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Education for Sustainable Development and Critical Thinking Competency

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Synonyms

Cognitive ability; Curiosity; Education to achieve sustainable development; Inquisitiveness; Sustainability education

Definitions

Education for sustainable development (referred to as "ESD" hereafter) is education that "empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity." In simple words, we can also define "ESD" as education to achieve sustainable development.

Critical thinking is the individual's ability to apply higher-order, rational thinking skills such as analysis, synthesis, problem recognition and problem-solving, inference, and evaluation. In this age of information technology, the amount of information available is massive. This kind of information explosion will continue in the future, and, in this situation, children need to weed through the information and not just receive it passively. Hence, critical thinking is important to form appropriate judgments and decisions.

Critical thinking is one of the key competencies in "ESD" ("ESD" is also identified as a measure of quality in education), and mainstreaming "ESD" can promote critical thinking among the next generations.

Introduction

In this entry, the concept of critical thinking, as a key competency in "ESD," has been discussed. The entry is divided in three sections. In the first part, research literature defining critical thinking, introducing learning domains, explaining critical thinking disposition, and establishing critical thinking as a competence has been evidenced. In the second part, context of UN Sustainable

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Development Goals (SDGs) has been provided in order to link it to the positioning of Education for Sustainable Development within the SDG framework with critical thinking identified as one of the core key competencies in education for sustainable development. In the final section, mainstreaming education for sustainable development as a solution has been discussed alongside the way forward recommendations on policy, efficient interventions, and pedagogies.

Critical Thinking

In the current digital age of fast-paced information transmission via technology, critical thinking is a vital skill for future success. The essential need for nurturing critical thinking is an area of consensus among the key stakeholders – academia, policy makers, and business leaders. Partnership for 21st century skills (a USA-based organization) has developed a P21 Framework for 21st Century Learning with input from educators, education experts, and business leaders. The framework defines and illustrates the skills, knowledge, expertise, and support systems that students need to succeed in work, life, and citizenship (P21 2009). Within this framework, critical thinking is listed as one of the key skills to foster innovation.

What is critical thinking? Critical thinking, as a focus area in academic literature, commenced from mid-late twentieth century. We find multiple and overlapping definitions of critical thinking in literature. The formal definition of critical thinking characterizes critical thinking as an intentional application of higher-order, rational, thinking skills such as analysis, synthesis, problem recognition and problem-solving, inference, and evaluation (Angelo 1995). Scriven and Paul (1996) defined critical thinking as an intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action. The simplest definition, however, is given by Beyer (1995), i.e., critical thinking means making reasoned judgments.

Bloom's Taxonomy of Learning Domains and Critical Thinking

In 1956, Dr. Benjamin Bloom proposed the "Bloom's Taxonomy" in order to promote higher forms of thinking, such as analyzing and evaluating (concepts, procedures, processes, and principles), in education, as compared to just remembering facts. Bloom (1956) identified three domains of educational learning, i.e., (i) cognitive (mental skills), (ii) affective (growth and feelings or emotional areas), and (iii) psychomotor (manual or physical skills).

The cognitive domain emphasizes intellectual outcomes. Bloom (1956) divided the cognitive domain further into six categories – starting from the simplest to the complex:

1. Knowledge (recalling)
2. Comprehension (the ability to prove understanding through explanation or rephrasing)
3. Application (application of information)
4. Analysis (division of information into smaller parts to achieve a clear understanding)
5. Synthesis (designing a plan or set of operations and combining parts to form a whole)
6. Evaluation (making judgments and forming opinions)

Among these six categories, the last three (i.e., analysis, synthesis, and evaluation) are the outcomes which are linked to critical thinking (Styron 2014). Hence, for individuals to think critically, they should be able to analyze, synthesize, and evaluate information. These cognitive skills are employed to form judgment.

