

REMOVING EDUCATIONAL BARRIERS FOR OUT-OF-SCHOOL-CHILDREN USING AN INNOVATIVE FRAMEWORK

Izharul Haq^{1*} and Rubina Haq²

¹Dr, Prince Mohammad Bin Fahd University, Saudi Arabia, ihaq@pmu.edu.sa

²Mrs, International Islamic University, Pakistan, rubinahaq54@gmail.com

*Corresponding Author

Abstract

It is estimated that there are over 300 million Out-Of-School Children (OOSC) worldwide. There are several factors that place barriers that prevent OOSC from receiving a basic education that is, both equitable and affordable. These barriers include the misuse of funds, delivery of quality education, teacher's absentees, as well as the lack of necessary resources. Furthermore, even after the above-mentioned requirements have been met, unfortunately, there are still even more complex and challenging barriers, one of which is the proper Monitoring and Evaluation (M&E) of the teaching and learning.

United Nation (UN) Sustainable Development Goal (SDG) number 4 is on quality education aimed to significantly reduce the number of OOSC. Tremendous amount of effort, funds, and resources are being directed by governments, private/public organizations to meet the target. Unfortunately, in some places, the donated funds are misused e.g., to set-up fake schools also known as 'ghost schools'. It is extremely difficult for the governing authorities to prevent organizations, often under the disguise of Non-Governmental Organizations (NGOs), actively taking part in such corrupt activities. This is considered to be the main barrier preventing OOSC from receiving their right to quality education. If these problems are not resolved satisfactorily it results in the cancellation of funds.

To prevent corruption the government currently uses M&E methods which are outdated such as inspection of schools, student surveys, interviews with teachers and administrators of the school. However, these methods lack transparency, accuracy, accountability and are highly subjective. Furthermore, inspectors are often dispatched to schools in faraway places to gather data on how well they are performing in terms of the appropriate use of funds, resources, and quality of education. It is important to bear in mind that such inspections are usually very expensive (salaries, traveling costs, accommodation, food, etc) and hence not always feasible. Usually, inspections are delegated to third parties which often exacerbate the problem in terms of the reliability of data and thus adding further barriers for OOSC.

Currently, Pakistan is in a state of education crisis where 1 out of every 10 school children worldwide are OOSC. The current statistics show that Pakistan has a staggering 44 percent OOSC. There are over 51 million children between the ages of 5 and 16 years of which only 56% attend schools while the remaining 44% (22.44 million) are out of school. There are many reasons for such a high number of OOSC which include child labor, lack of family support, unavailability of public schools in rural areas, etc. For Pakistan to solve these problems it must first eliminate the misuse of education funds which can be used to set up more local schools, reduce child labor and provide a financial incentive for parents. One way to do this is for the government to eliminate the existence of fake public schools which are rampant in Pakistan.

In this paper, we propose a new innovative educational framework that would eliminate the existence of fake schools in Pakistan. The framework is called ROFSET (Real-time Objective Feedback System for Effective Teaching). ROFSET is essentially integrated automated Artificial Intelligent (AI)-technology-based M&E techniques and processes whereas compared to the traditional M&E methods which are entirely manual. Preliminary results of using the ROFSET M&E framework shows promising results and are presented in this work.

Keywords: Out-of-school-children, Quality education, Monitoring & Evaluation, Educational technology, ROFSET, Fake schools, Pakistan, UN SDG, Educational accountability.

1 INTRODUCTION

Education is considered to be one of the most important components of an emerging nation in terms of its economics and the well-being of its citizens (Saqib, Panezai, Ali, & Kaleem, 2016; Memon, Joubish, & Khurram, 2010). The United Nation Sustainable Development Goal (UN SDG) number 4 (Unterhalter, 2019, p. 39) on education is truly ambitious which aims to provide education to over 300 million out-of-school-children (OOSC) worldwide by the year 2030. The goal is to provide 'quality' education and not just education. UN member countries are aggressively working one way or another to meet their set targets (Ridge, Kippels, Yimbessalu, 2019, p. 55). Various private and public organizations, Non-Governmental Organizations (NGO) and charities have received a great deal of money from donors to provide education opportunities to these needy OOSC. However, it is not easy or straightforward to determine how the vast amount of the donated money provided to these not-for-profit organizations is actually being used to meet the required UN SDG targets for education.

