Public libraries’ role in supporting e-learning and spreading lifelong education: a case study

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Abstract
Purpose – Public libraries play a pivotal role in supporting education and literacy. They provide numerous services, collections and resources for education and leisure. Bibliotheca Alexandrina (BA) is an international renowned public library that provides numerous services for different users worldwide. E-learning is an emergent and promising method for teaching and learning different subjects such as the science, technology, engineering and mathematics (STEM). The e-learning educational system is quite novel in Africa and the Middle East; hence, this paper presents the whole concept to the reader. In addition, it demonstrates number of e-courses tackling different domains provided by different educational institutions, national and public libraries worldwide.

Design/methodology/approach – In 2017, the BA inaugurated its e-learning services to cope with the new educational trend and to consolidate the lifelong learning concept in the community. The author showed special interest to the case of e-learning in the BA, as it is a regional public library. The main idea of this paper is to attract attention toward public libraries as a promising venue for e-learning implementation for general knowledge, library information sciences, soft skills, elementary and informal STEM education. The paper discusses in details e-learning and its characteristics.

Findings – In addition, the paper compares traditional education (face-to-face) with e-learning education, mentions both their pros and cons and recommends blending the two educational methods as they complement each other. Furthermore, the author has selected a sample of different STEM e-courses (203 different e-courses). These e-courses were selected to assert the possibility of presenting STEM topics in the form of e-courses.

Originality/value – This study would be one of the emergent research studies that connect e-learning to both STEM disciplines and public libraries. Additionally, this research highlights the importance of public libraries and all the services they provide. In the mean time, it shed light on the important and unique role of specialized librarians. Briefly, public libraries with all their resources, services and expert librarians could provide an exceptional e-learning experience to their community and be of great help to educational institutions and organizations.

Keywords E-learning, Public libraries, STEM, Traditional education

Introduction
During the late eighteenth and early nineteenth centuries, the whole world witnessed the industrial revolution, which had a powerful impact on all aspects of human lives. Since then, people have been facing unstoppable challenges in education, social, economic and environmental welfare. The most outstanding breakthrough was achieved in both the science and technology fields. Science and technology are key elements toward development in different domains, such as economics, trade, industry, health improvement, education and infrastructure. Therefore, innovative and advanced education systems have lately attracted...
more attention (Chetty, 2012) and (Eagleton and Manolopoulou, 2017). Recently, the information and communication technology (ICT) field has been extensively developed. The growing demand for novel educational techniques and the emerged ICT produced a new method of learning called e-learning. E-learning is an abbreviation that refers to electronic learning; it fluctuates between supporting classroom education to providing totally online distance-education. E-learning emerged due to the increasing number of population and learners, as well as an increasing demand for better, convenient and feasible education systems. Coinciding with this, the first computer-based learning system, PLATO, was developed by Bitzer in 1962 at University of Illinois. Additionally, there were pioneer researchers in this field such as Porter (1959), Uttal (1962) and Suppes (1964) (Bhatnagar, 2016).

State-of-the-art
Different authors have defined e-learning in the published literature according to the topic covered, providers, techniques and tools used. Sharifabadi (2006) defined e-learning as the use of the Internet to disseminate educational resources and learning materials. Furthermore, the system develops interaction between learners and instructors and/or trainers to enhance the teaching and learning experience (Bhatnagar, 2016). In 2009, Kumbhar defined e-learning as a learning system supported by electronic media. The e-learning educational system depends on computer devices, networks, telecommunication, storage and sharing technology. Moreover, the National Science Teachers Association (NSTA, 2016) defined e-learning as an efficient teaching technique developed by gathering digital content and learning support and services. NSTA stated that e-learning could be used to enhance the teaching of science and technology.

The author intended to point out the role of public libraries in spreading and supporting the e-learning system. Recently, this topic was discussed from different perspective in the published literature (Abbasi and Zardary, 2012; Han and Yates, 2016; Kumbhar, 2009). Abbasi and Zardary were interested about the role of digital libraries on supporting e-learning. They stated that digital libraries could provide both digitized services and electronic resources via Internet to support e-learning. Han and Yates presented a case of an academic library called Monash University Library, Australia that has adopted e-learning system for both research and learning skills development within the university. In this study, the authors showed special interest about the library staff members gained competencies and the impact of this on the sustainability and improving of the e-learning strategy. They concluded that their case study could give a positive sign for organizations which consider integrating e-learning. Additionally, they recommended the presence of qualified and centralized e-learning team who could create and develop easy to use manuals and support e-learning techniques. In 2009, Kumbhar presented a review of e-learning initiative in Library Information Science (LIS). The author stated that traditional and e-learning education systems are complementing each other in spreading LIS education.

Different educational systems (e-learning vs traditional learning)
The e-learning system is a web-enabled system that provides information and knowledge to various audiences anywhere, anytime. There are different terminologies for e-learning, such as online education, web-based training/learning (WBT, WBL), virtual university, computer-based education, etc. E-learning systems could support educational and teaching systems by using modern ICT tools and through effective use of different educational resources. Furthermore, e-learning facilitates lifelong learning and self-pace education. Time and place cannot limit the e-learning education, and e-learners could enroll and learn any topic anywhere, 24/7.

Nowadays, a large number of organizations are implementing e-learning educational systems as a flexible and timesaving method to train and increase the competence of their
employees. In the meantime, educational institutions such as universities and research centers are heading toward the adoption of e-learning. Educational institutions usually combine face-to-face (traditional/classroom) learning and e-learning systems in what is called “blended learning” (NSTA, 2016). Currently, e-learning uses diverse tools and techniques to facilitate the covering of numerous topics and fields; starting from LIS to engineering sciences, which will be discussed in detail later. Pros and cons of both e-learning and traditional (classroom) learning systems can be briefly outlined in Table I.

From all the above propositions, it could be noticed that both learning systems have advantages and disadvantages. The author recommends using both learning systems, which is called the blended system, which is a combination of both e-learning and traditional methods.

Library definition
Throughout time, libraries have supported education and played a key role in literacy dissemination. The word “library” is derived from the Latin word liber, which means “book”. Libraries ensure the provision of educational materials, books collections, electronic resources, periodicals, multimedia materials, referral services, etc. At the same time, this term could refer to the building or space itself, which includes all the previously mentioned materials (Shukla et al., 2013).

In 1994, International Federation of Library Associations/The United Nations Educational, Scientific and Cultural Organization (IFLA/UNESCO) (1996) defined public libraries as the perpetual source of information and knowledge. Public libraries promote lifelong learning, cultural development, peace and social welfare for the public. Public libraries are hubs of information, providing all kinds of knowledge available to users nationally and internationally. Public libraries help communities to develop, improve and carry out decision-making independently. The manifesto stated that public libraries deliver different services and materials for various categories of users based on equity and equality. In addition, IFLA/UNESCO recommended public libraries to disseminate special services, materials and reference sources among users who cannot have access to the regular libraries services and materials, such as linguistic minorities, disabled, hospitalized or imprisoned people (IFLA/UNESCO, 1996).

Users of different categories could easily access all the provided materials and organized collections through the help of well-trained and skilled librarians. Skilled subject librarians act in significant roles in both public and academic libraries. Generally, these tasks include collection-cataloging, development, reference services, building collaboration with educational organizations (schools, universities and research institutions) and providing instructional lectures to users.

The main aim of this study is to investigate the potential role of public libraries in spreading science, technology, engineering and mathematics (STEM) e-learning education. In this paper, the author will focus on STEM e-courses available, list providers (libraries, educational organizations, educational platforms, etc.) and the learning management system (LMS) used to present scientific context. Educational resources could take different formats (text, videos, interactive presentations, audio, animation, etc.) according to the subject covered. Finally, the main target of this study and previously published studies is to shed light on the role of libraries in supporting e-learning education, developing both e-learning and traditional educational systems and to use the advantages of both systems to the maximum for the sake of learners.