Critical Thinking Disposition

Research suggests that application of the use of critical thinking, while solving problems, is not a natural (or common) occurrence. In order to think critically, there must be some self-awareness and other characteristics present to enable a person to explain analysis and interpretation and to evaluate

any judgments made. These characteristics create disposition to think critically. Many researchers believe that, in order to think critically, the disposition to think critically should also be nurtured (Bailin et al. 1999; Daly 2001; Facione et al. 1994). Facione et al. (1995) proposed that a person who thinks critically uses seven dispositions to form or make judgments. For example, if an individual is not open-minded, he/she might not be able to tolerate views opposing his/her ideas or opinions and, hence, will not be able to consider broad options before forming an opinion or judgment. The seven dispositions are:

1. Truth-seeking: the desire for the best knowledge in any situation, even if such knowledge fails to support or undermines one's preconceptions, beliefs, or self-interests; the intellectual integrity to follow reasons and evidence wherever they lead
2. Open-mindedness: tolerance of divergent views, self-monitoring for possible bias
3. Analyticity: demanding the application of reason and evidence to resolve problems. Being alert to problematic situations and inclined to anticipate consequences
4. Systematicity: valuing organization, focus and diligence, and persistence in approaching problems of all levels of complexity
5. Self-confidence: trusting of one's own reasoning skills and seeing oneself as a good thinker
6. Inquisitiveness: curious and eager to acquire knowledge and learn explanations even when the applications of the knowledge are not immediately apparent
7. Maturity of judgment: prudence in making, suspending, or revising judgment; an awareness that multiple solutions can be acceptable; an appreciation of the need to reach closure in certain circumstances even in the absence of complete knowledge

Individuals may possess knowledge to think critically about an issue, but if these dispositional affects or attitudes do not work, individuals may fail to analyze, evaluate, and synthesize information to think critically (Walker 2003).

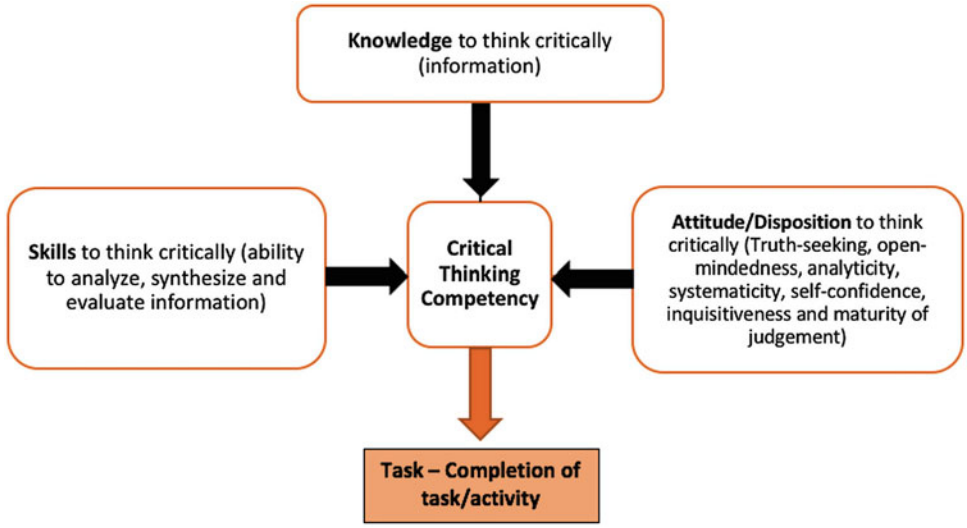
Critical Thinking as a Competency

According to the United Nations Industrial Development Organization (UNIDO) (2002), competency includes a combination of knowledge, skills, and behavior that are practiced for self-improvement. Salleh (2012) defined competency as a set of skills, knowledge, and behavior which characterize better performance. Rychen and Salganik (2001) proposed that competency not only is about knowledge and skills but also involves the ability to fulfill complex demands by preparing psychosocial resources such as skills and attitudes in specific context.

With this backdrop, critical thinking can be defined as a competency. To think critically, individuals need (a) knowledge to think critically (Walker 2003), (b) specific cognitive skills (ability to analyze, synthesize, and evaluate information) (Bloom 1956), and (c) specific attitudes/dispositions (truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity of judgment) (Facione et al. 1995). These three aspects are combined to solve some tasks/assignments which require critical thinking (as a competency). Figure 1, adapted from UNIDO (2002), illustrates critical thinking competency model that is based on three aspects.

