Open Education and Open Science in contexts of crises

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Abstract. Open Education and Open Science are powerful tools for Education. They can provide content, access, means and collaboration to anyone interested in learning, worldwide. Further, in contexts of crises, they increase their impact and outreach. There are many types of crises, from natural ones, such as earthquakes or hurricanes, to man-made produced, such as wars, occupations, migrations or financial recessions. In these cases, an open approach to use, re-use, share and produce, guarantees education and science, even in the hardest conditions. In this paper, the authors present an overall approach to openness and crises, and how to implement them based on competence frameworks. As a specific resource, the paper introduces the Open Education & Science Crisis (OES-Crisis), which is based on five components in the form of skill-sets: 1) literacy skills, 2) digital literacy skills, 3) safety and security skills, 4) hope and resilience skills, and 5) life skills.

Keywords: Open Education, Open Educational Resources, Open Science, Crises, Emergency Education.

1   Introduction

While the world is suffering from many crises nowadays and more to come are expected, the children's right to quality education has been compromised. Millions of children have been unable to continue their education safely and normally [1]. A big question is raised here: How can we ensure education for children in crisis situations? Either schools are closed, or children are in danger inside their schools. Teachers are unsafe, parents are worried and unsure about sending their children to schools. Many local and international institutions have worked very hard to ensure access to education in the past and were unable to sustain children's right to education, nowadays technology evolution is promising to solve many raising problems in times of crisis. In some countries, girls, in particular during an emergency situation, leave schools not only for the above reasons but also due to the possibility of being raped or killed on their way to and from schools. In conservative societies, many girls are prevented from going outside the shelters and staying inside to look after elderly people or taking a vital role as housekeepers.

Since the world is becoming a small village through the virtual life experience and digital development and rapid change in IT sector, you can reach, access, visit and communicate with anyone, anytime and anywhere in less than one second, a new opportunity for learning is open through Open Educational

Resources (OER) and Open Science. Many learning and research materials, such as online documents, videos, images, learning simulations, datasets, research results, and online lectures are shared free online and could be easily used by learners [2].

Children lost more than 70% of their learning process due to crises, conflicts, and natural disasters [1], as an example during COVID-19, two years of closure have disturbed children learning around the world and a new plan for recovery is urgently needed. Going back to schools and universities is not enough to substitute the learning loss.

2   Openness, in many ways (Education, Science, Competence Frameworks)

Openness is a merging term with multiple uses and meanings, reflecting the flexibility and comprehensive values as mentioned in [3].

Open education is defined as education without boundaries, many definitions from different researchers have been discussed. All definitions have mentioned at least 2-to 3 common terminologies such as free, freedom, accessibility, use and re-use, sharing, education for all, justice, and equity. Oliver [4] shed light on open education as an opportunity for freedom in education through flexibility, but in many cases, it is not used as it should be, while Farrow [5] argues the possibilities of open education to strengthen critical pedagogies and empower critical changes in education through creative solutions. From the writers' point of view, open education is free of charge, with no previous requirements to use and re-use, and could be accessed from any place, any time, and from anyone. So instead of going to schools and universities to learn, they come to you.

3   Open Science

Open Science represents a new approach to the scientific process based on cooperative work and new ways of diffusing knowledge by using digital technologies and new collaborative tools [6]. Further, there is an evolution in the open movement. Until 2015-2016, content and Open Educational Resources where the key element (and usually the only one) in the openness movement [7]. However, many other pillars were added along the way: access, technology, data, etc. [8]. This combination of pillars was modelled into what is now called Open Science, which mainly works with STE(A)M subjects [9]. Burgos [10] also supports this idea by a set of contributions focused on the implementation of Open Science, starting with the integration of all the basic pillars in the process. Further, the main question to address is how Open Science can contribute to complement official, accredited competences in STE(A)M in an effective way [11].