Types of libraries
Libraries have essential influence on education. Libraries could deeply support education by different means. Different types of libraries are listed and defined below:
| Parameters                  | E-learning system                                                                 | Traditional system                                                                 |
|-----------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Accessibility               | Learners should have smart device (computers, laptops, tabs and mobiles) and Internet connection. Learners could access any educational materials, data banks, up-to-date relevant and reliable scientific e-resources. | Learners should be enrolled on schools and/or campuses. Learners depend on the teachers’ explanations, study program, settled curriculum and fixed educational materials. Learners interact directly with the class teacher and classmates. |
| Instructor and learners relation | E-learning is like a virtual classroom. Learners could interact with instructors and each other through different tools, such as (messaging, forums, chat, e-mails, etc.) | Teacher and lecturer plays the role of the knowledge source and transmitter. In this system, teachers reach out to students, directly, through speeches and oral communication, hence, students could receive answers for their queries right away. |
| Pedagogical curriculum      | It suits wide, specific and general topics, modules and lessons. Learners could study at their own pace, independent of the group speed. E-learning depends on interactivity and help learners to construct their own knowledge. E-learning allows students to access and attend online educational content unlimited times 24/7. | It suits applied, detailed and collaborative subjects. Both teachers and students are strictly adhered to fixed curriculum. Traditional system depends on repetition and students are recipients. |
| Degrees available           | Learners could earn diplomas, master’s degree and/or PhDs any time anywhere while working in their jobs or in their own space. | Students attend classes in person and pass through different assignments, exams and evaluations to earn an academic degree. |
| Assessments and evaluation  | Learners could acquire any course and/or training about any subject and/or field of their interest with simple assessment or placement test or none. Most of the online courses evaluate participants through multiple choice or short answer assignments. The lack of clear objective of learner could be the reason for them to drop out e-courses. In addition, students attending e-courses could be inactive and fail more than students attending the same courses face-to-face in a regular classroom. | Students are evaluated according to different progress criteria that represent students' level of achievement or performance. Student performance is evaluated orally and via written tests/exams. |
| Suitability of learning system | This system would be considered a convenient system for independent and self-study learners. Learners are not limited by age, gender, job, origin, background, place or time. | Classroom learning suits different types of learners. Sometimes there is an age barriers to pursue definite degrees. |

(continued)

Table I. Pros and cons of e-learning and traditional learning systems (Purdue University Global, 2018; De, 2018; Heap, 2017; Versteijlen et al., 2017)
As mentioned earlier, public libraries are national organizations, funded and supported by governments and communities. Public libraries have a great impact on society, and they play the vital mission of spreading literacy and lifelong learning to improve and fulfill needs of society. Public libraries are no longer limited to their buildings, physical collection or indoor services. Most public libraries successfully cope with the publics’ increasing demands, as well as technological and educational challenges. Thanks to open access and open educational resources, public libraries can offer educational materials, courses, trainings, scientific publications, etc. to users. They manage to deliver their services not only face-to-face but also online. Earlier, all these resources were restricted to educational institutions, accessed in definite places, during specific times and at fixed prices. Nowadays, users and students have a vast amount of raised references on different topics, such as educational and reference resources, digital tools and services. Users access public libraries (physically or virtually) seeking the guidance and help of skilled and competent librarians.

| Parameters          | E-learning system                                                                 | Traditional system                                                                 |
|---------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Learners skills     | E-learning system could enhance self-motivation, creative thinking and time management skills. Learner is completely his/her own boss; learner is responsible for completing all the online courses requirements such as viewing lectures, interact with peers and instructor, submitting and required assignments before the deadline (self-direction). | It could be preferable for subjects, fields and programs that require hands-on-approach. Traditional system is efficient, and it could enhance self-motivation and discipline. This system could build strong relations between students and teachers. Meanwhile, it helps young students improve their personalities, increases their self-esteem and assists them in avoiding exam panic. |
| Learning system     | E-learning is a fast way of presenting lessons. Learners could retrieve and save the online sessions and electronic resources to revise them anytime anywhere. | The time required for the teaching process is 20–60 percent higher than the e-learning method. |
| time-consuming      | Expenses                                                                          |                                                                                     |
|                     | Learners could save travel expenses, course materials and accommodation fees by applying for e-learning courses. | Traditional learning cost is higher than e-learning (investments, educational buildings, academic staff, teachers and employees’ salaries, etc.). |
| Environmental impact| E-learning education has less impact on the environment. It is a paperless educational system; hence, it saves about 90 percent power and generates 85 percent less amount of CO₂. | Carbon footprint increases due to students and academic staff traveling and transportation. |
| Technical barriers  | Communication and technology barriers could limit the e-learning process. In addition, computer illiteracy endangers the spreading of the e-learning method. Transforming teaching material into interactive e-course is time-consuming and requires good knowledge of tools and technology available. Although by the end of the e-learning experience learner would enhance his/her digital skills. | If teacher or lecturer does not integrate technology within curriculum content, this would decrease the digital and technological skills of students. |

Table I.
Thus, public libraries should be classified as information hubs and central sources of a multitude of educational materials, ranging from traditional to online-based courses. Nevertheless, public libraries should collaborate with regional educational institutions (schools, universities and adult learning) to execute students’ demands and to avoid redundancy (Lifelong Learning, 2012; Balapanidou, 2015). Creelman (Lifelong Learning, 2012) stated that public libraries depend on their librarians’ professionalism and expertise. Balapanidou (2015) reviewed a number of published studies and stated that public libraries have played a fundamental role in every community by providing various services to different user categories, for both educational and recreational purposes. Nowadays, they are facing challenges in keeping up with technological evolution, moreover, maintaining and upgrading their services. In the meantime, they should reach and support all types of users, such as the literate, illiterate, children, youth, adults, the disabled, minorities, the hospitalized and/or imprisoned people. There are numerous examples of illuminating and inspiring public libraries, such as the Library of Congress (Washington D.C., USA), Bibliothèque Nationale de France BNF (the National Library of France) and the Bibliotheca Alexandrina (BA) (The Library of Alexandria). In this study, the author will focus on the BA and its different facets. This paper will highlight the efforts done by the Library of Alexandria to spread and increase public participation and support the e-learning educational system.

**Special library**

Special libraries could be briefly defined as establishments concerned with a specific subject or field with their own specialized collections. They provide help and guidance for their particular clientele (academia or professionals) (Bilawar, 2013). Generally, specialized libraries are involved in any research and/or educational process in any academic, industrial and business organizations. Special libraries include the following:

1. Science libraries;
2. Law libraries;
3. Medical libraries;
4. Music libraries and
5. Museum libraries.

**Academic library**

Academic libraries are entities that fall under the umbrella of educational or academic organizations, such as schools, universities, colleges or research institutions. They have two fundamental and integral functions: first, to support the curriculum of the educational organization, and second, to promote research in these organizations. Academic libraries are usually located within campuses, and they have materials and collections that help teachers, professors, researchers and students to fulfill their missions.

Examples of academic libraries are as follows:

1. American University in Cairo Libraries and
2. University of Lorraine Libraries

**Digital library**

Digital libraries are emerging paradigms of the rapid development of ICT. Trivedi (2010) defined digital libraries as virtual entities offering very large organized collections stored in
digital formats that can be accessed remotely. They consist of three main elements: the library materials (data), information about the library materials (metadata) and the performed functions that link all the library elements (processes) (Rajput, 2013).

Examples of digital libraries are as follows:

1. Egyptian Knowledge Bank (EKB);
2. Peking University Digital Library (China) and
3. Digitale Bibliothek Information und Medien (Germany).

Recently, it is noticeable that a large number of traditional libraries are heading towards digitizing their collections.

**Bibliotheca Alexandrina (BA)**
The BA was officially reborn on October 16, 2002. The main target of the modern library is to be a hub of merit in acquaintance creation and spreading. In addition, the BA aspires to be a destination of interchange, learning, tolerance and understanding. This paper will discuss the BA e-learning services as the case study.

The BA provides numerous services for all users. Most of these services are listed on the BA website. The core services, which are offered by the BA, are listed hereunder:

1. Free computers, Internet access and free Wi-Fi;
2. Electronic resources (open and closed access);
3. Community events;
4. Study rooms and reading space;
5. Printing and copying centers;
6. Reference and inquiry services;
7. Adult learning courses;
8. The BA catalog (enables users to search for items anytime, anywhere);
9. Specialized courses for librarians;
10. Researchers’ services;
11. Celebrity authors events;
12. Numerous cultural and scientific events and
13. Exhibitions, seminars, conferences, concerts and theatrical performances.

**BA e-learning services**
The BA has established an online educational service in January 2017. The main aim of this service is to enable the BA users (from all over Egypt, the Arab world, Africa and the worldwide) to attend the BA educational courses. This service will introduce the self-learning concept to the BA users and will increase their enthusiasm for self-improvement. This service ensures providing sustainable educational services for all types of users anytime anywhere. The BA e-learning services aim to provide access to massive open online courses (MOOCs), online courses and other e-learning modules. In addition, the BA e-learning Services strive to provide e-learning courses about different
topics not limited to LIS. The BA improves its e-learning resources, techniques and materials indoors and keen to cooperate with other educational organizations and institutions. This could be a positive indication for other public libraries looking forward to implement e-learning system. The BA develops its e-learning service internally depending on the subject expert librarians and externally by cooperating with educational institutions such as Alexandria University, Senghor University, The National Superior School of Information Science and Libraries (ENSSIB), the National Library of France (BnF), etc. Table II shows the available e-courses and online orientation sessions provided by the BA e-learning services.

