However, abstract concepts such as environmental, socio-economic, and moral dimensions must generally be addressed in connection with the ESD. Although, there is a need to address the knowledge in a holistic way. Thus, teachers must acquire the ability to integrate skills and techniques from multiple backgrounds to become successful ESD implementers. If education is properly delivered, it will lead to inclusive economic growth in a meaningful way, increase social integration, promote environmental preservation, and strengthen governance. For effective implementation, teachers should have basic knowledge of ESD. Also, they should understand the root causes of sustainability problems and distinguish alternative practices. Teachers must understand the essential and diverse aspects of the social, economic, and environmental dimensions of ESD critically.

In the earlier studies literature reported, the research tools used such as the sustainability consciousness questionnaire (Gericke et al., 2019), Another scale (Chen et al., 2018) that focused on SD indicators. Thus, not a single scale available that measures teacher educator's conceptions about SD dimensions in a holistic way. According to the current debate, the ESD concept is discussed in an ethical or moral meaning. The tool consisted of two phases. In the first part, demographic variables were asked. Gender, designation, age, academic qualification, total teaching experience, and university teaching experience. Second phase had four dimensions of ESD (social = 13 items, economic = 10 items, environment = 10 items, and moral = 11 items). After the final review of experts and analysis through EFA and CFA technique, the tool consisted of 37 total statements.

Current research mainly covered concept of sustainable development holistically. It is identified that there is a research tool that added the moral dimension. Literature reported that without a moral dimension, sustainable development goals could not be achieved. So, the current validated scale consisted of four dimensions; social, economic, environmental, and moral. The validity and reliability of the existing scale were administered. The reliability value was found excellent. The final scale development consisted of 37 highly correlated items. Moreover, the findings of the Exploratory Factor Analysis verified the presence of the four domains used in the present research.

Conclusion and Future direction

In Pakistan's existing education sector research regarding sustainable development and the promotion of ESD seems to be of little priority, with the situation worse in the past. Training for teachers and teacher educators must be centered so that they can learn about sustainable development. In order to improve teacher concepts and theoretical awareness

about modern concepts of sustainability and about ESD in Pakistan, investment needed for in-service and pre-service teachers in Pakistan. It could be possible to inspire if coursework use as a starting point for teaching pre-service teacher programs (Burmeister & Eilks, 2013).

However, a core mission for educational institutions will be to foster sustainability through social engagement and numerous activities through diverse discipline arts, crafts, and technology education. The Future researchers should discover ESD practices and pedagogies. For better implications, we should have a framework that helps teacher educators in teaching and integrating ESD in a holistic manner.

In a nutshell, it is concluded that to make the world sustainable, educate people to get awareness regarding social, economic, environmental, and moral aspects. As awareness increases in society, people can quickly identify how sustainable development will strengthen the quality of life and environments. Teacher education training can play a significant role in developing sustainable awareness among in-service and pre-service teachers. For implications future researchers should search the ways how better implementation can take place.

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