European academic programmes are structured in academic credits and competences, which are the building blocks of accredited programmes. Other countries in Africa (i.e. Morocco, Tunisia, South-Africa, etc.) follow the same pattern [12]. In other regions, like Latin America, USA, Australia or Canada, the basic unit is the academic hour and the learning outcome [13]. In China and India, there is a co-habitation of academic credits and Grade Point Average (GPA) [14,15]. Lately, a combination of these units is understood, translated or even applied, despite the own regulated unit; it is becoming usual to find the regional accreditation scheme along with a translation into other foreign schemes. For instance, an academic course depicted in European Credit Transfer System (ECTS) consistently used across Europe and the Bologna agreement, but presented with the equivalent learning hours, so that Latin American students can find a match to their educational systems [16, 17]. With the definition of competences happens very much the same. this research takes a competence as the building block of the whole accreditation scheme, since it is widely used in Europe and commonly accepted and translated, worldwide [18].

In this context, a competence is defined as "the ability to meet individual or social demands successfully, or to carry out an activity or task" [19]. Further, a competence is achieved based on individual work, group work, nurtured knowledge, personalised mentoring, exploring, practice and many other ways [20-22]. The systems to measure the progress and achievement of a competence are

diverse, but they always imply a series of metrics, with a possible combination of quantitative and qualitative control milestones [23]. Further, these resources and their tracking can take place in the academic, official environment, in a class, lecture, lab test, field work or through a number of assorted resources and channels. However, it can also happen off-classroom. Learning happens anytime, anywhere, any-how [24-25]. The instructional design has taken since 2003 key elements of inside and outside the classroom, to create the most personalised learning setting for the best learner performance [26].

Open Science makes use of that rich environment, it models the popular eagerness for openness, and it creates an extended learning and teaching setting to pursuit the academic objectives and achieve the related competences. Open Science is based in access, technology, content and other already cited pillars [7]. Burgos [27] also presented the OUF coding to name Open, Universal and Free resources, so they can be properly labelled and used in the context of Open Science and Open Education. They all might work together despite a) the official accreditation of the programmes, b) the basic building block (e.g., ECTS or hour) and c) the way to interpret the competence transfer from the academic world to the labour market [28,29]. Further, Open Science can be built on many subjects such as Literature, Music, Sociology and, of course, Science.

4   Open Competence Frameworks

Competences are defined in many ways. As per Ossandón and Castillo [30], competence comes from moving from knowledge to action. Competence is the performance of activities within a given context. For Tardif [31], a competence is an efficient combination of internal resources and complex knowledge. Alles [32] defines a competence like the combination of skills, knowledge and general motivations that are defined to meet some requirements in diverse contexts, so that they all keep the same meaning across those contexts. Further, competences are categorised into basic, generic, strategic and specific, usually [33,34]. Basic competences are those necessary to live and to get by in society and are usually linked to issues relating to living with others, communication, and information processing. Generic competences are those common to several professions, such as resource management, teamwork, information management, problem solving, or planning. Specific competences are those of a certain profession. They provide compulsory, unavoidable skills needed to get a qualification [35].

In academia and learning environments, generic and specific get more attention and allows for a more personalised way to develop the student or professional expertise [36]. Recently, for the last three or four years, all these competences are seriously designed, developed and assessed as a framework, instead of as isolated links to a concrete subject. Lopez et al. [37] support the combination of inputs to build a strong competence framework. They take these definitions and combine some features to produce an open competence framework based on STE(A)M subjects. There is a concern about how to migrate from subject-bounded competences to an integrated, open framework. In Europe, the Bologna process gathers 28 countries and tries to normalise a number of indicators and requirements for performance and success [38,39]. One of the key elements of the process is the use of competences to build academic programme. In an academic programme under Bologna the main elements are: Competences, learning results, credits and subjects. Structured in European credits (ECTS) an academic degree is given when the student is proved to have achieved the related competences for a specific area of knowledge [40,41]. Further, the competences are the actual building blocks of the academic degree, since they become the outcome of performing a learning process. They are interactions between activities and contexts, including "knowhow", "knowledge", and "knowing how to behave "and "knowing who you are".

A competence framework bridges academic environments and labour markets, in many ways: The basic competences are cross-topic; the generic competences are useful to perform better as a worker and to integrate better in any professional community; the strategic competences are linked to a broader vision into a certain field; and the specific competences provide the student with clustered knowledge in a certain area of that very field [42]. An academic programme must be necessarily linked to the market, so that the student does not achieve competences for nothing, but with a further purpose. These frameworks are the backbone that connects learning results with required skills and knowledge in the

market. Without the competences, both sides of the same coin are unconnected, which might lead to unemployed graduates or to qualified workers without an academic degree.

