

Chapter 2

Science Education in Algeria



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Abstract Throughout history, science education has played a vital role in developing and modernizing the countries. The education in Algeria has been developing for the last years as a result of several reforms undertaken for enhancing the quality of learning and teaching in the whole education system, ranging from the primary school to higher education. Hence, this book chapter attempts to present the science education in Algeria. It starts by providing some information about the geographical location, population, and political system, as well as outlining the economic, technologies, and cultural development in the country. It then presents an overview of the education development and the current situation of science education in Algeria. The present chapter further explores the requirements for future development of science education. Finally, challenges and strategies, reflections and issues, and future pathways are discussed in the hope of improving the leaning and teaching for tomorrow's world.

Keywords Science education · Education in Algeria · Teaching and learning in Algeria · Educational technology · Education system

2.1 Overview of the Country

2.1.1 *Geographical Location, Population and Political System*

Algeria is the 10th largest country in the world, and the largest country in Africa, in the Arab world, and in the Mediterranean Basin with 2,381,741 km² of area. It has an important geostrategic position as it is located in the center of North Africa facing Europe, bordered by Morocco in the west, Western Sahara, Mauritania, and Mali in the southwest, Niger in the southeast, Libya in the east, Tunisia in the northeast, and the Mediterranean sea in the north. The climate in Algeria is transitional between

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maritime in the north and semi-arid to arid in the middle and south, respectively, with an average annual temperature of 12 °C (Stambouli, 2011). The country is divided into 48 provinces (Wilayas) and its capital is Algiers, which is the biggest and most populous city.

According to the National Office of Statistics (National Office of Statistics, 2019a), the population in Algeria was estimated to be about 43 million of inhabitants in 2019. The natural increase recorded during the same year reached 837,000 people with a natural growth rate of 1.93%. The distribution of births by sex gave 104 boys for 100 girls and the total fertility rate was 3.0 children per woman. One third of the Algerian population is youth. The median age was 27.7 years, which is considerably lower compared to that of some other population countries such as the EU population (43.1 years). Algeria is a People's Democratic Republic, where the Arabic and Tamazight are the two national and official languages of the state.

2.1.2 Current Situation of Economic, Technologies and Cultural Development

Algeria is classified by the World Bank as an upper-middle income country and ranked as the third important economy in the region of the Middle East and North Africa. With about 4.5 trillion cubic meters of the proven natural gas reserves, Algeria is considered as the 10th largest natural gas reserves in the world, the second largest in Africa, and the 6th largest gas exporter (Abada & Bouharkat, 2018; World Bank Group, 2019).

In 2018, the Gross Domestic Product (GDP) growth reached 1.5% and sustained at the same percentage in Q1-2019. Recently, the growth in non-hydrocarbon sectors, including construction and public works, commercial services, industrial, and agriculture sectors reached a slight increase. However, the economy of Algeria is mainly depending on the exports of petroleum products, particularly natural gas, oil and other hydrocarbons. The renewable energy is potential that can contribute to the economy as the Sahara represents 86% of the total land.

The country has known many advances in the last years with the respect to the use of new technologies in various contexts. For example, the National Center for Space Technology (CNTS) has launched a microsatellite called Alsat-1, which is considered as the first step in developing the national space infrastructure (Bentoutou, 2012). The mission objective of Alsat-1 was to manage the natural disasters as well as other remote sensing utilizations. Next, many other satellites named Alsat-1B, Alsat-2A, Alsat-2B, Isat-1 N, and Alcomsat-1 were launched for different purposes, ranging from monitoring the agricultural and disaster to providing the broadcast television and high-speed Internet access.

Moreover, the Internet usage is increasing rapidly in Algeria. Currently, three telecommunication companies are providing mobile and wireless communication services including 4G Internet access with mobile phones. These companies are:

Mobilis, Ooredoo, Djezzy. Cultural development in Algeria contributes to the promotion of culture in all its dimensions and in all its forms with the objective of enhancing any national and local cultural systems.

2.2 Overview of the Education Development

2.2.1 Education System and Policy

Education is one of the most important priorities for the Algerian government. It is free for all at all stages in government schools and compulsory from the ages of 6–15, in which each Algerian is required to receive the basic education. Officially, the compulsory school entrance age is 6 and the academic year begins in September and ends in June.

The education system of the country is structured into several levels: preparatory, primary school lasts for 5 years (Ages 6–10), lower secondary school lasts for 4 years (Ages 11–14), upper secondary school lasts for 3 years (Ages 15–17), vocational training, and higher education. State policy in the primary and secondary education, higher education, and professional training and continuing education are implemented by the Ministers of National Education, Higher Education and Scientific Research, and Professional Education and Training, respectively.