Education for Sustainable Development Leading to Sustainable Development

Sustainability challenges, including climate change, loss of biodiversity, poverty, epidemics, and violent conflicts, manifest at a certain location, yet the underlying causes are linked to other nations, locations, and even the global society. Hence, options for mitigation, adaptation, and solution to these interconnected challenges require collaborated and coordinated efforts (Van der Leeuw et al. 2012). These interconnected environmental, social, economic, and political challenges call for education to enable the young generation to act and engage responsibly and innovatively with this world – "ESD" that "empowers learners to take informed decisions and responsible actions for environmental



Education for Sustainable Development and Critical Thinking Competency, Fig. 1 Main aspects of critical thinking competency. (Adapted from UNIDO 2002)

integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity" (UNESCO 2014).

On 25 September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development (UN Resolution 2015). At the core of the 2030 Agenda are 17 Sustainable Development Goals (SDGs). The universal, transformational, and inclusive SDGs describe major development challenges for humanity. The aim of these goals is to secure a sustainable, peaceful, prosperous, and equitable life on earth for everyone now and in the future (UNESCO 2017). In this (ambitious) agenda, SDG-4, Target 4.7 is an acknowledgment of the critical importance of education for sustainable development, global citizenship education, and other transformational education movements for a sustainable and peaceful future for all.

Target 4.7 states: "by 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development" (UN Resolution 2015).

Meaningful progress on the path of sustainable development will require a thoughtful transformation of how we think and act. In order to understand sustainability challenges, and to engage with sustainability issues, individuals must become sustainability change-makers. For becoming change-makers, they require the knowledge, skills, values, and attitudes that empower them to contribute to sustainable development (UNESCO 2017). Education, therefore, is crucial for the achievement of sustainable development. However, all forms of education do not support sustainable development. Education which promotes economic growth only can lead to unsustainable consumption patterns.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2017), "ESD" is defined as education that empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability, and a just society – for present and future generations. The aim of education for sustainable development is to enable individuals to reflect on their own actions, taking into account their current and future social, cultural, economic, and environmental impacts, from a local and a global perspective. Gough and Scott (2003) frame sustainability and learning as complex, uncertain, risky, and necessary, suggesting

that "ESD" should also empower individuals to act in a sustainable manner in complex situations. This may require thinking creatively and innovating, participating in sociopolitical processes, and leading their societies (spheres of influence) toward sustainable development.

In summary, "ESD" enables individuals to contribute to achieving sustainable development goals by equipping them with the knowledge and competencies they need to understand the sustainability issues and bring about the necessary transformations as informed citizens.

Critical Thinking as a Key Competency in Education for Sustainable Development

With the pace technology is progressing today, and with its intended as well as derivative consequences locally and globally, societies may encounter new kind of challenges. These challenges include uncertainty and complexity, more individualization and social diversity, environmental degradation, enhanced vulnerability to natural and technological hazards, and expanding economic and cultural uniformity. Dealing with these situations requires creative and self-organized actions. People must be aware of the complexity of the world they live in, and (recognize that) they need to collaborate, speak up, and act for positive change (UNESCO 2015). These people are titled as "sustainability citizens" (Wals 2015; Wals and Lenglet 2016).

There is general agreement that sustainability citizens need to have certain key competencies that allow them to engage constructively and responsibly with today's world (UNESCO 2017). Key competencies represent cross-cutting competencies that are necessary, for all learners, of all ages – worldwide (developed at different age-appropriate levels). Key competencies can be understood as transversal, multifunctional, and context-independent. They do not replace specific competencies necessary for successful action in certain situations and contexts but encompass these and are more broadly focused (Rychen 2003).