Further, these frameworks help normalising the requirements, the achievements and the expectations, from every party. In doing so, all the graduates that achieve those competences are guaranteed to have the requirements to apply that competence in the market, no matter the institution, region, language or any other demographic factor that might cluster them. This means that a framework is valid as long as it is properly integrated into the contexts where it should play (e.g., university and labour market) [43].

In addition, in the academic side, these frameworks must be integrated with the pedagogical model and the educational policy. These three instruments allow an institution for a structured and thorough approach to every educational level, role and activity in the educational system [9]. For instance, Burgos [44] presents a common effort through every stakeholder in a Higher Education institution, and he builds a policy, validated by 25 external experts, that interweaves every layer, work group and competence. In doing so, everyone is committed and accountable, and every competence becomes a part of the full structure. Further, a competence is a building block, as mentioned before, however is not an isolated one. That very block requires others (e.g., competences) and other elements (i.e., skills, metrics, educational resources, assessment protocols, quality controls, etc.) in order to create, support and improve the educational system in which they live in [45].

5   The OES-Crisis competence model in Open Education and Open Science

The researchers think of Open Education and Open Educational Resources as an opportunity to sustain education and recover the loss during crises by the following competence model, named as Open Education & Science Crisis (OES-Crisis).

5.1   The Model Goal

The main aim of this model is to ensure children's right to education through OER use in times of crisis and emergency. It is proposed that through OE and OER governments and institutions will be able to provide Children with needed knowledge, skills, and attitudes to survive and sustain their education. The Model could be used at the policy level, middle management level, and classroom level. While policymakers could be able to ensure all legislative, regulations, and infrastructures that are needed to ensure implementations. Middle management levels could be able to offer plans for implementations and conducting follow-up and assessments. School teachers, leaders, and parents could be able to reshape their children's daily activities to empower them through the model components. Children and young people are indirect beneficiaries of this model through its reflection on their life. The model will provide different components related to children well-being and insights into the future of their learning (see **Fig. 1**).

Fig 1. The Open Education & Science Crisis Model (OES-Crisis)

5.2   Model components

The model will consist of five main components that will elaborate on different competencies that are needed for children in crisis situations and at the same time ensure their basic needs for a better future and a peaceful life. In crisis times many institutions offer services on the Humanitarians' levels in order not to achieve the minimum standards of education in crisis but also to be more optimistic to sustain a high quality of education and life. In 2010 INEE published its handbook titled "INEE Minimum Standards for Education: Preparedness, Response, Recovery" as a solid step towards ensuring education for all.

Component number 1: Literacy skills

This component will focus not only on reading, writing, and numeracy skills but it will focus on an advanced definition of literacy that involves communication language related to the type of conflict and crisis situations. As Zakharia & Bartlett [46] defined literacy as a broad concept that includes lifestyle, language, conflict type, social, political, and cultural aspects of communications. So, this will depend on several factors in order to determine the content. Basic skills for children of different ages will be developed as an open resource that children will have access to them offline and online. The needed skills will be divided into three main levels. Level one will be for the minimum skills needed for any child age less than 10 years at the school level as globally agreed on. Further, children who are at school in the age or drop out of school for crisis situations should continue their learning until they are empowered with level 1 literacy competencies. Level 2 will be reading, writing, and numeracy skills for grades 12-16 which will concentrate on readings related to conflict resolutions, peace reconstructions, and family support. And finally, level 3 is related to reading historical essays for similar cases to drive lessons and best practices for future projections and related interventions. Role models will be a good strategy for learning to accept severe circumstances. Children with special needs should be also prioritized.

As an example, after the pandemic, it was necessary to develop a compensation plan for learning loss, especially for grades 1-4 around the world. Developing online manuals for teachers and parents could be a great support.

Component number 2: Digital literacy skills

UNESCO [2:23] defines digital literacy as "the ability to define, access, manage, integrate, communicate, evaluate and create information safely and appropriately through digital technologies and networked devices for participation in economic and social life. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy, data literacy, and media literacy".

