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Effective Teaching Strategies for Integrating ESD into STEM (Science, Technology, Engineering, and Math) in Jordanian Curricula

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Abstract
The goal of this study is to review and highlight some recent examples of integrating education for sustainable development (ESD) into science and associated curriculum in a way that is meaningful and relevant to staff and students in Jordan. In addition to reflecting on various embedding tactics and discourses, this study examines competencies and pedagogical strategies, tying them together in a framework based on twelve competencies and twelve pedagogical strategies that have been documented in the literature. Hermeneutics is used to do this. Future generations' attitudes and behaviors will be better developed if we provide them with a comprehensive set of sustainability competencies. The significance of the notion of sustainable development, which is typically more affected by global issues, will be examined in this article, with a focus on Jordan as a chosen global South nation. The primary focus of the research will be on the application of the sustainable development idea in Jordanian higher education, which is a field that has a significant impact on young people's personalities and future conduct. STEM education is a rapidly evolving research topic, with new frameworks and methodologies aiming for a more coherent educational experience. The concept of integration, real-world problem-solving, and integration needs further evaluation and understanding for effective implementation.

Keywords
SDG, STEM, Jordanian Universities, UNISCO

INTRODUCTION

Since the Sustainable Development Goals (SDGs) are now a global concept and governments, institutions, and even individuals are responsible for implementing them, it is vital to gauge public awareness of the goals in order to support any further implementation-related actions. University students can help support, encourage, and achieve development when they are aware of the SDGs' scope. The purpose of this study was to evaluate university students' knowledge of the Sustainable Development Goals (SDGs) [19].

The United Nations adopted the Sustainable Development Goals (SDGs), commonly referred to as the Global Goals, in 2015 as a global call to action to end poverty, safeguard the environment, and guarantee that by 2030 all people live in peace and prosperity.

The 17 SDGs are interconnected; they acknowledge that decisions made in one area will have an impact on other areas and that development must strike a balance between environmental, social, and economic sustainability. Nations have pledged to give the least developed nations' development the highest priority. The SDGs aim to eradicate discrimination against women and girls, hunger, AIDS, and poverty. The SDGs must be accomplished in every setting with the help of all societal members' inventiveness, expertise, technology, and financial resources.

JORDANIAN GOVERNMENT INTENSIFY EFFORTS TO ACHIEVE SDG 4

With this pledge, the Jordanian government will step up efforts to fulfill SDG 4 and Jordan's TES obligations in advance of the 2023 SDG Summit. Additionally, the Ministry of Education leads the government of Jordan in its efforts to improve all children and youth's access to and retention in high-quality education for early childhood education through tertiary education, including technical and vocational education (TVET). To this end, the Ministry of Education will oversee the following priority actions:

(i) Stepping up efforts to make KG2 universal and creating more avenues for kids under 6 to be enrolled in the educational system.

(ii) Combating learning loss by striving to enhance success levels, bridge educational gaps among students, and improve the quality of student outcomes while also combating the negative effects of the COVID-19 epidemic on education.
(iii) Quickly enhancing chances for pre- and in-service teacher professional development.
(iv) Restructuring TVET and vocational education streams at public universities to better meet the demands of the job market.

With this initiative, Jordan will expand on its various commitments, strategies, and implementation plans that are now in complete harmony with SDG4, offering the framework required to enable the transformation and acceleration of SDG4 targets and goals. More precisely, Jordan intends to revise current laws, strengthen ties with the business community, and augment infrastructure spending in order to expedite the process of KG2 universalization. The National Plan for Remedial Education, created by the Ministry of Education, will focus on school development and capacity building, curriculum updates to meet learners' needs, close monitoring of student assessment and accountability for educational quality, and school environment work to ensure social inclusion. To enhance pre-service teacher training, Jordanian institutions will also be implementing better teacher training programs to suit the demands of the Ministry of Education and enhance teacher qualifications. By 2025, the Jordanian government also plans to make in-service and pre-service training mandatory. In order to guarantee that no student is left behind in the classroom, this will also involve professional development for teachers that focuses on diversity and inclusion in education, with a particular emphasis on children with disabilities. The Ministry of Education and the Ministry of Higher Education will prioritize the creation of new vocational specializations, make investments in the professional growth of educators and young people in general, concentrate on improving and focusing career counseling, and expand their interactions with the commercial sector.