As yet there is no objective way of ensuring equity, quality and accountability in education for OOSC. Due to lack of proper and effective M&E system there is no way to ensure that the students and teachers are actually attending classes. Furthermore, there is no way of checking how many students actually drop out of school (UNICEF, 2016). The work described in this paper provides an AI technology-based framework that can overcome the Monitoring & Evaluation (M&E) challenges facing the UN SDG for education. The Framework we describe here is called ROFSET (Real-time Objective Feedback System for Effective Teaching). The implementation of the ROFSET framework is cost effective, scalable, data collection and analysis is in real-time and it is easy to deploy. Before we go into the details of the ROFSET Framework let us look at some major issues hindering the achievement of the UN SDG 4 for the OOSCs.

1.1 Ghost Schools Plague in Poor Countries

Recently, it was found that 15,000 teachers and 900 ghost schools were discovered in Pakistan and the funding for running these schools was immediately stopped. Similar results were found in Nigeria, India, Afghanistan, Bangladesh. For example, an organization may claim to be providing education to the OOSC but it is very hard to verify the claims due to expenses, compromised personnel doing the M&E at the local level and corruption (Kazmi & Quran, 2005; Malik & Hassan, 2015; Memon, 2007).

1.2 Current Monitoring and Evaluation Methods

Unfortunately, the M&E problem is not confined to only the OOSC but is a general worldwide phenomenon in many education institutions both private and public. It is more prevalent in the poor and developing countries. These methods to oversee the education institutions rely on out-dated M&E techniques that are unsuited for today's requirements. Furthermore, the M&E methods are costly, inaccurate, subjective and intrusive. For example a M&E method described by Marsh *et al* (Marsh & Roche 1997) is highly time consuming where the data is collected manually through various surveys. The results are then analysed and interpreted through consultation hence adding an extra layer to the M&E process.

It is important to acknowledge from the start that implementation of the ROFSET framework would be a top-down approach e.g., Governing authorities, school head, department head and teacher. The following are some of the challenges facing the education regulatory bodies and issues that cause huge impedance to achieving the UN SDG 4 for the OOSC (Henry, Dickey & Areson, 1991).

1.2.1 *Intrusive methods:*

One or more inspectors observe classes to evaluate teaching and learning effectiveness. This method is intrusive and usually changes the way a teacher will teach during an actual observation.

1.2.2 *Expensive:*

External inspectors are costly. Hence the frequency of their observations is usually once or twice a year.

1.2.3 *Student feedback:*

Student feedback is usually not accurate and is highly biased. A strict but an effective teacher may receive poor evaluation perhaps because he/she is giving too much work, strict on attendance etc.

1.2.4 *Time consuming developing course portfolios:*

Enormous amount of time is required to develop course portfolio. It is usually prepared under a lot of pressure and it is most likely inaccurate.

1.2.5 Subjective:

Data and information gathered by the inspectors are subjective.

1.2.6 Mundane tasks:

Instructors are required to map, track and analyze all learning outcomes.

1.2.7 Cumbersome:

Analysis of learning outcome is complex and requires a great deal of teacher's time and effort. Mostly it is inaccurate.

2 THE ROFSET FRAMEWORK

There are no methods currently available for accurately measuring teaching and learning effectiveness; tracking student learning outcomes; use of education technologies; effective pedagogies used etc. To get accurate data on teaching and learning an out-of-the-box solution is needed.

Technology alone cannot solve the present M&E problems without having some sort of intelligent agent continuously performing M&E. In this paper for the first time we propose a new type of quality assurance education framework called ROFSET. The ROFSET Framework (see Fig. 1) has some unique built-in characteristic features including:

- a. Real-time: Teaching and learning data capturing is done in real-time.
- b. Non-intrusive: It does not interfere with the teaching.
- c. Objective analysis: It is machine-based system thus it is not subjective.
- d. Automated: Data capture and analysis of teaching and learning is done automatically.
- e. AI engine: All inferences on data is done by algorithms embedded in the ROFSET Framework. AI Engine generates reports and provides feedback to teachers on all Teaching and Learning Key Performance Indicators (TL-KPI).

To test the ROFSET Framework a pilot application was developed in the form of a presentation application and we called it PowerTeach (PT). PT is a thin client that can be used to teach any course in the same way that we use Microsoft PowerPoint. The difference between the two is that PowerTeach has an intelligence engine in the background continuously gathering data and analyzing data of all the TL-KPIs in real-time.