All the previously mentioned e-courses, sessions and trainings are presented using the Moodle platform. The BA e-learning services adopted Moodle platform due to its special features such as:

1. Open access learning management system (LMS);
2. Free platform with unlimited time;
3. User-friendly platform (learners, tutors and administrators);
4. A well-organized and easy to navigate platform;
5. The design to be responsive and accessible (it is easy to navigate on both desktops and smart devices);
6. Multilingual capability platform (The BA uses Arabic, English and French);
7. Various modules, features, tools, and customizable themes and layout;
8. Modular design that simplifies syllabus and curriculum arrangement;
9. Interactivity between tutors and learners through various activities and collaborative tools (i.e. forums, chats, wikis, glossaries, databases, quizzes, etc.);
10. Easy plugin (sign in) management;
11. Consistent security updates;
12. Supports multimedia integration (courses could be uploaded in all types of formats as text and multimedia files);
13. Can integrate with different cloud storage services to share files such as MS OneDrive, Dropbox and Google Drive and
14. Implements both synchronous and asynchronous learning.

**Application of e-learning in international public libraries**

A number of published researches have indicated that public libraries are playing a key role in spreading and serving as remote sites for e-learning. Public libraries play a critical role in developing and expanding e-learning education (Proudfoot and Kebritchi, 2017). The traditional role of a public library is to offer information resources for users and play as information keepers. Nowadays, this role should be expanded to include being information providers and a gateway to knowledge (Sharifabadi, 2006). In this study, the author has listed a number of e-courses provided by three examples: the National Library of New Zealand, the American Library Association (ALA) and Australian Library and Information Association in Table III. The three selected examples are using Moodle as the LMS. From the previous context, it is clear that e-learning education is growing and developing rapidly; hence, libraries are pressured to support and embrace e-learning at massive scale.
| Courses/Trainings session       | Subject               | Topic                                                                 | Organization                                      | Duration  | Certified | Language     |
|--------------------------------|-----------------------|----------------------------------------------------------------------|---------------------------------------------------|-----------|-----------|--------------|
| Orientation sessions           | General Knowledge     | Introductory Session; History of Suez Canal                        | Bibliotheca Alexandrina (BA)                      | Self-paced| N/A       | Arabic       |
|                                |                       | Orientation; Egyptian Knowledge; Bibliotheca Alexandria (BA)        |                                                   |           |           | Arabic and English |
|                                |                       | Orientation; Bibliotheca Alexandria (BA)                           |                                                   |           |           | Arabic       |
|                                |                       | Orientation; Bibliotheca Alexandria (BA)                           |                                                   |           |           | Arabic       |
|                                |                       | Information for Africa (BAIFA)                                      |                                                   |           |           | Arabic       |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic       |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic       |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic       |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic       |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic       |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic       |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic       |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic       |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic       |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic       |
| Training courses for beginners |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic       |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic       |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic       |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic       |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic       |
| Advanced training courses      | Library Science       | Citation                                                            | BA Online Catalog                                 |           |           | Arabic and English |
|                                |                       | Internet                                                            |                                                   |           |           | Arabic and English |
|                                |                       | References                                                          |                                                   |           |           | Arabic and English |
|                                |                       | Electronic Resources                                                |                                                   |           |           | Arabic and English |
|                                |                       | Web 2.0 Innovation et Bibliotheques                                  |                                                   |           |           | Arabic and English |
| Researchers' Program           | Specialized Courses for Postgraduates and Researchers               | Citation                                                            | BA Online Catalog                                 |           |           | Arabic and English |
|                                |                       | Internet                                                            |                                                   |           |           | Arabic and English |
|                                |                       | References                                                          |                                                   |           |           | Arabic and English |
|                                |                       | Electronic Resources                                                |                                                   |           |           | Arabic and English |
|                                |                       | Web 2.0 Innovation et Bibliotheques                                  |                                                   |           |           | Arabic and English |
|                                |                       | Marketing for Library                                               |                                                   |           |           | Arabic and English |
|                                |                       | Academic Writing                                                    |                                                   |           |           | Arabic and English |
|                                |                       | References                                                          |                                                   |           |           | Arabic and English |
|                                |                       | Management Systems                                                 |                                                   |           |           | Arabic and English |
|                                |                       | Data Analysis                                                       |                                                   |           |           | Arabic and English |
|                                |                       | Poster Preparation                                                  |                                                   |           |           | Arabic and English |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic and English |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic and English |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic and English |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic and English |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic and English |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic and English |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic and English |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic and English |
|                                |                       | Information for All                                                |                                                   |           |           | Arabic and English |
|                                |                       | How to Use Moodle                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Sharing Large Files                                                |                                                   |           |           | Arabic and English |
|                                |                       | over the internet                                                  |                                                   |           |           | Arabic and English |
|                                |                       | Effective Presentations                                            |                                                   |           |           | Arabic and English |

(continued)
| Courses/Trainings session                  | Subject                          | Topic                                                                 | Organization                                                                 | Duration          | Certified   | Language     |
|------------------------------------------|----------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------|-------------|--------------|
| Le Diplôme Universitaire en Sciences de l’Information et des Bibliothèques (DUSIB Programme) | Information and Library Sciences | Introduction Générale aux Bibliothèques                           | l’Université Senghor d’Alexandr, i.e. l’Ecole Nationale Supérieure des Sciences de l’Information et des Bibliothèques (Enssib), la Bibliotheca Alexandrina (BA), et la Bibliothèque Nationale de France (BnF), avec l’Appui de l’Association des Amis de la Bibliotheca Alexandrina | 9 months         | Certified   | French       |
| Webinar                                  |                                  | Gestion du Patrimoine Audiovisuel                                    |                                                                              |                   | Self-paced  | N/A          |
|                                          |                                  | Droit de la Propriété Intellectuelle                                  |                                                                              |                   |             | English      |
|                                          |                                  | Médiation et Ingénierie Culturelle                                    |                                                                              |                   |             |              |
|                                          |                                  | IFLA International Advocacy Program                                    |                                                                              |                   |             |              |
|                                          |                                  | Cell Press Authoring and Researcher Engagement                          |                                                                              |                   |             |              |
| Topic                                                                 | Organization                                       | Duration | Cost          | Country      | Language |
|----------------------------------------------------------------------|----------------------------------------------------|----------|---------------|--------------|----------|
| Inquiry Learning: The Role of Resources to Inspire and Inform         | National Library of New Zealand                   | 5 weeks  | Paid course   | New Zealand  | English  |
| Building a Responsive Collection for Your School Library              |                                                    | 5 weeks  |               |              |          |
| Developing Digital Literacy in Your School                            |                                                    | 5 weeks  |               |              |          |
| Raising Readers: School and Home Connections                         |                                                    | 5 weeks  |               |              |          |
| Sail into Summer Reading: Keeping Students Reading Over Summer       |                                                    | 5 weeks  |               |              |          |
| Developing Your School Library Services                               |                                                    | 6 weeks  |               |              |          |
| Organization and Personnel Management                                | American Library Association (ALA)                | 2 weeks  | USA           |              |          |
| Science, Technology, Engineering, and Math (STEM) Programs Made Easy |                                                    | 4 weeks  |               |              |          |
| Fundamentals of Cataloging                                          |                                                    | 6 weeks  |               |              |          |
| Fundamentals of Metadata                                             |                                                    | 6 weeks  |               |              |          |
| Mindfulness in Libraries                                             |                                                    | 4 weeks  |               |              |          |
| Budget and Finance                                                   |                                                    | 5 weeks  |               |              |          |
| Making Games and Online                                             |                                                    | 3 weeks  |               |              |          |
| Interactive Content                                                  |                                                    |          |               |              |          |
| Fundamentals of Acquisitions                                         |                                                    | 6 weeks  |               |              |          |
| Fundamentals of Electronic Resources Acquisitions                    |                                                    | 4 weeks  |               |              |          |
| Fundamentals of Collection Development and Management                |                                                    | 4 weeks  |               |              |          |
| Fundamentals of Collection Assessment                                |                                                    | 6 weeks  |               |              |          |
| Fundamentals of Preservation                                          |                                                    | 4 weeks  |               |              |          |
| Whole Person Librarianship Social Work Concepts for Holistic Patron Services |                                | 5 weeks  |               |              |          |
| Project Management in Libraries                                      |                                                    | 4 weeks  |               |              |          |
| E-Resources Licensing: Best Practices                                |                                                    | 3 weeks  |               |              |          |
| Building An Accessible and Inclusive Library Community               |                                                    | 6 weeks  |               |              |          |
| Contemporary Issues in Action: Ethics for Librarians                 |                                                    | 4 weeks  |               |              |          |
| Storytelling with Puppets                                            |                                                    | 5 weeks  |               |              |          |
| Fundraising and Grantmanship                                         |                                                    | 5 weeks  |               |              |          |
| Who Manages, Who Leads?                                              |                                                    | 4 weeks  |               |              |          |
| Negotiating License Agreements and Pricing with Confidence Planning and Management of Library Buildings |                                                    | 6 weeks  |               |              |          |
| Marketing the 21st Century Library                                   |                                                    | 4 weeks  |               |              |          |
| Management of Technology STEM in Libraries                           | Australian Library and Information Association   | 6 weeks  | Paid Course   | Australia    | English  |
| Fundamentals of Preservation Education                                |                                                    | 4 weeks  |               |              |          |
| |
**Table III.** E-courses, sessions and trainings offered by international libraries

Role of public libraries in e-learning
Research design and sampling procedure

This study implemented an empirical data analysis, which applied qualitative and quantitative approaches to data collection and analysis. The collected data were retrieved via web searches. The collected data were e-courses provided by different universities and educational organizations and hosted by different MOOCs platforms. In order to make the study representative, data were collected based on three criteria: the selected e-courses should be limited to STEM topics, should have best review and rating, the educational institution/organization which provided the e-course should have high-ranking. The selected data are listed in Table AI.