To improve accessibility, the Ministry of Education is also working to digitize vocational workshops. The Ministry of Education & Ministry of Higher Education will collaborate closely with Jordanian education sector partners and stakeholders to carry out the aforementioned initiatives. They will also make use of funding support, public-private partnerships, and technical assistance as implementation modalities. The Ministry of Education's in-kind contribution will also make use of its current financial and personnel resources.

Over the past 20 years, there has been an increase in both research and implementation of higher education for sustainable development. These have centered on educating upcoming generations of professionals about sustainability. In this regard, the inclusion of SD in university courses has advanced significantly. The majority of these initiatives have been directed on developing and delivering competencies with a sustainability focus. Various pedagogical approaches have been suggested by some peer-reviewed studies to improve the delivery of SD in these courses; nevertheless, little research has been done on the relationship between pedagogical approaches and sustainability competencies.

Through education for sustainable development (ESD), students in all subject areas acquire the values, abilities, and information needed to pursue sustainable future visions. Learners are assisted in tackling difficult or "wicked problems" and figuring out how they may contribute to solutions that address social justice, economic success, and environmental integrity through the use of active pedagogies (Fig. 1) [20]

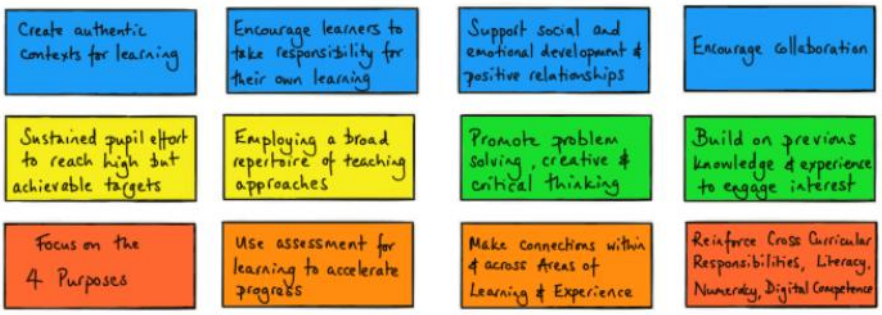

Fig. 1 Pedagogical Principles

All educational professionals learn in higher education, so it is crucial to ensure that all professionals are ESD literate. Leaders in higher education institutions can play a significant role in fostering an equitable and environmentally responsible future by making SD a primary academic and organizational focus. Universities and higher education networks can also conduct research and offer advice and guidance on how to strengthen national education systems and build capacity for sustainable development across various sectors.

UNISCO EDUCATION SECTOR RELATES ESD AND HIGHER EDUCATION

Institutions of higher learning (HEI) can offer local ESD projects knowledge and assistance. They are able to integrate information stored at higher levels with local expertise and knowledge.

HEI can enhance the relationship between research outcomes and decision-making by employing problem-based scientific research and evidence-based data. Higher education establishments, such as universities, are crucial to the success of all ESD-GAP Priority Action Areas.

The past 20 years have seen a rise in the study of and application of Higher Education for Sustainable Development (HESD). Future generations of professionals have been the focus of these efforts to teach sustainability [1]

and integrate sustainable development (SD) into Higher Education Institutions (HEIs) system elements, such as operations, research, outreach to the community, assessment and reporting, collaboration with other universities, on-campus life experiences, education, and "Educate-the-Educators" programs [2].

Integrating SD into curriculum necessitates multidisciplinary approaches and systems thinking [2], as well as pedagogical innovations that offer experiential, transformative, interactive, and real-world learning [3]. The majority of attempts to include SD in curriculum have concentrated on learning outcomes [4] or on the design and delivery of curricula [5].

Research on competencies for sustainable development has increased, there has been little research on the relationship between how courses are taught (pedagogical techniques) and how they could affect sustainability skills, despite the fact that certain peer-reviewed studies (e.g., [6]) have suggested various pedagogical approaches to better convey SD inside courses.

The United Nations developed the Sustainable Progress Goals (SDGs) as a roadmap for global progress and a brighter future for everybody. This is the halfway point of the goals, which were set in 2015 with the intention of achieving them by 2030. It's a fantastic moment to consider how we're contributing to their accomplishment. As educators, we can directly promote Goal 4 of the Quality Education SDG by choosing to educate about the 17 Sustainable Development Goals. "Education is both a goal in itself and a means for attaining all other SDGs," states UNESCO. It is not only a crucial component of sustainable development, but also one of its main enablers. For this reason, employing education as a tool to achieve the SDGs is crucial.