After bringing the compulsory education level, students who leave school can get the vocational training they need in order to develop the necessary skills and build a career. On the other hand, to pursue higher education, students must obtain the national exam named Baccalauréat, or an equivalent foreign qualification. In 2004, Algeria adopted the LMD system, which is composed of three grades: 3-years License (Bachelor), 2-year Master, and Doctorate lasting 3 years. However, some studies like medicine, dentistry, and pharmacy are still taught following to the classical educational system. The LMD system is distinguished by the contents of innovative educational programs, evaluation and accreditation of education programs, reorganization of the teachings, and new education architecture (Benouar, 2013).

The reform aiming at using the LMD system in higher education is one of the major forms of the governmental policies that were initiated to improve education in Algeria since gaining the independence in 1962. In addition, investing a significant part of the general budget in this sector and making education free of charge at all levels in public institutions are other critical components of the government's policy to enhance education in the country.

Table 2.1 Main indicators for the national education sector in Algeria for the 2019–2020 academic year (National Office of Statistics, 2019b)

Level	Pupils	Teachers	Educational establishments
Preparatory	495,481	17,791	19,037
primary	4,513,749	199,850	
Lower secondary	2,979,737	159,065	5,512
Upper secondary	1,222,673	102,279	2,433
Total	9,211,640	478,985	26,982

2.2.2 Statistics on the National Education

The main indicators for the Algerian national education sector in the 2019–2020 school year are shown in Table 2.1. It can be observed that the pupils enrolled in primary school, including preparatory school, represent 54.40% of the total number of pupils, while those enrolled in lower secondary and upper secondary represent 32.34% and 13.26%, respectively. Of the total number of teachers found (478,985), 21,7641 are in preparatory and primary schools, 159,065 are in middle schools, and the rest in high schools. Regarding to school level indicator for the 2019–2020 school year, the sector of national education has a total of 26,982 schools, including 19,037 primary schools, 5,512 middle schools, and 2,433 high schools.

To obtain the data for the number of pupils per teacher, the total number of pupils in each education level is divided by the total number of teachers in the corresponding education level. The obtained results for the three levels are as follows: 23 pupils/teachers in preparatory and primary schools, 19 pupils/teachers in lower secondary schools, and 12 pupils/teachers in upper secondary schools. Pupil Teacher Ratio (PTR) consisting of the average nationally of the total number of pupils divided by the total number of teachers is 19 for all pupils in the all levels of education. This indicates that on average there is one teacher for every 19 pupils.

In the report published by the Global Out-of-School Children Initiative (Global Out-of-School Children Initiative, 2014), it was highlighted that the out-of-school numbers calculated based on the administrative data are 101,304 pupils for children aged 6–10 years in primary school and 151,879 pupils for children aged 11–14 years in lower secondary. The risk of children dropping out of primary school involves around of 94,271 pupils, while the children at risk of dropping out of school in lower secondary school affects 408,172 pupils.

2.2.3 Educational Research and International Collaboration

The network of higher education institutions covers the whole territory of the country under direct Ministry supervision. This network consists of 50 universities, 20 national higher schools, 13 university centers, 11 higher teacher training colleges,

10 higher schools, and 2 annexes (MESRS, 2020). The number of enrolled students in higher education institutions has increased significantly from 2,881 in 1962–1963 to 1,730,000 in 2017–2018 (Souleh, 2017; Université de Rouen, 2019).

In order to implement the national strategy of research, the General Directorate for Scientific Research and Technological Development was created in 2009 under the authority of the Minister of Higher Education and Scientific Research. Some of its main tasks (DGRSDT, 2020) are to put into action the most appropriate elements related to programming, scientific cooperation, university research, human resource development, as well as research results valorization. The research structures are spread over Algeria and composed of research agencies (5 Thematic Research Agencies and 2 Research Agencies), research centers (12 Research Centers -EPST type- MESRS, 11 Research Centers -EPST type- outside MESRS, 4 Research Centres under the COMENA, 2 Research Centers under the ASAL), research and development centers with 12 centers, and research units (12 Research Units Attached to universities and schools and 14 Research Units Attached to EPST) (DGRSDT, 2020).

Developing international collaboration among educational institutions is the most crucial aspect in regard to acquire access to the latest technologies and information. In this context, many programs of international cooperation and training between institutions of higher education in Algeria and other institutions in other countries were developed. For example, the program of residential training abroad is a one of international exchange programs that offers scholarships to excellent students for preparing their Master's degree and PhD.