STEM e-learning education

In this part, the author has selected a sample of different STEM e-courses that are relevant to the spectrum of the study. Additionally, the author was keen to choose e-courses based on the following factors to narrow down the sampling process:

1. Topic is limited to STEM fields;
2. E-courses should have best review and rating and
3. Educational organization/institution which provided the e-courses should have high ranking.

The list of these e-courses are shown in. Table AI. Figures 1 and 2 illustrate the STEM fields were covered, the number and percent of the e-courses provided.

From the collected data, the selected STEM e-courses were categorized into five main classes: the scientific discipline or field, the educational organization, the country, language of the e-course and the used platform. From Figure 3, it is noticeable that the chosen STEM e-courses are offered by countries in the following order: the USA, the UK and Egypt. Switzerland, Australia, South Africa, Canada, Denmark and Italy offered the remaining 8 percent of the covered STEM e-courses. Accordingly, the topics covered by the USA and UK are illustrated in Figures 4 and 5. The collected data show that the fields are represented as follows: 22.3 percent computer science, 12.9 percent engineering, 12.4 ;percent medicine, 11.4 percent biology, 10.9 percent physics, 5.4 percent mathematics, 5.4 percent STEM, 5 percent chemistry, 5 percent environmental sciences, 3 percent statistics and probability, 2.5 percent astronomy, 1.5 percent science, 1 percent bioinformatics, 0.5 percent Earth science, 0.5 percent quantum mechanics and 0.5 percent urban planning.

Discussion

Recently e-learning has shown significant expansion and attracted learners’ attention worldwide. E-learning assists learners who are geographically remote from educational institutions, unable to participate as full-or part-time campus students and grownups. E-learning promotes the “lifelong-learning” concept, ensures learning equity and increases the competence of workforce in order to cope with the overwhelming development in the modern economy and industry. Generally, e-learning depends on three main factors:

1. The instructor (teacher or tutor) and learner;
2. Educational institution, which creates and influences the process and
3. LMS that provides two-way communication between instructor, educational institution and learners.
Figure 1. STEM E-courses provided by different educational organizations.
In addition, LMS carries the e-courses materials and offers different tools and techniques to evaluate and transform courses into interactive and interesting e-courses.

In the twenty-first century, it is clear that science, technology, engineering and mathematic fields have great influence on the labor market (Chen et al., 2018). These fields are in continuous and hectic expansion. As a result, educators and learners are in great need of implementing technological innovations to become more engaged with STEM education and its latest topics. Nowadays, a number of researchers, scientists and professors are searching for more innovative techniques for STEM teaching. A number of published studies in literature have shown that e-learning plays a key role in STEM education (Tiwari, 2011). STEM education via e-learning could be of great help to schools and university students. E-learning could foster science literacy and introduce new scientific findings to the public.
the collected data, it is obvious that STEM education via e-learning is widely spreading, covering mostly all topics and offered by distinguished institutions worldwide.

From all the above propositions, international educational, commercial and cultural institutions have created numerous programs and e-courses. A number of international agencies are supporting e-learning, such as the Commonwealth and the World Bank Group. Public libraries have supporting elements and great potential to empower them to play significant roles in developing and spreading e-learning education. Each public library has different scope and objectives, nevertheless, all presented cases showed positive indications that e-learning education could be offered by public libraries depending on their resources, skilled librarian staff and collaboration with different educational organizations (Universities, research institutions, information services’ centers, etc.). However, most of the libraries providing e-learning services are confined to the LIS field. The collected data show that STEM subjects are successfully presented in interactive e-courses carried by LMS. The author suggests that as learners participate in engaging positive STEM e-learning courses, they would become more concerned with STEM and STEM-related careers. From the collected data, it is obvious that public libraries have full capacity

Figure 4. The STEM topics covered by the USA

Figure 5. The STEM topics covered by UK
(potential) to offer e-learning in STEM fields. This paper points out the value in having e-
learning team experts, this team could provide simple and/or deep scientific content;
provide, support and develop e-learning technologies; as well as create interactive and
entertaining e-courses. IT support teams could provide consultation to the e-learning teams.
In this study, the author has attempted to shed light on the role of the BA in e-learning as a
case study. The BA is a public library emerged as a hub for excellence providing a wide
range of innovative services. Among the remarkable services come the BA e-learning
services. The nascent service aims to deploy the lifelong learning approach and introduces
emerging scientific findings in interactive and simple means to specialized and non-
specialized audience. The BA e-learning services will achieve these goals by developing
collaboration between the BA and different educational institutions (schools, universities
and research institutions).

The BA e-learning service during three years was able to offer different e-courses
categories that could match the requirements of various users (general and lifelong learner,
LIS specialist, researchers and postgraduates). The BA in cooperation with Senghor
University, The National Superior School of Information Science and Libraries (ENSSIB), the
National Library of France (BnF) was able to award the DUSIB 2018–2019 alumni their
diploma and launched its second round 2019–2020. In year 2019, it offered the Researchers’
Program, which covers different topics, targets researchers and postgraduates and aims to
enhance their competencies. Researchers, scientists and professors from academia and
specialized librarians could cooperate to prepare and provide interactive, hands-on and useful
scientific e-courses. The author would like to highlight the idea that the role of public libraries
is providing online education to assist educational organizations, enhance society literacy,
increase public awareness and to embrace lifelong learning concept. Indeed, public libraries
could be partner to educational organizations not a substitute or alternative. There are
varieties of e-learning platforms that produce STEM e-courses for individuals. Many library
users are looking to public libraries to provide access to these platforms. Gale course,
Knowledgecity and Skillsoft are examples of platforms that provide various e-courses topics
for libraries. Briefly, public libraries with all their resources, services and expert librarians
could provide an exceptional e-learning experience to their community and be of great help to
educational institutions and organizations.

Conclusion
There is a diversity of e-courses, activities and programs that promote STEM education, but
there are limited models of extending STEM e-courses by employing e-learning platforms in
public libraries. These trials could be a positive sign that public libraries are promising key
players in developing and supporting e-learning education in different fields not only in LIS.
There is an increased need to augment STEM education via e-learning in a technology-driven
society and generate initiatives that develop STEM literacy and increase individuals’
awareness toward STEM, health, environmental issues and related professions. E-learning is
considered one of the most rapid and emergent industries. It is obvious that e-learning has left
a significant footprint on educational systems worldwide. Nowadays, public libraries with
their immense capacities open a new gateway toward e-learning. Public libraries have an
important and critical role to disseminate knowledge, education and literacy to the
community. They should ensure the quality of the provided educational material and
services. Public libraries should work on delivering their services equally to all types of public
users. To achieve their goal in the e-learning industry, public libraries should build strong
collaborations and partnerships with different educational institutions. Specialized librarians
are uniquely qualified to become active members of the e-learning team and assist both their
libraries and the educational institutions to effectively integrate STEM subjects into e-
courses. Public libraries should focus on basic and elementary STEM concepts, as well as create and enhance awareness of STEM fields and possible occupations. In conclusion, spreading the concepts of e-learning, STEM and lifelong education could have great impact on developing labor competence, enhancing socio-cultural and environmental public awareness.