There is a consensus in defining key competencies to successfully design academic programs (Baartman et al. 2007) as competence-oriented education focused on output – the output approach asks what problem-solving strategies, concepts, and abilities pupils should have (De Haan 2010). "ESD" aims to develop competencies which can enable learners to participate in the sociopolitical processes and move their society toward sustainable development (De Haan 2006; Hopkins and McKeown 2002). Within the sustainability programs, key competencies are important because developing students to be leaders, problem-solvers, and change agents of the future needs a particular set of "knowledge and skills" (Willard et al. 2010). Hence, key competencies are referred to as an amalgamation of skills, knowledge, and attitudes which leads to task performance and problem-solving with respect to real-world sustainability challenges and prospects (Barth et al. 2007; Wiek et al. 2011).

UNESCO (2017) identified that eight key competencies are generally seen as crucial to advance sustainable development. These key competencies must be seen as output of "ESD." These competencies are adapted from de Haan (2010), Rieckmann (2012), and Wiek et al. (2011) and are as follows:

1. Systems thinking competency
   The ability to recognize and understand connections and analyze complex systems across scales and domains
2. Anticipatory competency
   The ability to understand and evaluate multiple futures – possible, probable, and desirable, to create one's own visions for the future, to apply the precautionary principle, to assess the consequences of actions, and to deal with risks and changes
3. Normative competency
   The ability to understand and reflect on the norms and values that underlie one's actions and identify, map, collate, and negotiate sustainability concepts, values, goals, targets, and principles
4. Strategic competency
   The ability to collectively develop and implement innovative actions that further sustainability at the local level and further afield
5. Collaboration competency

Education for Sustainable Development and Critical Thinking Competency, Table 1 Key competencies in "ESD" divided into three domains

	Cognitive domain	Socio-emotional domain	Behavioral domain
Key competency	Systems thinking	Collaboration	Strategic
	Anticipatory		
	Normative	Self-awareness	Integrated problem-solving
	Critical thinking		

The ability to learn from others; to understand and respect the needs, perspectives, and actions of others (empathy); to understand, relate to, and be sensitive to others (empathic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem-solving

6. Critical thinking competency
   The ability to question norms, practices, and opinions; to reflect on one's own values, perceptions, and actions; and to take a position in the sustainability discourse
7. Self-awareness competency
   The ability to reflect on one's own role in the local community and (global) society, to continually evaluate and further motivate one's actions, and to deal with one's feelings and desires
8. Integrated problem-solving competency
   The overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive, and equitable solution options that promote sustainable development, integrating the abovementioned competences

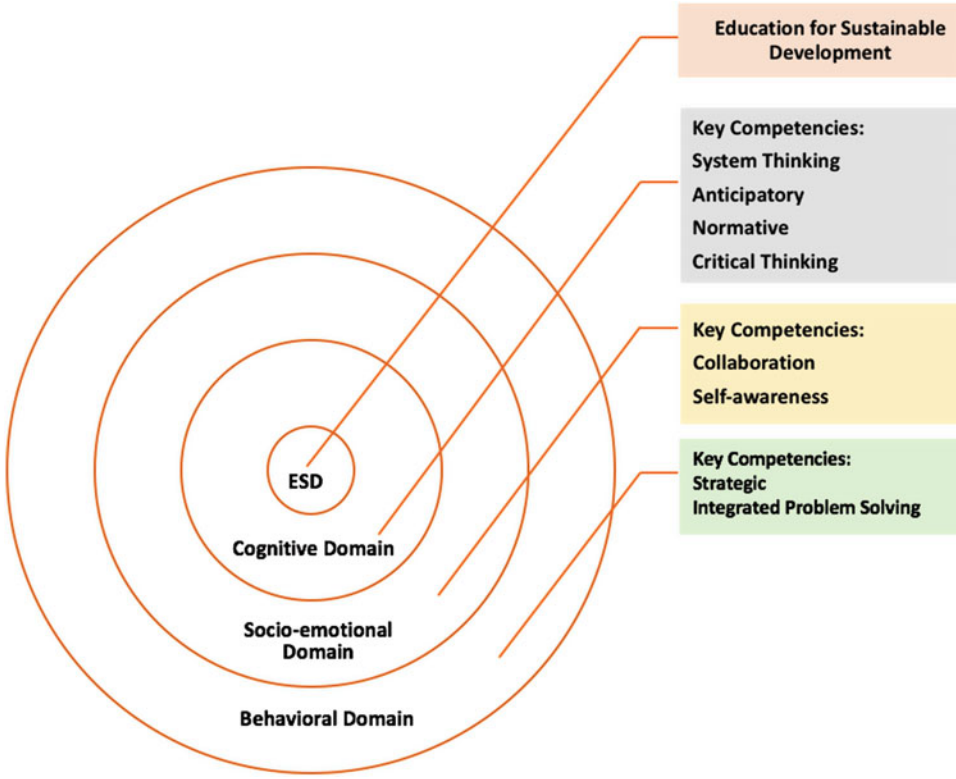
Table 1 divides the abovementioned competencies into three domains, i.e., (a) cognitive domain (knowledge and thinking abilities), (b) socio-emotional domain (social abilities), and (c) behavioral domain (action competencies).