2.3 Current Situation of Science Education

2.3.1 Policies and Standards

The policies governing the education system in Algeria are mainly defined by the Algerian constitution. It is reported, notably in article 65 edition 2016, that the right to education is guaranteed and the education is compulsory and free for all children under the age of 16 years old. The State, moreover, organizes the national education and protects equal access to schooling and vocational training. The management of staff and educational institutions is decentralized. Law 08/04 of 23 January 2008 on the national education guidance enshrines, through articles 10, 11, 12, 13 and 14, the guarantee of the right to education. For example, in article 10, it is indicated that the State ensures the right to education to all Algerians without discrimination based on sex, social or geographical origins. In article 14, it is reported that education is free at all levels in public institutions of national education. In addition, the State provides support for the education of underprivileged students by enabling them to benefit from multiple aids, particularly in terms of scholarships, textbooks and school supplies, food, accommodation, transport, and school health (Ministry of National Education, 2020a).

2.3.2 Curriculums, Digital Resources and Teacher Training

Because the education in Algeria falls under the responsibility of ministries, the curriculums that are standardized for each field of study are approved by the corresponding Ministry. All primary, lower secondary, and upper secondary school deliver the same textbooks and curriculum as designed by the Ministry of National Education. Since 2003, Algeria has engaged gradually in a series of reforms at all levels of education. These reforms were initiated with the aim of improving the effectiveness of the education system and responding to increases in socio-economic advances. The educational curriculum is, therefore, reformed in terms of skills and textbooks, to integrate learners-centered approaches rather than the traditional approaches, which are based on teachers-centred pedagogical pattern during the learning process.

The integration of digital resources into education has a direct impact on the quality of learning and teaching, and therefore on the national education system. The use of digital resources in education started decades of years ago. Some of major initiatives launched by the Algerian government include (Guemide & Benachaiba, 2012): the project of the Ministry of Education to equip all schools with computers by 2005; the distance education project; the virtual university project; and the research network to be put in place by the Ministry of Higher Education and Scientific Research.

There are many teachers training schools and colleges in Algeria that enable to enhance learning by training teachers to acquire the skills and competencies needed to further teaching in schools. Primary school, lower secondary, and upper secondary teachers are usually trained in one of the higher normal schools spread over the country. For example, the higher normal school of Elbachir Elibrahim (<https://www.ens-kouba.dz/>) aims at training secondary school teachers for the sector of national education in different fields such as: computer science, natural sciences, mathematics, physics, and chemistry.

2.3.3 Student Assessment and Achievement

For any education system, the evaluation of students in schools and classrooms is a relevant topic because the assessment process can describe not only what students have learned, but also how well they have acquired the knowledge. In Algerian education system, the students' assessment and achievement as well as their advancement from one level to another are based on some pedagogical principles. Indeed, there are different forms for the evaluation such as the ongoing assessment and the annual assessment (Ministry of National Education, 2020b).

In the ongoing assessment form, teachers can get continuous feedback on the performance of students' learning by gathering information using formal and informal classroom observations about their learning activity and behavior. In a such form of assessment, a variety of tools can be used, ranging from simple to more complex tests covering one or more concepts, or one or more units of the program.

On the other hand, the annual assessment is a kind of summative assessment in which the teachers can determine the learning outcomes and the profile for the students at the end of the year. This allows them to have evidence about what their students have learned during that year, as well as to measure the students' abilities for determining whether they can succeed in achieving the higher level of education. The students' move from one year to another is, therefore, made on the basis of the results obtained in the final exam at the school and the teachers' council decision. Additionally, the exams for transitions from primary to lower secondary school, from lower secondary to upper secondary school, and from upper secondary to higher education are common and organized at the national level.

Algeria participated to Trends in International Mathematics and Science Study (TIMSS), that is considered as the enabler to provide reliable trend data on the mathematics and science achievement of fourth and eighth-grade students over the world. In 2015, Algeria joined the Programme for International Student Assessment (PISA) (Kartianom & Ndayizeye, 2017), which aims to measure the ability of 15-year-olds in using their reading, mathematics and science knowledge and skills for meeting the challenges of the real-life. For example, the average score in mathematics learning achievement was 360 in 2015.

2.3.4 Science and Technology Venues and Centers

Almost all universities have a faculty of science and technology in which the subject of science and technology is taught to students due to its relevance to their lives. More specifically, there are two universities specializing in the field of science and technology, that are the university of Science and Technology Houari Boumediene (USTHB) (<https://www.usthb.dz/>) and the University of Sciences and Technology—Mohamed Boudiaf (USTO-MB) (<https://www.univ-usto.dz/>).