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| #  | Scientific subject                     | Topic                                               | Provider                                      | Platform | Duration | Certified | Cost  | Country | Language           |
|----|----------------------------------------|-----------------------------------------------------|-----------------------------------------------|----------|----------|-----------|-------|---------|--------------------|
| 1  | Biology and Life Sciences              | Quantitative Biology Workshop                       | Massachusetts Institute of Technology (MITx) | edx      | 8 weeks  | Paid certificate | Free  | USA     | English            |
| 2  | Engineering, Business and Management,  | Principles of Manufacturing (8 courses)             | Massachusetts Institute of Technology (MITx) | edx      | 8 weeks  | Paid certificate | Free  | USA     | English            |
|    | Math, Data Analysis and Statistics     |                                                     |                                               |          |          |            |       |         |                    |
| 3  | Astronomy                              | The Science of Solar System                         | California Institute of Technology (Caltech)   | Coursera | 10 weeks | Paid certificate | Free  | USA     | English (subtitles: English, French) |
| 4  | Astronomy                              | Astrobiology and the Search for Extra-terrestrial Life | University of Edinburgh | Coursera | 5 weeks  | Paid certificate | Free  | UK      | English (Subtitles: English, Russian, Romanian, German) |
| 5  | Astronomy                              | Introduction to Astronomy                           | Duke University                                | Coursera | 10 weeks | Certificate available | Free  | USA     | English            |
| 6  | Astronomy                              | Atmospheric Chemistry; Planets and Life Beyond Earth | University of Leeds                             | FutureLearn | 2 weeks  | Paid certificate | Free  | UK      | English            |
| 7  | Astronomy                              | Our Solar System and Beyond; Teaching Primary Science | Royal Observatory Greenwich                     | FutureLearn | 3 weeks  | Paid certificate | Free  | UK      | English            |
| 8  | Biology                                | Dino 101: Dinosaur Paleobiology                    | University of Alberta                           | Coursera | 12 weeks | Paid certificate | Free  | Canada  | English (Subtitles: English, French, Italian, German, Spanish) |

(continued)
| #  | Scientific subject | Topic                                                                 | Provider                  | Platform | Duration | Certified          | Cost     | Country | Language |
|----|--------------------|----------------------------------------------------------------------|---------------------------|----------|----------|-------------------|----------|---------|----------|
| 9  | Biology            | Understanding the Brain: the Neurobiology of Everyday Life           | The University of Chicago | Coursera | 11 weeks | Paid certificate | Free     | USA     | English  |
| 10 | Biology            | Introduction to Genetics and Evolution                               | Duke University           | Coursera | 11 weeks | Paid certificate | Free     | USA     | English  |
|    |                    | (Subtitles: English, Romanian)                                       |                           |          |          |                   |          |         |          |
| 11 | Biology            | Introductory Human Physiology                                       | Duke University           | Coursera | 10 weeks | Paid certificate | Free     | USA     | English  |
| 12 | Biology            | Medical Neuroscience                                                | Duke University           | Coursera | 13 weeks | Paid certificate | Free     | USA     | English  |
| 13 | Biology            | Visual Perception and Brain                                          | Duke University           | Coursera | 5 weeks  | Paid certificate | Free     | USA     | English  |
| 14 | Biology            | Music as Biology: What We Like to Hear and Why                      | Duke University           | Coursera | 6 weeks  | Paid certificate | Free     | USA     | English  |
| 15 | Biology            | Bioelectricity: A Quantitative Approach                             | Duke University           | Coursera | 7 weeks  | Paid certificate | Free     | USA     | English  |
| 16 | Biology            | Bioelectricity: the Mechanism of Origin of Extracellular Potentials | Duke University           | Coursera | 7 weeks  | Paid certificate | Free     | USA     | English  |
| 17 | Biology            | Foundational Neuroscience for Perception and Action                 | Duke University           | Coursera | 9 weeks  | Certificate available | Free     | USA     | English  |
| 18 | Biology            | Neuroscience: Perception, Action and the Brain Capstone              | Duke University           | Coursera | 6 weeks  | Certificate available | Paid course | USA     | English  |
| 19 | Biology            | Anatomy: Know Your Abdomen                                          | University of Leeds       | FutureLearn | 2 weeks  | Paid certificate | Free     | UK      | English  |

(continued)
| #  | Scientific subject | Topic | Provider | Platform | Duration | Certified | Cost | Country       | Language                  |
|----|--------------------|-------|----------|----------|----------|-----------|-------|----------------|----------------------------|
| 20 | Biology            | How Does the Body Use DNA as a Blueprint? | University of Aberdeen | FutureLearn | 3 weeks | Paid certificate | Free | UK            | English                    |
| 21 | Biology            | Extinctions: Past and Present | University of Cape Town | FutureLearn | 5 weeks | Paid certificate | Free | South Africa | English                    |
| 22 | Biology and Life Sciences | Introduction to Biology: the secret of life | Massachusetts Institute of Technology (MITx) | edx | 12 weeks | Paid certificate | Free | USA            | English                    |
| 23 | Biology and Life Sciences | Molecular Biology – Part 1: DNA Replication and Repair | Massachusetts Institute of Technology (MITx) | edx | 8 weeks | Paid certificate | Free | USA            | English (Transcripts Simplified Chinese) |
| 24 | Biology and Life Sciences | Molecular Biology – Part 2: Transcription and Transposition | Massachusetts Institute of Technology (MITx) | edx | 7 weeks | Paid certificate | Free | USA            | English                    |
| 25 | Biology and Life Sciences | Introduction to Biology – The Secret of Life | Massachusetts Institute of Technology (MITx) | edx | 12 weeks | Paid certificate | Free | USA            | English                    |
| 26 | Biology and Life Sciences | Biochemistry: Biomolecules, Methods and Mechanisms | Massachusetts Institute of Technology (MITx) | edx | 12 weeks | Paid certificate | Free | USA            | English                    |
| 27 | Biology and Life Sciences | Making Biologic Medicines for Patients: The Principles of Biopharmaceutical Manufacturing | Massachusetts Institute of Technology (MITx) | edx | 6 weeks | Paid certificate | Free | USA            | English                    |

Table AI. Role of public libraries in e-learning (continued)
| #  | Scientific subject     | Topic                                                                 | Provider                                                                 | Platform | Duration | Certified | Cost       | Country | Language |
|----|------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|----------|----------|-----------|------------|---------|----------|
| 28 | Biology and Life Sciences | Making Biologic Medicines for Patients: The Principles of Biopharmaceutical Manufacturing | Massachusetts Institute of Technology (MITx)                          | edx      | 8 weeks  | Paid certificate | Free       | USA     | English |
| 29 | Biology and Life Sciences | Light, Spike and Sight: The Neuroscience of Vision                    | Massachusetts Institute of Technology (MITx)                          | edx      | 9 weeks  | Paid certificate | Free       | USA     | English |
| 30 | Bioinformatics          | Algorithms for DNA Sequencing                                         | Johns Hopkins University                                              | Coursera | 4 weeks  | Paid certificate | Free       | USA     | English |
| 31 | Bioinformatics          | Finding Hidden Messages in DNA (Bioinformatics I)                     | University of California, San Diego                                  | Coursera | 5 weeks  | Paid certificate | Free       | USA     | English |
| 32 | Chemistry               | The Brain and Space                                                   | Duke University                                                        | Coursera | 6 weeks  | Paid certificate | Free       | USA     | English |
| 33 | Chemistry               | Introduction to Chemistry: Structures and Solutions                   | Duke University                                                        | Coursera | 7 weeks  | Paid certificate | Free       | USA     | English |
| 34 | Chemistry               | Introduction to Chemistry: Reactions and Ratios                       | Duke University                                                        | Coursera | 7 weeks  | Paid certificate | Free       | USA     | English |
| 35 | Chemistry               | Introduction to Chemistry                                              | Duke University                                                        | Coursera | 9 weeks  | Certificate available | Free       | USA     | English |
| 36 | Chemistry               | Discovering Science: Medicinal Chemistry                              | University of Leeds                                                    | FutureLearn | 2 weeks  | Paid certificate | Free       | UK      | English |
| 37 | Chemistry               | Discovering Science: Global challenges                               | University of Leeds                                                    | FutureLearn | 2 weeks  | Paid certificate | Free       | UK      | English |
| 38 | Chemistry               | Discovering Science: Chemical Products                               | University of Leeds                                                    | FutureLearn | 2 weeks  | Paid certificate | Free       | UK      | English |
| 39 | Chemistry               | Discovering Science: Atmospheric Chemistry                            | University of Leeds                                                    | FutureLearn | 2 weeks  | Paid certificate | Free       | UK      | English |

(continued)
| #  | Scientific subject | Topic                                                                 | Provider                                      | Platform     | Duration | Certified        | Cost  | Country | Language |
|----|-------------------|----------------------------------------------------------------------|-----------------------------------------------|--------------|----------|------------------|-------|---------|----------|
| 40 | Chemistry         | Teaching Practical Science: Chemistry                                | National STEM Learning Center                 | FutureLearn  | 3 weeks  | Paid certificate | Free  | UK      | English  |
| 41 | Chemistry         | Introduction to Solid State Chemistry                               | Massachusetts Institute of Technology (MITx) | edx          | 15 weeks | Paid certificate | Free  | USA     | English  |
| 42 | Computer Science  | Robotics                                                             | Columbia University (ColumbiaX)              | edx          | 12 weeks | Paid certificate | Free  | USA     | English  |
| 43 | Computer Science  | Artificial Intelligence (AI)                                         | Columbia University (ColumbiaX)              | edx          | 12 weeks | Paid certificate | Free  | USA     | English  |
| 44 | Computer Science  | Machine Learning                                                     | Columbia University (ColumbiaX)              | edx          | 12 weeks | Paid certificate | Free  | USA     | English  |
| 45 | Computer Science  | Introduction to Computer Science and Programming Using Python        | Massachusetts Institute of Technology (MITx)| edx          | 9 weeks   | Paid certificate | Free  | USA     | English  |
| 46 | Computer Science  | Global Health Informatics to Improve Quality of Care                 | Massachusetts Institute of Technology (MITx)| edx          | 10 weeks | Paid certificate | Free  | USA     | English  |
| 47 | Computer Science  | Computational Thinking for Modeling and Simulation                   | Massachusetts Institute of Technology (MITx)| edx          | 6 weeks   | Paid certificate | Free  | USA     | English  |
| 48 | Computer Science  | Principles of Synthetic Biology                                      | Massachusetts Institute of Technology (MITx)| edx          | 15 weeks | Paid certificate | Free  | USA     | English  |