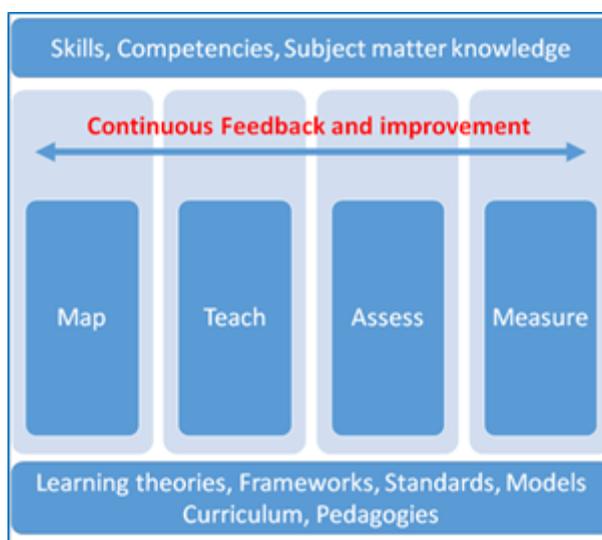


Fig. 1: ROFSET Framework Architecture

2.1 Automation of M&E Using the ROFSET Framework

In general automation has given us great benefits. Automation is everywhere, automation has given rise to

the industrial revolution, the printing press, mass production, and automatic speed cameras on highways etc. Everywhere we look we see automation. By de-facto automation is cost effective, provides standardized products and services, and allows machines to be operational 24x7 without much human supervision. All measurements are objective.

With this in mind we have developed the ROFSET Framework to fully automate the entire M&E process in order to ensure equity, quality and accountability in education for the OOSC. As we will see automation (or machine-based M&E system) will be the key aspect which will pave the way to overcome the UN SDG 4 issues discussed earlier.

2.2 Content Mapping in the ROFSET Framework

The material or the content taught to the students in a class taught by a teacher is based on a prescribed syllabus/curriculum and is usually designed by Subject Matter Experts (SME). To distinguish between the traditional course content/material and that used in the ROFSET we describe the traditional teaching material as 'passive' in the sense it is unable to respond to the teacher's interaction with it.

In the ROFSET Framework we transform the passive traditional teaching material into what we call 'active content'. This is done by tagging and defining the response of the content when the teacher interacts with it. Not all the material is active. The active components are referred to as active objects' and they all have specific data and function associated with them.

The process of tagging is done by SME during the compiling of the teaching material or it can also be done by a qualified teacher. The process does not take long and only has to be done once and not every time the material is taught unless of course there is a major change in the syllabus/curriculum. Hence, it is very efficient and effective. This one-to-many mapping is shown in Fig. 2.

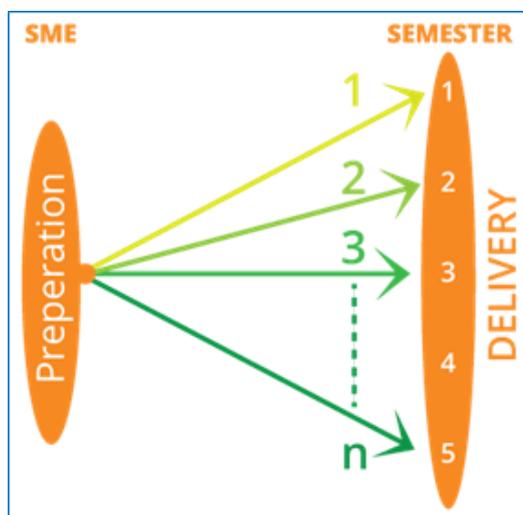


Fig. 2: Active Content Mapping

The active objects are able to receive and pass on information continuously to the AI engine in the ROFSET Framework. All this is happening during the actual teaching. This interaction data is analyzed by AI algorithms that correlate content with the TL-KPIs to generate reports. The AI interface is seamless and is completely non-intrusive to teachers and students. The ability of the ROFSET Framework to make the teaching content active is crucial to achieve equity, quality and accountability in education for the OOSC.

2.3 Measuring Teaching Effectiveness Using the ROFSET Framework

We begin by defining what we mean by quality education. Quality education can be defined as teaching and learning according to a set of education standards typically encapsulated in the country's National Qualification Framework (NQF). Most countries follow the Outcome Based Education (OBE) framework. Different countries have developed their own methods to ensure accountability in the OBE system (Skedsmo, Huber, 2019). Each course has a number of Learning Outcomes (LO) that must be learnt by students upon the completion of each course. The manual process of managing and ensuring that the LOs are properly covered during teaching is extremely hard.