The Crisis and Risk Management Strategy for the Ministry of Education in Jordan (2023–2027) was introduced by Education Minister H.E. Prof. Azmi Mahafzah, signaling a significant advancement in the sector's crisis response capabilities. The goal of the Crisis and Risk Management Strategy is to make sure that, despite the various risks and dangers Jordan faces, the Ministry of Education (MoE) can continue to provide high-quality instruction in a safe and secure setting. By defining critical system-wide strategic measures, the strategy aims to mitigate the risks to Jordanian education and enable education players, including schools and students, to adopt a decentralized and localized approach to managing risks and crises.

Through a comprehensive consultation process including the entire Kingdom, the Strategy was produced with the technical assistance of UNESCO and its International Institute for Educational Planning (IIEP). It is in line with the National Center for Security and Crises Management's (NCSCM) Jordanian Natural Disaster Risk Reduction Strategy (2023–2030). Additionally, crisis and risk management are emphasized in the Ministry's Education Strategic Plan (ESP) 2018–2025 as a means of facilitating system strengthening and guaranteeing inclusive, egalitarian, and high-quality education for all.

The UNESCO Representative to Jordan, Ms. Min Jeong Kim, commended the Minister of Education for creating the Strategy. Jordan has proven its dedication to guaranteeing that every kid and young person can exercise their right to an education once more. The Ministry is laying the groundwork for the Kingdom's education system to become more robust, effective, and responsive by institutionalizing crisis-sensitive planning.

"Strengthening national policies, strategies, and plans in accordance with international frameworks like the Sendai Framework for Disaster Risk Reduction is necessary for risk management, which is a regional and global priority. The National Center for Security and Crisis Management's H.E. Mr. Saleh al-Sheyyab, Director of Strategic Planning, stated, "The Ministry of Education has successfully accomplished this." H.E. Prof. Azmi Mahafzah emphasized the value of collaboration at all levels as a fundamental component of crisis and risk management while thanking UNESCO and IIEP for their assistance in the creation of the strategy. "With the help of our partners in this crucial field and in collaboration with the NCSCM, the Ministry of Education will be able to further guarantee that it can fulfill its obligations to guarantee the provision of high-quality education in times of crisis. He stated, "This is one of our government's goals, as outlined in our Economic Modernization Vision and ESP.

Along with the strategy's introduction, the MoE recently established a Risk Management Unit for the first time, with assistance from UNESCO and the IIEP. This unit will play a key role in carrying out the strategy. The Unit is already developing a costed-operational strategy in collaboration with important MoE authorities.

As part of the System Strengthening Partnership (SSP), which is presently being carried out under a Multi-Partner Trust Fund (MPFT) supported by Canada, the Italian Agency for Development and Cooperation (AICS), Norway, and Switzerland, UNESCO is providing the MoE with support for crisis-sensitive planning. Under the auspices of H.E. the Minister of Education, the Crisis and Risk Management Strategy was introduced. Important partners and stakeholders in the education sector, as well as representatives from the NCSM and the National Center for Cybersecurity, were present.

THEORETICAL FRAMEWORKS FOR SUSTAINABILITY IN STEM EDUCATION

STEM stands for science, technology, engineering, and math. It is a relatively recent term, having its roots in the national science foundation in the US in the late 1990s, which aimed to unify disciplines and encourage students' interest in and proficiency in STEM fields. There is a lot of uncertainty around STEM techniques because of their ambitious goal to integrate four complicated disciplines, which carries the danger of continuing to engage with disparate subjects [25].

International organizations have developed new frameworks, assessments, standards, and dialogues about the state of education going forward and the necessity of equipping the next generation for the challenges of the twenty-first century. But sometimes these discourses have trouble translating into the realities of the classroom, as stated in the report

following the decade of education for sustainable development, which said that reaching teachers and students—beyond the level of policymakers and connecting and transforming the educational experience—has proven to be a more significant challenge [26].

The literature on STEM education opportunities primarily focuses on secondary and higher education, focusing on ages 4-10. It includes conceptual foundations, practical guidelines, and expected learning outcomes. Definitions consider natural and computational sciences, social and behavioral sciences.