(continued)
| #  | Scientific subject | Topic                                      | Provider                                                                 | Platform | Duration | Certified | Cost    | Country | Language |
|----|-------------------|--------------------------------------------|--------------------------------------------------------------------------|----------|----------|-----------|---------|---------|----------|
| 49 | Computer Science  | Introduction to Computational Thinking and Data Science | Massachusetts Institute of Technology (MITx)                           | edx      | 9 weeks  | Paid certificate | Free    | USA     | English  |
| 50 | Computer Science  | Quantum Information Science I, Part 1      | Massachusetts Institute of Technology (MITx)                           | edx      | 5 weeks  | Paid certificate | Free    | USA     | English  |
| 51 | Computer Science  | Quantum Information Science I, Part 3      | Massachusetts Institute of Technology (MITx)                           | edx      | 7 weeks  | Paid certificate | Free    | USA     | English  |
| 52 | Computer Science  | Understanding Robotics                     | Massachusetts Institute of Technology (MITx)                           | edx      | 11 weeks | Paid certificate | Free    | USA     | English  |
| 53 | Computer Science  | Functional Programming Principles in Scala | École Polytechnique Fédérale de Lausanne                             | Coursera | 6 weeks  | Paid certificate | Free    | Switzerland | English  |
| 54 | Computer Science  | CS188.1x: Artificial Intelligence          | University of California                                             | edx      | 12 weeks | Paid certificate | Free    | USA     | English  |
| 55 | Computer Science  | CS50's Introduction to Computer Science    | Harvard University                                                    | edx      | 4 weeks  | Paid certificate | Free    | USA     | English  |
| 56 | Computer Science  | Learning from Data (Introductory Machine Learning) | California Institute of Technology (Caltech)                        | edx      | 10 weeks | Paid certificate | Free    | USA     | English  |
| 57 | Computer Science  | Intro to Computer Science                  | University of Virginia                                              | Udacity  | 12 weeks | Free       | USA     | English  |
| 58 | Computer Science  | Cryptography I                              | Stanford University                                                 | Coursera | 7 weeks  | Paid certificate | Free    | USA     | English  |

(continued)
| #  | Scientific subject | Topic Provider Platform | Duration | Certified | Cost | Country | Language |
|----|--------------------|-------------------------|----------|-----------|------|---------|----------|
| 59 | Computer Science   | Bitcoin and Cryptocurrency Technologies | FutureLearn | 11 weeks |       | USA     | English  |
| 60 | Computer Science   | Introduction to Cyber Security | The Open University | 8 weeks | Free certificate | UK | English |
| 61 | Data Science       | Statistical Thinking for Data Science and Analytics | Columbia University (ColumbiaX) | 5 weeks | Free certificate | USA | English |
| 62 | Data Science       | Machine Learning for Analytics | edX | 5 weeks | Free certificate | USA | English |
| 63 | Data Science       | Data Science and Analytics | edX | 5 weeks | Free certificate | USA | English |
| 64 | Data Science       | Enabling Technologies for Data Science and Analytics | Columbia University (ColumbiaX) | 5 weeks | Free certificate | USA | English |
| 65 | Data Science       | The Internet of Things for Data Science for Executives | Columbia University (ColumbiaX) | 15 weeks | Free certificate | USA | English |
| 66 | Data Science       | Capstone Exam in Statistics and Data Science | edX | 9 weeks | Paid certificate | USA | English |
| 67 | Data Science       | Introduction to Probability – The Science of Uncertainty | edX | 16 weeks | Paid certificate | USA | English |

Table AI. Role of public libraries in e-learning
| #   | Scientific subject | Topic                                                                 | Provider                                                                 | Platform | Duration | Certified     | Cost     | Country     | Language |
|-----|--------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------|----------|----------|--------------|----------|-------------|----------|
| 68  | Data Science       | The Analytics Edge                                                   | Massachusetts Institute of Technology (MITx)                            | edx      | 13 weeks | Paid certificate | Free    | USA         | English   |
| 69  | Data Science       | Data Mining with Weka                                               | University of Waikato                                                    | Independent | 5 weeks | Free | New Zealand     | English   |
| 70  | Data Science       | Big Data Analysis with Apache Spark                                 | University of California, Berkeley                                     | edx      | 4 weeks  | Free          | USA      | USA         | English   |
| 71  | Data Science       | Data Science: R Basics                                              | Harvard University                                                       | edx      | 8 weeks  | Paid certificate | Free    | USA         | English   |
| 72  | Data Science       | Analyzing and Visualizing Data with Excel                            | University of California, San Diego                                    | edx      | 6 weeks  | Paid certificate | Free    | USA         | English   |
| 73  | Data Science       | Introduction to Data Analysis Using Excel                            | Microsoft                                                               | edx      | 4 weeks  | Paid certificate | Free    | USA         | English   |
| 74  | Data Science       | Python for Data Science                                             | University of California, San Diego                                    | edx      | 10 weeks | Free          | USA      | USA         | English   |
| 75  | Disease and Disorders | Tropical Parasitology: Protozoans, Worms, Vectors and Human Diseases | Duke University                                                         | Coursera | 8 weeks  | Paid certificate | Free    | USA         | English   |
| 76  | Disease and Disorders | Causes of Human Disease: Understanding Causes of Disease             | University of Leeds                                                     | FutureLearn | 2 weeks | Paid certificate | Free    | UK          | English   |
| 77  | Disease and Disorders | Exploring Cancer Medicines                                          | University of Leeds                                                     | FutureLearn | 2 weeks | Paid certificate | Free    | UK          | English   |
| 78  | Disease and Disorders | Causes of Human Disease: Transmitting and Fighting Infection         | University of Leeds                                                     | FutureLearn | 2 weeks | Paid certificate | Free    | UK          | English   |
| #  | Scientific subject       | Topic                                                                 | Provider                  | Platform     | Duration | Certified          | Cost     | Country | Language |
|----|--------------------------|----------------------------------------------------------------------|---------------------------|--------------|----------|-------------------|----------|---------|----------|
| 79 | Disease and Disorders    | Causes of Human Disease: Exploring Cancer and Genetic Disease         | University of Leeds       | FutureLearn  | 2 weeks  | Paid certificate  | Free     | UK      | English  |
| 80 | Disease and Disorders    | Causes of Human Disease: Understanding Cardiovascular Disease         | University of Leeds       | FutureLearn  | 2 weeks  | Paid certificate  | Free     | UK      | English  |
| 81 | Disease and Disorders    | Causes of Human Disease: Nutrition and Environment                    | University of Leeds       | FutureLearn  | 2 weeks  | Paid certificate  | Free     | UK      | English  |
| 82 | Disease and Disorders    | Understanding Dementia                                                | University of Tasmania    | Independent  | 7 weeks  | Certificate available | Free     | Australia | English |
| 83 | Earth Science            | Introduction to Solar Cells                                          | Technical University of   | Coursera     | 5 weeks  | Paid certificate  | Paid course | Denmark | English |
| 84 | Engineering              | Major Engineering Project Performance                                 | University of Leeds        | Coursera     | 5 weeks  | Paid certificate  | Free     | UK      | English  |
| 85 | Engineering              | Circuits and Electronics 1: Basic Circuit Analysis                    | Massachusetts Institute of Technology (MITx) | edx          | 5 weeks  | Paid certificate  | Free     | USA     | English  |
| 86 | Engineering              | Circuits and Electronics 2: Amplification, Speed, and Delay           | Massachusetts Institute of Technology (MITx) | edx          | 5 weeks  | Paid certificate  | Free     | USA     | English  |
| 87 | Engineering              | Circuits and Electronics 3: Applications                              | Massachusetts Institute of Technology (MITx) | edx          | 7 weeks  | Paid certificate  | Free     | USA     | English  |