For teacher's evaluation we often rely on student feedback, exam results, peer reviews, and class

observations which are all subjective methods. The problem of having these checks and balances for the OOSC is even more troublesome because most of these schools are located in rural areas. Sending observers and inspectors to evaluate the teaching is very costly and often not practical. Relying on local personnel often give rise to compromised results. In order to overcome these issues we have defined several important TL-KPIs which can be tracked and measured automatically. Table 1 gives a summary of five TL-KPIs that can be used as a measure of quality education.

In this paper we will present our findings for three TL-KPIs namely Course coverage, Learning Outcome coverage and student participation. This will ensure the proper running of schools, presence of teachers and delivery of quality education. We have selected these because they provide the three key results we need for this work namely equity, quality and accountability.

Table 1: Teaching and Learning Key Performance Indicators

TL-KPI	Description	Measures
Course coverage	How much of the course content was covered based on the prescribed syllabus requirement.	Accountability: The teacher has actually covered the course according to the syllabus as expected.
Topic Depth (time dependent)	Have the relevant topics been adequately covered as required in terms of time and depth.	Quality: This to a certain degree provides the quality of teaching. For example, it measures the relative time spent on easy and hard topics.
Learning outcomes	To what extent the learning outcomes have been covered.	Quality: How many LOs have been covered. How much time was spent covering them.
Pedagogy	What methods were used to teach the various topics?	Quality: What methods and techniques were used in teaching?.
Student participation	How well the students participated and were engaged in learning.	Equity: Comparative analysis between genders.

2.4 M&E on Any Smart Devices and Anywhere

Once the ROFSET Framework is used the feedback and reporting on all the TL-KPIs are available on any smart device anywhere and anytime. ROFSET Framework is cloud-based, distributed architecture. If there is any deviation from the expected teaching and learning deliverables that have been predefined automatic alerts are sent to the monitoring agency or to the responsible person in charge of the M&E.

3 RESULTS

In this paper we describe the results of measuring the three TL-KPIs of Table 1. The data was gathered from two schools in the UK. The data was collected manually to test ROFSET Framework. In this work we have not taken into consideration the Hawthorne effect which states that the behavior of an individual changes when being observed analogous to the Observer's effect in Physics.

The results are provided in the form of graphs for better visualization and interpretation. We have not used all the 20 TL-KPIs as described in the ROFSET Framework. We selected those that are more relevant for the OOSC in terms of availability of resources. For example we have left out TL-KPIs such as video and audio capture, access to Learning Management Systems (LMS) such as Blackboard, Moodle etc. These TL-KPIs will play a less significant role for the OOSC.

3.1 Course Coverage

Fig. 4 below show the course coverage of three subjects namely Chemistry, Physics and Biology for Grade 10. We can see from the graph that Biology course had a coverage of 68%, followed by Chemistry at about 53% and Physics at 46%. The latter two would be of concern to the head of department. In this particular case this was discovered towards the end of the course and immediately red lights were flashing. Extra intensive classes were given to students in the last 2 months to cover the missed material. This placed a lot of pressure on student and faculty.

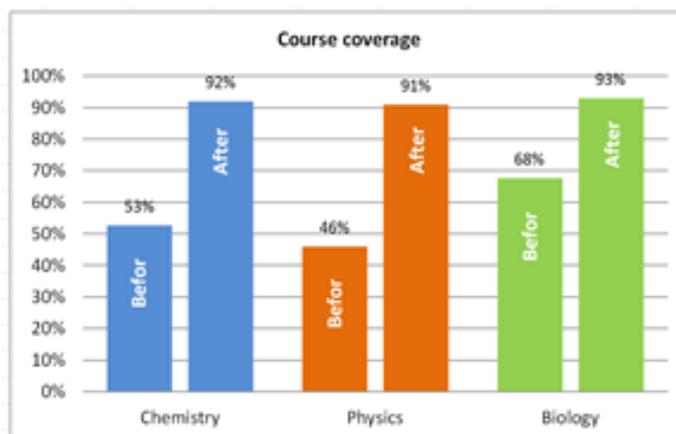


Fig. 3: Course Coverage for Science Subjects

Since the ROFSET Framework will provide real-time data to the teachers it is anticipated that the problem of course coverage would be solved.