The concept of integration in STEM frameworks aims to connect different subjects, starting from real-world situations, to encourage critical thinking, problem-solving, and retention. This balance between disciplinary knowledge and integration aligns with philosophical debates on science and complexity, and modern science's ability to tackle complex global challenges in diverse contexts. Situated knowledge is crucial to avoid biases in scientific endeavors.

You can include learning about the Sustainable Development Goals into your school activities in three primary ways: by adding SDG units or creating linkages to school events, by extending current curriculum subjects, and by including national and international commemorations.

The 17 SDGs should be able to be mapped to either subjects or themes given the numerous potential to improve present topics by learning about the SDGs. It is ideal to finish this as a staff-wide task to take accessibility and age appropriateness into account.

For example, teaching students in kindergarten through second grade about the SDGs related to experiences they are more likely to have had—such as Goal 3, Good Health and Well-Being—would be a good place to start, given that students in this grade range may have visited hospitals, dentist offices, or doctors. Expand on what they learn about themselves in science or health classes by having them think about the difficulties faced by people who don't have access to enough food or clean water, as well as nutrition and hygiene. A straightforward experiment using glitter or a spray that is only visible in the UV can replicate how germs spread and how soap and water are necessary defenses against them.
Using simulations to foster empathy for people in situations that differ from our own can be very beneficial. For younger students, it can be poignant and meaningful to use cookies to illustrate how food is distributed throughout the world or jugs to illustrate how accessible and high-quality drinking water is. Split the class up into equal groups; 4-6 kids are a good number. A set quantity is given to each group to divide; this could be anything from a single cookie crumb to an entire bag. Acknowledging these disparities and expressing the injustice of the circumstance exposes students to challenging issues like Goal 2's Zero Hunger.

DIFFICULTY OF INCORPORATING ESD INTO STEM COURSES

One specific example of how education for sustainable development (ESD) is being applied is in TEM subjects. The objective of this initiative is to heighten students' consciousness regarding the connections between their field of study and sustainable development, the possible influence and role they can play in achieving it, and the cultivation of skills that will serve them well in their future professions where they will likely have the opportunity to positively impact both people and the environment.

Though there are numerous locations in which education for sustainable development (ESD) activities could be undertaken, some, like the South countries where the current project was implemented, are of particular interest. Rapid shifts in geopolitical environments and the growing geopolitical significance of environmental and natural resource management are characteristics of this region.

This precarious state, marked by the transition from one phase of environmental emergency to another of environmental integration, presents a number of obstacles for education. [21]. There has been much discussion on the topic of creating training programs to get students ready for professions in fields 5 connected to sustainability. Providing a sufficient profile that takes sustainability issues into account has been emphasized in numerous UNESCO texts over a long period of time, from Rio 1992 to Rio + 20 (including the United Nations Decade of ESD) (UN 2012; UNESCO 1992, 2004, 2005). The establishment of specialized training programs is the goal of Agenda 21 (UNESCO 1992), which aims to guarantee that all societal sectors have the skills required to carry out their work in a sustainable manner.

Point 51 of the UN report from the Rio + 20 Conference (UN 2012) emphasizes the importance of education and recommends that workplaces should be used as hubs for sustainability-related information, training, and education. According to Point 230, training programs that educate students for professions in sustainability-related fields should be developed, as well as curricula centered around the subject.

ESD is a multifaceted idea that encompasses things like the creation of engagement in decision-making processes and knowledge of issues related to sustainable development (UN 2012; UNESCO 1992, 2004, 2005). the acquisition of information, 20 abilities, ideas, and values to enable individuals of all ages to assume responsibilities because preparing for a sustainable future is essential.

Academics and government (MoE and MoHESR) authorities in Jordan have a general understanding of the value of STEM. The government, business, and economy often do not fully understand the reasons behind the significance of STEM.

Understanding the connections between STEM competencies and general education, technical education, vocational education, higher education, and basic economic needs is something that needs to be facilitated. Few Jordanians are aware of the close connections between STEM education and learning capacity and long-term competitiveness. Because of this, it's critical to collaborate with specific industries, develop a competitive strategy,

pinpoint the competencies needed to succeed in that strategy over the long term, and share these connections with the government, business, and academic communities. enterprises and recognized economic sectors won't demand good STEM education in a proactive way unless they have shown and linked the value of this type of education to enterprises.

Furthermore, it is mandated nationally for secondary school instructors to undergo retraining in order to teach STEM courses in an integrated way that fosters active, interdisciplinary learning for students. Modifying the way in which STEM disciplines are taught will help kids become more creative and proficient problem solvers.