The first one was founded in Algiers in 1974. It is one of the most prestigious universities in Algeria. It has over 20,000 students and more than 1,500 teachers and workers. With 8 faculties, USTHB offers education in various fields, including biological science, Physics, chemistry, Mathematics, civil engineering, electronics and computer science, mechanical engineering and engineering processes, and earth science and country planning. The second university USTO-MB established in 1975 in Oran, provides training for students in different areas of learning, ranging from natural science and life to mathematics and computer science. It has about 26,000 enrolled students taught by 1000 teachers, performing both academic and research tasks.

Science, Technology, Engineering, Art, and Mathematics (STEAM) is the first STEAM center in Algeria launched in 2016. The center has trained more than 900 students and 25 teachers from across the country after its first 16 months (World Learning, 2020).

2.3.5 Utilizing Emerging Technologies

The future of any education system is highly linked with the utilization of emerging technologies that can influence the way in which the education institutions teach and students learn. Over the past years, many initiatives have been undertaken in numerous studies to deal with the challenges of using emerging technologies in learning and teaching. For example, Mostefaoui et al. (2017) developed a remote electronic laboratory having the features of a low-cost alternative solution and flexible lab. It uses only the open source hardware and software products and requires a little maintenance. The graphical user interface of the remote lab can be used remotely with a low bandwidth Internet connectivity. The experimental results showed that the students who learned with this solution realized their task in a short time and had slightly better scores than those learned with the traditional method in a hands-on laboratory.

Soltani et al. (2018) presented an innovative framework based on one of artificial intelligence applications, that is the facial emotion detection used in Massive Open Online Courses (MOOCs) with the aim to help teachers to stay aware of the emotions of learners and their evolution during the learning activity. The framework was able to provide adaptive learning contents based on students' emotional states and profiles. It was developed based on three principles: modeling the learner using the MOOC; using of pedagogical agents during the learning activities; and capturing and interpreting the facial emotion of the students.

Furthermore, students from Algeria have participated in the project related to an education program at the Surrey Space Center, and instruments on board the satellite equipped with a Space Mag-PV Boom, magnetometer, RadFET radiation monitors, C3D2 camera, and Thin Film Solar Cel (Siebrits, 2019).

2.4 Requirements for Future Development of Science Education

The development of science education plays an important role in developing and modernizing the countries. The future development of science education in Algeria enabling the transition from the traditional education to the modern education is a major task that requires the involvement of the whole society. New technologies such as Artificial Intelligence, Internet of things (IoT), Virtual Reality (VR), 5G are expected to drive country growth in the coming years and change how we think, learn and live. This then demands a rethinking of all existing learning and teaching policies and standards to build a new curriculum that could help in preparing students for further complex issues.

In addition, the science education should be developed in the perspective of supporting the growth and the diversity of national economy with an appropriate adaptation to dynamically changing conditions.

Educators and teachers from whole country should learn from others in other countries. Godek (2004) suggested that the science education should be practical, relevant and appropriate, and the technical knowledge should be taken from developed countries but it must be suitable to the society and their needs. Because the future is uncertain and complex, it is closely important to adopt the strategy of future-focused to make considerable changes while keeping the current education system working.

2.5 Discussion and Conclusion

The education in Algeria has been developing for the last years as a result of several reforms undertaken for improving the learning and teaching in the whole education system, ranging from the primary school to higher education to vocational training.

While the Algerian government has placed great importance on the education development, there are still some challenges to overcome. The curriculum taught today at school does not meet tomorrow's employability skills such as the use of emerging technologies like Artificial Intelligence. Thus, there is a need of national strategy based on innovative programs preparing the students for successful transitions to tomorrow's world and employment by teaching Artificial Intelligence the at all level of education; AI needs to be considered as a pillar for any further reform of the education system. Moreover, the higher teacher training colleges should predict the evolution in the society to develop learning programs to allow students not only to reproduce the knowledge, but also to create it. As the country's main source of revenues is relied to gas and oil sector, there is an urgent need to develop new strategies to diversify the economy by investing more in innovation and education.

During the pandemic of Corona Virus Disease 2019 (COVID-19), the students and teachers have faced problems in remote education due to the slow internet connections and a lack of Information and Communications Technology (ICT) infrastructure (Bozkurt et al., 2020). Data transfer speeds and Internet connectivity should be improved to better provide students with opportunities to learn at any given time and space in the digital age.

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