Arranging these key competencies, in the framework of three domains (see Fig. 2), it is conclusively clear that for "ESD" to be effective, key competencies in cognitive domain have to develop first, followed by the competencies in socio-emotional and behavioral domain. Key competencies, in cognitive domain (systems thinking, anticipatory, normative, and critical thinking), provide foundation for competencies in socio-emotional (collaboration and self-awareness) and behavioral domain (strategic and problem-solving) to develop. Knowledge and thinking competencies are vital to provide appropriate disposition to develop socio-emotional competencies. Without cognitive competencies, it is impossible to develop socio-emotional or behavioral competencies. To develop behavioral competencies, so that individuals can behave or to be sustainability citizens, it is important for individuals to have a certain amount of knowledge, abilities to think (cognitive competencies), and awareness about themselves and others around them (socio-emotional competencies). Action needs foundation, and that foundation is provided by knowledge, thinking abilities, and social abilities.

Based on this framework, cognitive competencies can also be regarded as core key competencies in "ESD." Critical thinking, one of the key competencies in "ESD," falls under the cognitive domain. Conversely, developing critical thinking, as a competency, is a critical prerequisite for building sustainability citizens. It is vital to "mainstream" ESD in order to develop critical thinking and other key competencies (that will now be necessary) to survive and thrive in an uncertain and technology-driven future.

Way Forward to Mainstream Education for Sustainable Development in the Context of Nurturing Critical Thinking

The importance of building critical thinking competency among individuals and this being a key competence within "ESD" is well established in the literature. "Mainstreaming education for sustainable development" is seen as one of the core strategies to (a) impart critical thinking



Education for Sustainable Development and Critical Thinking Competency, Fig. 2 Key competencies in education for sustainable development arranged in a three-domain framework

competency among the future generation and (b) help in achieving SDG-4, Target 4.7. As a way forward, the following points can be considered to promote critical thinking, via "ESD," as a vital component of education and learning.

Policy

Policy is a key ingredient in mainstreaming "ESD" in formal, informal, and non-formal education settings. There is a need for relevant and coherent policies to facilitate educational reforms. The ministry of education (or equivalent national regulatory body) in every country, across the globe, bears the responsibility of ensuring that the respective education system is prepared and responsive to existing and emerging sustainability challenges. This includes, among others, integrating education for sustainable development into curricula and national educational quality standards and developing framework to establish standards for learning outcomes.

Reorientation of educational policies toward sustainable development is underway. For example, Kenya adopted the education for sustainable development strategy in 2008. This strategy acknowledges that in order to have quality education, leading toward development, it is important to nurture productive and socially responsible individuals. This ESD strategy was aimed at promoting teaching and learning that inculcates appropriate values, behavior, and lifestyles for good governance and sustainability among other focuses. The Kenya Institute of Curriculum Development also formulated the "ESD" policy framework in 2012. The aim of this policy framework is to support sustainable development through transformative curriculum support materials. "ESD" has also been entrenched in the National Education Sector Program to be implemented over 5 years (2013–2018) and is captured in Vision 2030, Kenya's road map to the realization of sustainable development,