3.2 Learning Outcome Coverage

Similar trends were seen in the LO for each subject mentioned above. The result is shown in Table 2. The ROFSET framework will also solve this problem in real-time.

We can see clearly that it is easy to obtain valuable insight into teaching and student learning. For example we can see that nearly the whole class found LO3 more difficult and hence performed less well in the exams. The ROFSET Framework would allow us to drill deeper to determine the cause of this problem. It could be one of several reasons: (i) that LO3 was not covered thoroughly, (ii) it was hard for this group of students, (iii) the exam questions related to LO3 were too hard, (iv) questions were not designed well, and (v) the method of teaching and pedagogy was not effective.

Similarly, we can see certain students were performing poor in various LOs. From the table we can identify students' number 2 and 9 who have scored low in most LOs. Using such analysis it is easy to pin point such cause and effect.

Table 2: Students Learning Outcome Coverage

Student	LO1	LO2	LO3	LO4	LO5	Student Average
1	64	94	56	78	71	91
2	66	59	13	68	56	36
3	67	67	51	74	68	65
4	80	75	45	69	76	69
5	87	64	32	81	74	68

6	68	56	41	83	68	63
7	98	91	52	78	79	96
8	75	63	24	86	86	67
9	76	58	20	65	74	48
10	89	88	66	89	72	97
Class Average	77	67	39	79	72	67

With this type of knowledge it was possible to provide differentiated learning for these students. Special worksheets can be provided to these students to improve their performance in the weaker areas. Other teaching strategies can also be used including group work where the weak student may be grouped with higher ability students assuming peer learning may help. There we can see clearly that the ROFSET Framework allows the teacher to adopt various teaching strategies for every student in every class.

We can also note that the 3 students (number 1, 7 and 10) have scored very high marks in the LOs and in particular LO2. These students can be given additional more advanced work to ensure they are not being held back by other students.

3.3 Student Participation

It was found that using the ROFSET Framework it was possible to obtain better results by engaging students who are less participatory. Different teaching strategies can be used to address these particular students and keep their progress in check through the ROFSET Framework. All students are provided or/and prompted with an opportunity to participate in class discussions and activities.

Overall it was also possible to track and show progress of students' participation from all the previous classes. It was found that this feedback prompted competitiveness amongst students to participate more. This positive engagement generally resulted in better student focus on their learning during the class. Fig. 5 shows the overall participation of the female and male students. This result is reflective of the country, in this case the UK. It is expected that the results would be different in different countries. This way it is possible to ensure education is gender neutral which is a major issues in developing countries (Ridge, Kippels, Yimbessalu, 2019). However, under the ROFSET Framework the teacher will have the tool to normalize gender inequality when it arises. This feature of the ROFSET Framework is of particular importance in regions where there is gender discrimination. The ROFSET Framework will show actual results.

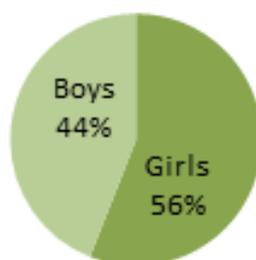


Fig. 4: Participation Percent for Male and Female Students

3.4 Teaching Effectiveness and Progress Monitoring

Using data from the three TL-KPIs (course coverage, LOs and student participation) it was possible to determine the teaching effectiveness and track teachers' progress (monitor). It is important to know that the effectiveness in this case is defined as how close (actual) the teaching has been to the prescribed content (expected) set out by the SME. The result is the difference between the expected to the actual. The ROFSET framework will monitor teachers progress automatically and non-intrusively in real-time.

We can see from Fig. 6 that teachers 2, 5, 6 and 11 were performing below expectations. This could have

serious consequences on student learning progress e.g., in later courses that rely on the content of this course. If such cases go unchecked it may lead to poor teaching standards and hence poor student performance. It was mentioned earlier in this paper that when such cases are discovered it is often too late to rectify the problem with traditional M&E.