STEM education is the acronym for mathematics, science, technology, and engineering education. An increasingly vital instrument for national growth is STEM education. Due to its impact on how future individuals view and comprehend the world, STEM is becoming more and more recognized as a developmental standard. Because of this, STEM education is becoming a more and more important educational paradigm for a globally competitive economy. Academics in Jordan are usually aware of the significance of STEM. This knowledge is obtained from reading about and investigating recent developments in education conducted by academics and government organizations, without fully grasping the information or justification for the conclusions made regarding the value of STEM. The fact that none of the recent development initiatives, including JV 2025 and the National Employment Strategy (2011–2020), specifically mention STEM education as a goal or a required component for sustained economic development, makes this ignorance glaringly obvious. Thus, it is unlikely that direct and concentrated efforts will be made in the near future to advance STEM development.

The fact that micro, small, and medium-sized businesses predominate Jordan's economy is a critical component of this country's predicament. Most of these businesses don't do anything that adds any value. Because of this, the vast majority of the economy is unaware of or undervalues the possible financial benefits that enhanced STEM and vocational education and training could have for certain companies. The private sector requires cheap labor input instead of competent labor because there is minimal perceived value and an actual inability to utilize such talents (a result of poor value adding operations). The commercial sector might effectively advocate for effective VET and STEM education in universities if it valued skilled technical and vocational labor as well as STEM competencies.

Jordan has always made investments in its citizens' training and education. This was, in large part, the mindset of Jordan's founder, King Abdullah the First, to get past the obstacles to the country's development brought on by its dearth of natural resources. This kind of thinking is still in use today. Early in the 1990s, reforms to schooling were implemented. Under King Abdullah II, the process of educational reform has proceeded and picked up speed. The project of educational reform's most recent economic goal was to make Jordan is a proactive participant in the global economy and a hub for technology in the area. Towards the end of 2002, the Vision and Mission for Jordan's national education were created and approved. Three national advisory texts that provided guidance and shaped the country's vision for the necessary educational reform [22].

In recent times, there have been multiple national initiatives, including the Jordanian National Employment Strategy and the Jordan Vision 2025 (JV 2025), as well as multiple sectoral studies conducted by the National Centre for Human Resource Development (NCHRD), which have all suggested, to varying degrees, industries with potential for growth and some that require skills equivalent to those found in universities. These studies don't go into great detail about student proficiency, STEM education, or the connections between STEM and the economy. This suggests that there are either no connections at all or very few between STEM and national human resource development requirements.

As a result, despite the existence of several national institutions tasked with employment, education, vocational/technical training, and national economic development, their ties to the private sector and the national economy are tenuous. The majority of Jordanian firms are micro, small, and medium-sized organizations, which make it difficult for them to determine their individual and collective skill demands and requirements. This leads to poor links. As a result, the connections between STEM and skill sets and competences that are crucial to the economy are not well understood in practice.

The numerous studies that have been designed and carried out over the previous few years serve as the foundation for National Human Resource Development initiatives.

The National Employment Strategy, the National E-TVET Strategy of Jordan, and the UNDP/JICA research The Labor Market: The Case of Vocational Training in Jordan are some of these studies.

Altogether, STEM is not mentioned as a topic of interest in any of these studies. According to two studies, STEM subjects like science and math are only variables that must be measured in order to be compared to other nations (using the TIMSS and PISA tests). Furthermore, these studies highlight broad and general labor shortages in the market without going into great detail about the competencies and abilities needed to sustain, expand, and develop promising economic sectors. As a result, there is no national policy for the development of human resources that is in action.

INTEGRATING SUSTAINABILITY INTO STEM EDUCATION

Since the general public's understanding of Agenda 2030 and the SD concept is inadequate in Jordan, it is imperative that knowledge and information be disseminated among all people, demonstrating to them that everyone can contribute to the attainment of SD. Implementing these issues in Jordanian education is even more crucial, especially at the tertiary level, where universities have a significant influence on young people's behavior and personality development. Thus, our goal is to investigate and evaluate Jordanian universities' application of the SD concept.

Jordan is undergoing a rapid reform of its educational system. The creation of curricula, training of teachers, utilizing communication and information technology, enhancing teaching and learning techniques, and incorporating new subjects are the primary objectives. Through critical thinking and problem-solving techniques, education for SD can empower concerned citizens to create a world that is socially, environmentally, and economically sustainable.