showing the importance of alignment with national sustainable development objectives (UNESCO 2014). In another example, Costa Rica has been one of the acknowledged leaders in efforts to promote "ESD" in the form of environmental learning, and national policy includes a threefold national development strategy which simultaneously promotes education, conservation, and ecotourism (Blum 2008). Costa Rica has been applauded for its attention to educational initiatives to promote sustainability attitude and behavior. National policies keep making reference to how these efforts are contributing to wider international agendas. This makes sure that international agendas are converged to the national context for effective implementation. The national state school curriculum, for instance, requires environmental learning as part of both primary and secondary education, while state-run national conservation areas provide informal learning opportunities for both domestic and international visitors. Designing this kind of integrated and cross-sectoral policy has been successful because of the support from national and international NGOs and private sector. Leaders from all of these sectors commonly express a commitment to a national development strategy which simultaneously encourages conservation, ecotourism, and education. Hence, collaboration and consultation played its role.

For initiating change, it is crucial for education ministries to design relevant and coherent policies in consultation and collaboration with private sector, local communities, academics, and civil society. "ESD" has to be "integrated into sub-national, national, sub-regional, regional and international policy frameworks, plans, strategies, programs and processes related to education and to sustainable development" (UNESCO 2014). When it comes to policy, there is no "one-size-fits-all" approach. Every region/country has its own political and sociocultural realities. Also, social, environmental, and ecological challenges may vary from region to region. With this background, contextual grounding of "ESD" and locally and nationally relevant interpretations of "ESD" are required. This will help in achieving broad international agendas to mainstream and implement "ESD." By enabling learners to live and act in an uncertain world, "ESD" enhances the quality of education or quality of teaching and learning (Laurie et al. 2016). Education policy has to view "ESD" as an important contributor to educational quality.

Efficient Interventions

Laurie et al. (2016) identified the need to integrate "ESD" across all subjects in order to provide professional development to the teachers and ensure "ESD" policy implementation. Within formal education, "ESD" should be included in early childhood care and education, primary and secondary education, technical and vocational education and training (TVET), and higher education. For example, "Finland is reforming the national core curricula for pre-school and basic education to support and promote sustainable development and well-being following the value basis of education, where the necessity of a sustainable way of living and eco-social understanding is emphasized. The aim is to support all students in developing the knowledge, skills, values and attitudes that promote their ability to understand the importance of a sustainable future" (UNESCO 2014).

Subject content, textbooks, and curriculum have always been at the heart of formal education system, and their design impacts teachers' education, pedagogies, and classroom practices. In some countries, where the modern education system was developed under colonialism, textbooks – more than the syllabus or curriculum – dictate what teachers teach. Even in our increasingly digital era, school textbooks remain "the most visible part of the curriculum," and they are often seen as "authoritative sources for the transfer of knowledge and social values" (Georgescu et al. 2007). However, in some other countries, curriculum and syllabus dictate what teachers teach in the classes. Keeping in mind all these cases, "ESD" needs to be inculcated in what teachers teach in the class and the pedagogies they implement. To achieve this, "ESD" should be embedded in all subjects instead of being introduced as a separate subject. Given the number of instructional hours to teach all the subjects and, in some cases, their mandatory examinable status,

embedding "ESD" into core subjects will be a more effective and efficient way to nurture key sustainability competencies and achieve SDG Target 4.7 (UNESCO 2017). UNESCO (2004) has identified two key dimensions of educational quality: (1) the promotion of learners' cognitive development and (2) the cultivation of the skills, knowledge, values, and attitudes necessary for responsible, active, and productive citizenship. Embedding "ESD," therefore, contributes directly to the long-established quality agenda of education, as well as the integrated and transformative agenda for sustainable development. While structure is required for the curriculum to maintain the standards, at the same time, flexibility in curriculum policy and design is also required in order to allow primary and secondary schools to develop projects and content which are locally relevant. This will also nurture innovation and creativity.