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| #  | Scientific subject | Topic                                                                 | Provider                                                       | Platform | Duration | Certified | Cost   | Country | Language |
|----|--------------------|-----------------------------------------------------------------------|---------------------------------------------------------------|----------|----------|-----------|--------|---------|----------|
| 88 | Engineering        | Structure of Materials, Part 1: Fundamentals of Materials Structure   | Massachusetts Institute of Technology (MITx)                  | edx      | 5 weeks  | Paid certificate | Free   | USA     | English  |
| 89 | Engineering        | Manufacturing Systems II                                              | Massachusetts Institute of Technology (MITx)                  | edx      | 8 weeks  | Paid certificate | Free   | USA     | English  |
| 90 | Engineering        | Supply Chains for Manufacturing II                                    | Massachusetts Institute of Technology (MITx)                  | edx      | 8 weeks  | Paid certificate | Free   | USA     | English  |
| 91 | Engineering        | Mechanics of Deformable Structures: Part 1                           | Massachusetts Institute of Technology (MITx)                  | edx      | 12 weeks | Paid certificate | Free   | USA     | English  |
| 92 | Engineering        | Structure of Materials, Part 2: The Crystalline State                 | Massachusetts Institute of Technology (MITx)                  | edx      | 5 weeks  | Paid certificate | Free   | USA     | English  |
| 93 | Engineering        | Management in Engineering II                                          | Massachusetts Institute of Technology (MITx)                  | edx      | 8 weeks  | Paid certificate | Free   | USA     | English  |
| 94 | Engineering        | Manufacturing Process Control I                                       | Massachusetts Institute of Technology (MITx)                  | edx      | 8 weeks  | Paid certificate | Free   | USA     | English  |
| 95 | Engineering        | Mechanical Behavior of Materials, Part 1: Linear Elastic Behavior     | Massachusetts Institute of Technology (MITx)                  | edx      | 5 weeks  | Paid certificate | Free   | USA     | English  |

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| #  | Scientific subject | Topic                                                                 | Provider                                           | Platform | Duration  | Certified          | Cost       | Country  | Language   |
|----|--------------------|------------------------------------------------------------------------|----------------------------------------------------|----------|-----------|--------------------|------------|----------|------------|
| 96 | Engineering        | Mechanical Behavior of Materials, Part 2: Stress Transformations, Beams, Columns and Cellular Solids | Massachusetts Institute of Technology (MITx)       | edx      | 4 weeks   | Paid certificate  | Free       | USA      | English    |
| 97 | Engineering        | Mechanical Behavior of Materials, Part 3: Time Dependent Behavior and Failure | Massachusetts Institute of Technology (MITx)       | edx      | 6 weeks   | Paid certificate  | Free       | USA      | English    |
| 98 | Engineering        | Engineering the Space Shuttle                                          | Massachusetts Institute of Technology (MITx)       | edx      | 12 weeks  | Paid certificate  | Free       | USA      | English    |
| 99 | Engineering        | Introduction to Aerospace Engineering: Astronautics and Human Spaceflight | Massachusetts Institute of Technology (MITx)       | edx      | 8 weeks   | Paid certificate  | Free       | USA      | English    |
| 100| Engineering        | Introduction to Aerodynamics                                           | Massachusetts Institute of Technology (MITx)       | edx      | 15 weeks  | Paid certificate  | Free       | USA      | English    |
| 101| Engineering        | Analysis of Transport Phenomena I: Mathematical Methods               | Massachusetts Institute of Technology (MITx)       | edx      | 12 weeks  | Paid certificate  | Free       | USA      | English    |
| 102| Engineering        | Computer-Aided Engineering (CADE)                                      | American University in Cairo (AUC)                 | moodle   | 3 months  | Paid course       | Paid course | Egypt    | English and Arabic |

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| #  | Scientific subject | Topic                                           | Provider                                      | Platform | Duration | Certified      | Cost       | Country  | Language                  |
|---|--------------------|-------------------------------------------------|----------------------------------------------|----------|----------|---------------|------------|----------|---------------------------|
| 103| Engineering        | Engineering Management Professional Certification (PCEM) | American University in Cairo (AUC)           | moodle   | 3 months | Paid certificate | Paid course | Egypt    | English and Arabic        |
| 104| Engineering        | Risk Assessment (RASH)                           | American University in Cairo (AUC)           | moodle   | 3 months | Paid certificate | Paid course | Egypt    | English and Arabic        |
| 105| Engineering        | Welding Engineering (WLEN)                       | American University in Cairo (AUC)           | moodle   | 3 months | Paid certificate | Paid course | Egypt    | English and Arabic        |
| 106| Engineering        | Cement Industry                                 | American University in Cairo (AUC)           | moodle   | 3 months | Paid certificate | Paid course | Egypt    | English and Arabic        |
| 107| Engineering        | The 3D Printing Revolution                      | University of Illinois at Urbana–Champaign   | Coursera | 2 weeks  | Paid certificate | Free       | USA      | English                   |
| 108| Engineering        | Introduction to Engineering Mechanics           | Georgia Institute of Technology              | Coursera | 5 weeks  | Paid certificate | Free       | USA      | English                   |
| 109| Environmental      | Environmental Engineering (EVEN)                 | American University in Cairo (AUC)           | moodle   | 3 months | Paid certificate | Paid course | Egypt    | English and Arabic        |
| 110| Science            | Marine Megafauna: an Introduction to Marine Science and Conservation | Duke University                              | Coursera | 8 weeks  | Certificate available | Free       | USA      | English                   |
| 111| Science            | Environmental Challenges: Justice in Natural Resource Management | University of Leeds                           | FutureLearn | 2 weeks  | Paid certificate | Free       | UK       | English                   |

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| #  | Scientific subject | Topic                                                                 | Provider                        | Platform | Duration | Certified       | Cost  | Country | Language |
|----|--------------------|----------------------------------------------------------------------|---------------------------------|----------|----------|----------------|-------|---------|----------|
| 112| Environmental Science | Environmental Challenges: Rights and Values in Ecosystem Services   | University of Leeds             | FutureLearn | 2 weeks | Paid certificate | Free  | UK      | English  |
| 113| Environmental Science | Environmental Challenges: Hierarchy in Property Rights               | University of Leeds             | FutureLearn | 2 weeks | Paid certificate | Free  | UK      | English  |
| 114| Environmental Science | Environmental Challenges: Human Impact in the Natural Environment    | University of Leeds             | FutureLearn | 2 weeks | Paid certificate | Free  | UK      | English  |
| 115| Environmental Science | Fairness and Nature: when worlds collide                             | University of Leeds             | FutureLearn | 2 weeks | Paid certificate | Free  | UK      | English  |
| 116| Environmental Science | Environmental Management: Social-Ecological Systems                  | University of Leeds             | FutureLearn | 3 weeks | Paid certificate | Free  | UK      | English  |
| 117| Environmental Science | Global Biosecurity for One Health                                    | Murdoch University              | FutureLearn | 3 weeks | Paid certificate | Free  | Australia | English  |
| 118| Environmental Science | Sustainable Development in Humanitarian Action                       | International Federation of Red Cross and Red Crescent Societies | FutureLearn | 4 weeks | Paid certificate | Free  | Switzerland | English  |
| 119| Health care         | Improving Healthcare Through Clinical Research                       | University of Leeds             | FutureLearn | 4 weeks | Paid certificate | Free  | UK      | English  |
| 120| Health care         | Whole Genome Sequencing: Decoding the Language of Life and Health    | NHS Health Education England    | FutureLearn | 3 weeks | Paid certificate | Free  | England | English  |

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| #   | Scientific subject | Topic                                                                 | Provider                                                                 | Platform      | Duration | Certified | Cost | Country   | Language |
|-----|--------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------|---------------|----------|-----------|------|-----------|----------|
| 121 | Health care        | Dysphagia: Swallowing Difficulties and Medicines                      | University of East Anglia                                                | FutureLearn   | 6 weeks  | Paid      | Free | UK        | English  |
| 122 | Health care        | Creating Moments of Joy for People with Alzheimer’s                   | Purdue University                                                        | FutureLearn   | 2 weeks  | Paid      | Free | USA       | English  |
| 123 | Health care        | First aid for adults                                                 | International Federation of Red Cross and Red Crescent Societies         | FutureLearn   | 2 weeks  | Paid      | Free | Switzerland | English  |
| 124 | Health care        | First aid for babies and children                                     | International Federation of Red Cross and Red Crescent Societies         | FutureLearn   | 2 weeks  | Paid      | Free | Switzerland | English  |
| 125 | Health care        | Be Ready: Staying Safe During Disasters                               | International Federation of Red Cross and Red Crescent Societies         | FutureLearn   | 2 weeks  | Paid      | Free | Switzerland | English  |
| 126 | Health care        | Medicine and the Arts: Humanizing Healthcare                          | University of Cape Town                                                  | FutureLearn   | 6 weeks  | Paid      | Free | South Africa | English  |
| 127 | Health care        | Mindfulness for Wellbeing and Peak Performance                        | Monash University                                                        | FutureLearn   | 6 weeks  | Paid      | Free | Australia  | English  |
| 128 | Health care        | Understanding Clinical Research: Behind the Statistics                | University of Cape Town                                                  | Coursera      | 6 weeks  | Paid      | Free | South Africa | English  |