The main challenge in Jordan is how to merge all sustainability ideas and principles within various educational activities in different universities as there are about two hundred thousand university students who have a direct effect in any social change. The integration of this education is important also in
order to find new ways to create knowledge needed in a world characterized by a turbulent environment and increasing changes [14].

Numerous studies indicate that in previous years, both among students and the majority of the research staff at Jordanian universities, the Education for SD was not sufficiently clear. Unless these issues happened by accident, the majority of academics did not take various sustainability issues into account when they were teaching. The main issue was a lack of training to develop teaching abilities for sustainability. Along with other changes, new staff training programs were implemented to increase awareness among academics and students [14].

Environmental and social issues have been included in a number of STEM courses through either new or modified versions of the existing curriculum. This has most likely been noticeable in the engineering field since these activities usually entail resource and energy consumption as well as changes to the surrounding environment. This last point is particularly relevant to civil engineering. The introduction of life cycle or sustainability assessment methods, sustainable design and materials, systems analysis, and assessments of renewable energy and other clean technologies are a few examples of change [23].

The economy and society of the twenty-first century depend heavily on sustainable development, but there is frequently a gap between the ideals for its realization that students are exposed to from their institutions, the media, and other sources, and the reality of their daily lives in the laboratory. Overall, and particularly in comparison to other campus areas, this area continues to have a very large environmental footprint (energy consumption up to five to ten times that of an office building per square meter, for example), with little real action taken to reduce it. According to Labs 21, users can mitigate some of this environmental impact by being more aware of how their lab activities affect the environment.
Additionally, there are ways to incorporate these insights into the STEM curriculum by having students gain the ability to reflect on and devise plans to affect activities in their own labs. Additionally, a lot of STEM courses require fieldwork outside of the host institution.
Advantages of Long-Term STEM Education are:

(1) Encouraging Critical Thinking: Students are encouraged to think critically, examine issues, and come up with original solutions as part of STEM education. By incorporating sustainability principles, we help them become more adept at approaching environmental problems from an analytical position.
(2) Fostering Multidisciplinary Collaboration: Multidisciplinary methods are necessary to address sustainability concerns. Students from different backgrounds come together in STEM education, which promotes collaboration across areas including environmental science, engineering, and biology. This cooperation fosters comprehensive problem-solving and develops critical teamwork abilities.
(3) Developing Resilience: Students who receive a sustainable STEM education are more prepared to deal with uncertainty and adjust to shifting environmental circumstances. Fostering an innovative culture teaches students to take on obstacles, try new things, and learn from mistakes.
(4) Promoting Moral Decision-Making Through an examination of the moral aspects of sustainability, STEM education instructs learners to contemplate the ramifications of their decisions on the environment and society. This encourages making ethical decisions and having compassion for the environment and all living things.

Indeed, one of the primary competencies in a lot of applied and research-led STEM courses is the capacity to perform fieldwork. Technology and design complement each other, fostering creativity, problem-solving, and teamwork. Practical Design and Technology projects help students develop communication, problem-solving, critical thinking, and teamwork skills, which are highly sought-after in the workforce.

Science education can address complex challenges like climate change and socio-ecological issues by promoting transdisciplinary dialogue and addressing the loss of meaning when dealing with problems that cannot be solved logically or rely on ethical assumptions.

Environmental education specialist and Mexican sociologist Enrique Leff [24] also emphasizes the significance of environmental pedagogy. His revolutionary viewpoint, founded on critical pedagogies motivated by Freirean concepts (Freire [26-27], 1978, 1998), offers educational pathways to displace modern rationality, which is predicated on the concepts of reductionism and objectivity found in contemporary science. According to him, the reductionist scope has allowed science to become more specialized and efficient.

The chemical industry itself is not well-liked by many environmentalists, and the public frequently views its products—"chemicals!"—as innately dangerous and suspicious. Numerous laws and programs, such as the recently passed European REACH (registration, evaluation, authorization and restriction of chemicals) directive and supply chain efforts by numerous retailers, reflect this. This low perception of the environment is further supported by the fact that oil still accounts for 90% of organic chemical production, leaving an extremely large carbon footprint. However, there are a

number of initiatives underway at the undergraduate level to create resources to supplement practical's that illustrate the principles of green chemistry.