Teachers hold the key to change in schools. This has been recognized by international agencies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) who have identified the professional development of teachers in education for sustainable development (ESD) as "the priority of priorities" (UNESCO-UNEP 1990). Integrating "ESD" component in teachers' education is important, but the content of the teacher education programs must be developed with the participation of key stakeholders including students, teachers, NGOs, and "ESD" experts. As there are still many teachers who have not learned about "ESD" in their previous or preservice training, "ESD" as a component should be inculcated in the in-service training. On the one hand, it opens up opportunities for developing the necessary knowledge and competencies to participate in the process of sustainable development. On the other, this professional development is a prerequisite for reorienting educational processes and educational institutions.

Ferreira et al. (2007) conducted a study that sought to identify and appraise the models underpinning a range of initial teacher education initiatives in "ESD" developed in Australia. The study recommended that a hybrid of the "action research" and "whole-of-system" models should be adopted, in future efforts, to mainstream "ESD" in initial teacher education. The concept of these two models is as follows:

(a) Action research model: initiatives based on the action research model aim to build capacity in educators so that they see themselves as competent developers and deliverers of curriculum and policy. While action research is commonly seen as a research method, it can also be used as a process of professional development.
(b) Whole-of-system model: The whole-of-system model includes working at the interface of every contextual layer of initial teacher education from students and practicum school principals and teachers to program directors and external agencies, so that the organizational culture and processes of each can be influenced. While such a broad approach is difficult to coordinate, the initiatives using this model demonstrated the greatest degree of long-term and system-wide change. This is a top-down and bottom-up, multifaceted system change approach.

Ferreira et al. (2007) proposed to combine best practices from the abovementioned models and named the hybrid of these two models as "Sustainability Mainstreaming" model. This model incorporates a multilateral approach to engaging stakeholders to ensure whole-of-system support. This, in combination with an action research method, offers a powerful means for developing a practitioner's sense of autonomy, ownership, and ability to bring about change within one's own context or settings. This approach can allow stakeholders to determine what is needed (based on the context) – it can be new curriculum, new policies, or a reform in the delivery of initial teacher education – and what would work best within their particular contexts.

Pedagogies

As "ESD" is about developing active sustainability citizens, it shall motivate and empower learners to think critically and participate in shaping the future of this world. In this context, it is important to use appropriate pedagogies in the

classrooms. UNESCO (2017) proposed three pedagogical approaches deemed adequate to achieve this aim:

(a) Learner-centered approaches – require learners to reflect on their own knowledge and learning processes in order to manage and monitor them. Educators should stimulate and support those reflections. In a learner-centered approach, educators act as facilitators of learning processes (Barth 2014).
(b) Action-oriented approaches – require learners to engage in actions and reflect on their experiences. Action learning is aligned to Kolb's experiential learning theory which has the following stages: (1) having a concrete experience, (2) observing and reflecting, (3) forming abstract concepts for generalization, and (4) applying them in new situations (Kolb 2014). Action learning links abstract concepts to personal experiences and hence increases knowledge acquisition, competency development, and values clarification.
(c) Transformative approaches – aim at empowering learners to question and change the ways in which they see and think about the world in order to deepen their understanding of it (Slavich and Zimbardo 2012). The educator, being a facilitator, challenges the learners to alter their world views.

Conclusion

With the technology-driven winds of change blowing at the speed of knots, critical thinking is one of the essential skills for future success and survival. There is a consensus among academics, practitioners, and policy makers that nurturing critical thinking competence is vital for the future generation(s). Critical thinking is also an established key competency in education for sustainable development. Mainstreaming education for sustainable development can contribute to improving the quality of education by imparting key competencies (including critical thinking). Education officials, policy makers, academics, educators, curriculum developers, and other key stakeholders are called upon to rethink education in the light of mainstreaming education for sustainable development in order to contribute to the achievement of sustainable development goals and facilitate a thriving future. This dual-purpose learning can be promoted with the help of policies, educational institution design, curriculum, textbooks, teachers' training, and the right pedagogical approaches. All of these measures can be guided by the key competencies in education for sustainable development in order to make sure that right competencies are being nurtured.

Cross-References

- Education for Sustainable Development
- Future Trends in Education
- Global Curriculum
- Preschool Education

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