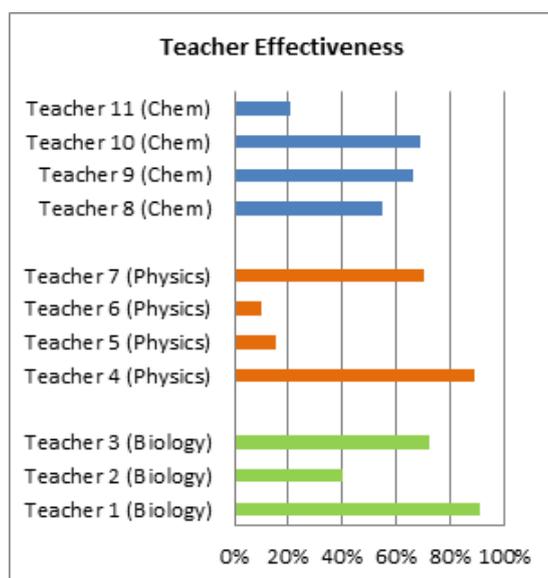


Fig. 5: Teaching Effectiveness for Science Subjects

4 CONCLUSIONS

A new approach for conducting M&E on ensuring equity, quality and accountability for the UN SDG 4 on education was presented. The new approach is based on the ROFSET Framework introduced in this paper. The ROFSET Framework uses automation, AI and real-time M&E on all aspects of teaching and learning during an actual class. The M&E work in the ROFSET Framework is conducted non-intrusively i.e., requiring no human intervention or special equipment, thus it is extremely cost effective and therefore well suited for OOSC education.

REFERENCE LIST

- Saqib, E. S., Panezai, S., Ali, U., & Kaleem, M. (2016). The effects of education, experience and skill on individuals' earning: Empirical evidence from Khyber Pakhtunkhwa, Pakistan. *International Journal of Advanced and Multidisciplinary Social Science*, 2(1), 27–32.
- Henry G T, Dickey K C, Areson J C, (1991), Stakeholder Participation in Educational Performance Monitoring Systems, *Educational Evaluation and Policy Analysis (EEPA)* Volume: 13 issue: 2, p: 177-188. <https://doi.org/10.3102/01623737013002177>
- Kazmi, S. W., & Quran, H. (2005). Role of education in globalization: A case for Pakistan. *SAARC Journal of Human Resource Development*, 1(1), 90–107.
- Malik, M. A., & Hassan, R. (2015). An analysis of parallel education systems in Pakistan, and the challenges they pose in education research. *Advances in Social Sciences Research Journal*, 2(10). <https://doi.org/10.14738/assrj.210.1562>.
- Marsh, H. W., & Roche, L. A. (1997). Making students' evaluations of teaching effectiveness effective: The critical issues of validity, bias, and utility. *American Psychologist*, 52(11), 1187-1197. <http://dx.doi.org/10.1037/0003-066X.52.11.1187>
- Memon, G., Joubish, F., & Khurram, A. (2010). The perceptions of quality assurance in

- educational institutions of Pakistan. *World Applied Sciences Journal*, 11(12), 1494–1499.
- Memon, G. (2007). Education in Pakistan: The key issues, problems and the new challenges. *Journal of Management and Social Sciences*, 3(1), 47–55.
- Morrissey, M. (2017). Qatari philanthropy and out-of-school children in Southeast Asia: An interview with the director of 'Educate A Child'. *Austrian Journal of South-East Asian Studies*, 10(2), 265-270. <https://doi.org/10.14764/10.ASEAS-2017.2-9>
- Richter S. (2018), A system dynamics study of Pakistan's education system: Consequences for governance, *The Electronic Journal of Information Systems in Developing Countries (EJISDC)* <https://doi.org/10.1002/isd2.12065>
- Ridge N, Kippels S, Yimbessalu J.P, (2019) Developing National Agendas in Order to Achieve Gender Equality in Education (SDG 4), 2030 Agenda for sustainable development, G20, 2019, Japan. https://www.jica.go.jp/jica-ri/ja/publication/other/l75nbg000017w7gh-att/TF1_web_0603_0007.pdf
- Skedsmo G, Huber S G, (2019), Forms and practices of accountability in education, *International Journal of Policy, Practice and Research*, <https://link.springer.com/article/10.1007/s11092-019-09305-8>
- UNICEF (2016), *Monitoring Education Participation: Framework for Monitoring Children and Adolescents who are Out of School or at Risk of Dropping Out*. Book ISBN:978-92-806-4860-7. Document code:UIS/2016/ED/TD/7
- Unterhalter E (2019), The Many Meanings of Quality Education: Politics of Targets and Indicators in SDG4, *Global Policy*, Volume 10, S1. <https://doi.org/10.1111/1758-5899.12591>