A means of characterizing intended educational outcomes is through competencies. They link complex knowledge, skills, and attitudes [13] and include cognitive, functional, ethical, and personal dimensions [7, 8]. The goal of competency-based education is to help students acquire the critical knowledge, morals, skills, and attitudes they'll need to deal with the complicated problems they'll face in both their personal and professional lives later on [9].

The amount of literature addressing and debating the definition and application of competencies for SD has increased over the past ten years. In recent years, a number of authors have proposed lists of competencies related to education for sustainable development and their application. The Barth group [10] discussed how SD's core competencies were developed in higher education, with an emphasis on how these competencies affected both formal and informal learning environments. Brundiers et al. [11] talked about how actual key SD competencies are acquired through learning opportunities. et al. Hanning [12] offered a comparison of the industry requirements and the SD competencies attained by engineers.

JORDAN BACKS SUSTAINABLE DEVELOPMENT STRATEGY

Even though every developing nation is at a different stage, many of them have made significant strides toward advancing SD. We're heading to draw attention to how the SD strategy and SDGs are being applied in Jordan is a chosen nation in the global south. Jordan has made significant advancements in economic, social, and human development over the past few decades, investing heavily in infrastructure and human resources while also raising living standards, according to the UN (UN Knowledge Platform, 2017). Jordan was among the first nations in the world and the Arab world to take action toward the Millennium Development Goals (UNDP, 2000), and it was a very successful move. However, it has encountered numerous significant difficulties over the past ten years.

This raised the pressure on Jordan's finite resources, particularly the sustainable management of its water resources, and led to an increase in the country's debt and budget deficit. The world community must assist the nation in addressing these issues.

Despite this, Jordan is committed to the 2030 Agenda and works to involve every member of the public. This is partly because the nation actively participated in international consultations to develop the post-2015 agenda, and Queen Rania was one of the 27 world leaders who advised the UN Secretary General on the 2030 Agenda's structure. The Agenda was naturally adopted as a result of this. The Jordanian government unveiled plans for putting the SDGs into practice and accomplishing them, along with Jordan's top goals in this area. The first, which served as the cornerstone for all subsequent initiatives, involved increasing public awareness of the 2030 Agenda and the SDGs, targets, indicators, and implementation (UN Knowledge Platform, 2017).

Jordan has developed numerous significant national plans, laws, and strategies to implement the 2030 Agenda. One of the most significant is the Jordan 2025 strategy, which includes a number of Sustainable Development Goals (SDGs). These include the elimination of poverty, enhancement of the educational system, supply of clean water and sanitation, assurance of decent work and economic growth, and creation of sustainable communities and cities (UN Knowledge Platform, 2017). The UN Country Team, which consists of 17 UN agencies operating in Jordan, was established to support the achievement of the Sustainable Development Goals (SDGs) and to help national institutions boost performance and improve capacities to deliver on Jordan 2025 and the SDGs (UN Knowledge Platform, 2017). It also aims to increase individuals' awareness of their rights and provide them with access to information, education, skills, and services; to support the engagement of people and youth in economic, environmental, and social processes; and to support Jordan in responding to the refugee crisis, among other things (SDG Knowledge Hub, 2017). Jordan is a crucial international ally in the pursuit of the SDGs. To ensure this, though, it requires ongoing and increased financial and technical support. The Jordanians' perspective is significant because they view the 2030 Agenda as a shared duty. The UN delegates also emphasized Jordan's excellent cooperation in accomplishing the SD agenda. This nation is making notable strides, particularly in the areas of food security and water scarcity (The Jordan Times, 2017).

The world community believes that the 2030 Agenda has the power to alter our planet. Jordan is happy about it and is seeing significant advancements in its goals. Cross-cutting concerns like energy, water, and climate change are essential to achieving all of the SDGs as well as to Jordan's development, security, and fight against poverty. The SDGs are crucial for this nation, so all members of the community must be involved in the actions, which must be carried out thoroughly and collaboratively.