There are two faces for the need for digital literacy competencies in times of crisis and emergency situations that should be developed through OER. The first one is how to be safe online while the second one is how to be able to distinguish between fake news and the real one, especially in crisis times, many rumours became part of the normality. Digital literacy skills nowadays are more needed than before, especially with the rapid growth of children and youth's access to the internet. Children and youth are digital citizens but unfortunately, many of them lack the knowledge, skills, and attitudes needed to be good digital citizens. As an example, many unaccepted photos from war victims will be published and shared online through social media which might have negative impacts on children's wellbeing and may raise children's fears and cause nightmares.

When youth have digital skills, they may use these skills to raise awareness for their case and be able to send evidence to international communities and legal institutions in order to support their case.

A clear example is when people from East Jerusalem (Sheikh Jarrah) were able to produce short videos and publish them online to get international support to save their homes and families. Kurdi's family was able to gain consensus on their case and postpone their house demolitions.

Component number 3: Safety and security skills

In times of crisis, children are in danger and in need of protection. They need to learn how to save their lives and secure their basic life needs. Their wellbeing is essential not only in normal situations but also in emergency situations. Children are in danger of being killed, abused, or violating their right to life, health, education, or safe shelter. Children are in need to learn how to be safe. UNICEF [47] considers the urgent response of children to protection as a priority and part of the UN humanitarian role to ensure children's wellbeing since they are a vulnerable group. Their right to protection is part of the Convention on the Rights of the Child (CRC) as well as their right to education, life, and health. Children and youth need to learn how to survive in emergency situations, UNICEF with others [1] have developed the 26 minimum standards for children protections that governments should work on in order to ensure their protection.

Physical and mental health stand at the same levels of importance, while digital safety is also vital in the era of technology.

Component number 4: Hope, and resilience skills

In times of emergency and crisis usually, children lose hope and get frustrated, scared, and unsure about their future. They are unable to think, they have big worries, and unable to express themselves. The crisis usually negatively affects their emotional wellbeing, so it is important to educate them on how to rebuild their hopes and confidence and give them strategies to cope and re-imagine their future. Save the children consider psychological support as a good solution and a priority and an essential need for children.

OE and OER are great tools to provide hope for children in emergency situations in different forms and strategies to meet the needs of different learners' styles.

As an example, online games could be developed to engage children in a crisis situation in order. Also, many videos could be produced to improve children's spirit and raise their resilience with strong speeches and similar success stories from history.

Component number 5: Life skills

Different terminologies have been used to describe these skills such as soft skills, 21century skills, and others. In emergency situations, these skills are much needed to achieve the above 4 components of the model and they will help children and youth to be able to develop their learning and reach their potential in social-emotional development and at the same time be able to continue their lives despite all the difficult circumstances around them. There are many frameworks that describe life skills but in this model what we are suggesting is flexibility, leadership, being initiative, responsible, and productive. Problem-solving, self-control, and conflict resolutions are very important skills for these critical situations.

OE and OER could be suitable tools for developing these skills in times of crisis, where parents, educators, and teachers could use well-developed guidelines to empower their children and students.

6   Conclusion

Open education and Open educational resources have been used widely in normal and also crisis situations. What is proposed here in this paper is to plan an effective, well-prepared course through the suggested model in different languages to sustain children and youth education in Crisis situations. Education is a human right and should be protected in conflict zones and natural crises from being violated. It is very difficult to keep Children motivated for education while they are in danger or insecure, or maybe their schools have been damaged or they have been displaced.

The humanitarian response organizations consider education as the main factor to protect children and empower them. Formal education will not be able to sustain and offer quality education for several reasons, so a new form of education should be developed and offered in order to meet the needs of children. Their needs are highly vital to be considered according to culture, social, political, and conflict context, since each crisis has its own requirements, and each community has its own culture.

Resistance to learning will be a key issue to consider when planning to implement this model. Parents' and teachers' involvement is vital, but after setting up an urgent capacity-building program and providing them with professional guidelines and designed toolkits.

The OES-Crisis model as described consists of five different components, each component will be divided into several learning objects and each object will be designed online as an open educational resource. Each learning object will be opened for all under a Creative Commons license, and it will be presented in several learning forms such as textual, audio, and visual to meet different learners' styles. The learners will have the access to print the textual learning material, reuse and share, to give the chance for children from low income and disadvantaged areas to use it. Teachers and parents will be able to use, adapt, and share OERs. Finally, this model should be designed for implementation through collaborative work on a governmental level globally, followed by an assessment and evaluation process, to test its applicability and validity for international users.

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