SUSTAINING EFFORTS TOWARDS SUSTAINABLE DEVELOPMENT

Jordan delivered its report on the Voluntary National Review (VNR) to the UN Political Forum on Sustainable Development in July 2017. The VNR outlines Jordan's plan to implement the SDGs and facilitates partnerships among multiple stakeholders. Jordan desires to concentrate on increasing community awareness and capacity-building, as in addition to supporting the statistical system to put the SDGs into practice locally and domestically (UNESCO, 2017). It emphasizes how important it is for scientists and policymakers to support the SDGs. Jordan wishes to assist the private sector and civil society in accomplishing the SDGs. Jordan seeks to increase information accessibility and incorporate these concerns into higher education. The intention is to demonstrate to individuals their genuine role in the process of development. Additionally, there is a particular UN project that concentrates on three main objectives that are crucial for

Jordan's SD challenges: SDG 6: Guarantee universal access to water and sanitation; SDG 7: Guarantee universal access to modern, affordable, dependable, sustainable energy; SDG 13: Act quickly to mitigate the effects of climate change. The project's primary objective should be to give policymakers a framework for better understanding the SDGs' implementation process, placing the objectives within already-existing environmental initiatives, and formulating plans for how to get there (WANA Institute, 2017).

APPLICATION OF THE CONCEPT OF SUSTAINABLE DEVELOPMENT AT A FEW JORDANIAN UNIVERSITIES

Following the disappointing outcomes in Jordanian higher education, the challenge was to develop creative institutional and organizational structures in research and teaching that would, through the process of mutual learning among all parties involved, result in creative solutions for future development. As a result, we will analyze the results of our investigation from six particular Jordanian universities in this section, as well as the state of affairs in the field we studied. Higher education in Jordan is typically proactive in educating the public, instructors, and students about SD issues and strategies. There are significant efforts being made to raise awareness of these issues, primarily through specialized study programs that are offered at each university under review and focus on SD issues. The majority of the institutions under examination then establish a variety of research centers. Additionally, arranging various scientific gatherings—primarily national and international conferences—is well-liked. Academic staff members conduct extensive research, which is primarily accomplished through research projects.

International conferences on SD issues are still held more frequently, with Jordanian universities organizing them in collaboration as well. The various Jordanian universities are working together in a robust and proactive manner to integrate SD concerns into their curricula.

Via numerous EU projects, Jordanian universities have demonstrated a strong and active partnership with European universities in order to support significant global issues, challenges of the day, and SD-related concerns.

In light of Jordan's challenges, Jordanian universities are primarily engaged in the areas of energy resources, water scarcity, and the environment as priority SDGs. Every university under review is involved in SD education. Our research's conclusions allow us to conclude that BAU and UJ are the most active in this area. All of the universities under investigation show signs of growing awareness, and most of the staff members we asked to assist us with the research were knowledgeable about the idea.

At every university under review, there are still more scholars working on these problems. Associated with the SD concept, primarily working in the areas of climate change, water management, and renewable energy, which align with the most significant SD established priorities for Jordan

DISCUSSION AND CONCLUSION

We can conclude from the findings that there is a notable and expanding interest in integrating SD issues into Jordanian higher education. Nonetheless, it is evident that there are still certain areas in which the SD concept and strategy's presence and level of interest can be strengthened. In light of this, we offer the following suggestions as a conclusion, based on the findings of our investigation and analysis.

The public and civil society still need to be made more aware of the 2030. Agenda, which includes comprehending the SDGs' potential and nature as well as how individuals and institutions must change to address SD in all facets of education systems, not just in particular study centers or programs.

SDGs are overarching concerns that can be incorporated into all academic programs to ensure that all students receive the proper instruction, understanding, and training. There is also a need for national government support. Larger private sector assistance would also be suitable and beneficial. "In the context of the demands of modern society, there is a need to develop new global skills for today's global labor market" [15] impacted by globalization and related issues.
In order to raise awareness of the issues, it is necessary to encourage greater openness and increased access to data and information for the government, institutional authorities, and entire civil communities through ICT, online social networks, and community media [16].

More practical learning can also help Jordan's higher education system in the area of SD education. Acquiring theoretical knowledge and information is valuable, but it won't have the full impact until it's properly connected to practice. Students need to be made aware of reality and taught how they can each make a personal contribution to global sustainability. Youth in particular need to understand their place in this process more fully [17].

The improvement of SD education at Jordanian universities requires ongoing support for academic training because there is a continued need for globally educated and prepared teachers (see more in [15]) and other professionals. This is necessary so that the general public and students can obtain the necessary knowledge and information from highly qualified experts in an efficient and long-lasting manner [18].

A wealthier and environmentally friendly future for our world can be shaped by sustainable STEM education, which is a transformative force. We prepare our children to be the environmental stewards that our world sorely needs by instilling in them an earth consciousness in this digital age. Together, let's seize the opportunity presented by STEM education and move decisively in the direction of a robust and sustainable future.

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