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| #  | Scientific subject                      | Topic                                                                 | Provider                              | Platform | Duration | Certified | Cost      | Country  | Language       |
|----|-----------------------------------------|----------------------------------------------------------------------|---------------------------------------|----------|----------|-----------|-----------|----------|----------------|
| 129| Health care, Environmental Sciences     | Occupational Health, Safety and Environmental Control (HSE) (OSHA)   | American University in Cairo (AUC)   | moodle   | 12 weeks | Paid certificate | Paid course | Egypt    | English and Arabic |
| 130| Machine Learning                        | Machine Learning                                                     | Stanford University                  | Coursera | 11 weeks | Paid certificate | Free      | USA      | English         |
| 131| Mathematics                            | Differential Equations: Linear Algebra and NxN Systems of Differential Equations | Massachusetts Institute of Technology (MITx) | edx      | 9 weeks  | Paid certificate | Free      | USA      | English         |
| 132| Mathematics                            | Calculus One                                                         | Ohio State University                | Coursera | 16 weeks | Free      | USA      | English         |
| 133| Mathematics                            | Calculus 1A: Differentiation                                         | Massachusetts Institute of Technology (MITx) | edx      | 12 weeks | Paid certificate | Free      | USA      | English         |
| 134| Mathematics                            | Calculus 1B: Integration                                              | Massachusetts Institute of Technology (MITx) | edx      | 15 weeks | Paid certificate | Free      | USA      | English         |
| 135| Mathematics                            | Calculus 1C: Coordinate Systems and Infinite Series                  | Massachusetts Institute of Technology (MITx) | edx      | 8 weeks  | Paid certificate | Free      | USA      | English         |
| 136| Mathematics                            | Differential Equations: Fourier Series and Partial Differential Equations | Massachusetts Institute of Technology (MITx) | edx      | 9 weeks  | Paid certificate | Free      | USA      | English         |
| 137| Mathematics                            | Fractals and Scaling                                                 | Santa Fe Institute Complexity Explorer | Coursera | 7 weeks  | Certificate available | Free      | USA      | English         |
| 138| Mathematics                            | Introduction to Mathematical Thinking                                | Stanford University                  | Coursera | 9 weeks  | Paid certificate | Free      | USA      | English         |

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| #   | Scientific subject | Topic                                                                 | Provider                                      | Platform | Duration | Certified          | Cost  | Country | Language       |
|-----|--------------------|------------------------------------------------------------------------|-----------------------------------------------|----------|----------|--------------------|-------|---------|----------------|
| 139 | Mathematics        | Algorithms: Design and Analysis, Part 1                              | Stanford University                          | Coursera | 7 weeks  | Paid certificate   | Free  | USA      | English         |
| 140 | Mathematics        | Algorithms, Part I                                                    | Princeton University                         | Coursera | 6 weeks  | Free               | USA   | English  |
| 141 | Mathematics        | Introduction to Dynamical Systems and Chaos                          | Santa Fe Institute                           | Complexity Explorer                         | 10 weeks | Certificate available | Free  | USA      | English         |
| 142 | Medicine           | Pediatric HIV Nursing                                                 | Columbia University                          | edx      | 8 weeks  | Paid certificate   | Free  | USA      | English         |
| 143 | Medicine           | Fighting HIV with Antiretroviral Therapy: Implementing the Treat-All Approach | Columbia University                          | edx      | 6 weeks  | Paid certificate   | Free  | USA      | English         |
| 144 | Physics            | How Things Work: an Introduction to Physics                           | University of Virginia                       | Coursera | 8 weeks  | Paid certificate   | Free  | USA      | English         |
|     |                    |                                                                        |                                               |          |          |                    |       |          | (Subtitles: English, Arabic, French, Portuguese (European), Chinese (Simplified), Greek, Italian, Korean, German, Urdu, Russian, Hebrew, Spanish, Hindi, Japanese) |         |
| 145 | Physics            | Mechanics: Rotational Dynamics                                        | Massachusetts Institute of Technology (MITx) | edx      | 6 weeks  | Paid certificate   | Free  | USA      | English         |
| # | Scientific subject | Topic | Provider | Platform | Duration | Certified | Cost | Country | Language |
|---|-------------------|-------|----------|----------|----------|----------|-------|---------|----------|
| 146 | Physics | Applications of Quantum Mechanics | Massachusetts Institute of Technology (MITx) | edx | 19 weeks | Paid certificate | Free | USA | English |
| 147 | Physics | Electricity and Magnetism: Electrostatics | Massachusetts Institute of Technology (MITx) | edx | 7 weeks | Paid certificate | Free | USA | English |
| 148 | Physics | Electricity and Magnetism: Maxwell’s Equations | Massachusetts Institute of Technology (MITx) | edx | 6 weeks | Paid certificate | Free | USA | English |
| 149 | Physics | Electricity and Magnetism: Magnetic Fields and Forces | Massachusetts Institute of Technology (MITx) | edx | 6 weeks | Paid certificate | Free | USA | English |
| 150 | Physics | Mastering Quantum Mechanics Part 1: Wave Mechanics | Massachusetts Institute of Technology (MITx) | edx | 5 weeks | Paid certificate | Free | USA | English |
| 151 | Physics | Mastering Quantum Mechanics Part 2: Quantum Dynamics | Massachusetts Institute of Technology (MITx) | edx | 5 weeks | Paid certificate | Free | USA | English |
| 152 | Physics | Mastering Quantum Mechanics Part 3: Entanglement and Angular Momentum | Massachusetts Institute of Technology (MITx) | edx | 5 weeks | Paid certificate | Free | USA | English |
| 153 | Physics | Quantum Mechanics: 1D Scattering and Central Potentials | Massachusetts Institute of Technology (MITx) | edx | 7 weeks | Paid certificate | Free | USA | English |

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| #  | Scientific subject | Topic                                         | Provider                              | Platform | Duration | Certified       | Cost  | Country | Language |
|----|--------------------|----------------------------------------------|---------------------------------------|----------|----------|----------------|-------|---------|----------|
| 154| Physics            | Mechanics: Momentum and Energy               | Massachusetts Institute of Technology (MITx) | edx      | 7 weeks  | Paid certificate | Free  | USA     | English  |
| 155| Physics            | Quantum Mechanics: Quantum physics in 1D Potentials | Massachusetts Institute of Technology (MITx) | edx      | 7 weeks  | Paid certificate | Free  | USA     | English  |
| 156| Physics            | Mechanics: Simple Harmonic Motion             | Massachusetts Institute of Technology (MITx) | edx      | 4 weeks  | Paid certificate | Free  | USA     | English  |
| 157| Physics            | Mechanics: Kinematics and Dynamics            | Massachusetts Institute of Technology (MITx) | edx      | 6 weeks  | Paid certificate | Free  | USA     | English  |
| 158| Physics            | Quantum Mechanics: Wave functions, Operators and Expectation Values | Massachusetts Institute of Technology (MITx) | edx      | 7 weeks  | Paid certificate | Free  | USA     | English  |
| 159| Physics            | Quantum Information Science II: Efficient Quantum Computing – fault tolerance and complexity | Massachusetts Institute of Technology (MITx) | edx      | 4 weeks  | Paid certificate | Free  | USA     | English  |
| 160| Physics            | Quantum Information Science I, Part 2         | Massachusetts Institute of Technology (MITx) | edx      | 6 weeks  | Paid certificate | Free  | USA     | English  |
| 161| Physics            | Quantum Information Science II                | Massachusetts Institute of Technology (MITx) | edx      | 9 weeks  | Paid certificate | Free  | USA     | English  |

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| #   | Scientific subject | Topic                                                                 | Provider                                           | Platform | Duration | Certified  | Cost       | Country | Language |
|-----|--------------------|----------------------------------------------------------------------|----------------------------------------------------|----------|----------|------------|------------|----------|----------|
| 162 | Physics            | Atomic and Optical Physics I – Part 1: Resonance                     | Massachusetts Institute of Technology (MITx)       | edx       | 4 weeks  | Paid certificate | Free            | USA      | English   |
| 163 | Physics            | Atomic and Optical Physics: Optical Bloch Equations and Open System Dynamics | Massachusetts Institute of Technology (MITx)       | edx       | 4 weeks  | Paid certificate | Free            | USA      | English   |
| 164 | Physics            | Global Warming Science                                               | Massachusetts Institute of Technology (MITx)       | edx       | 12 weeks | Paid certificate | Free            | USA      | English   |
| 165 | Physics            | Effective Field Theory                                               | Massachusetts Institute of Technology (MITx)       | edx       | 18 weeks | Paid certificate | Free            | USA      | English   |
| 166 | Physiology         | What is body?                                                        | University of Aberdeen                             | FutureLearn | 3 weeks  | Paid certificate | Free            | UK       | English   |
| 167 | Physiology         | What Drives the Body?                                                | University of Aberdeen                             | FutureLearn | 3 weeks  | Paid certificate | Free            | UK       | English   |
| 168 | Programming        | An Introduction to Interactive Programming in Python (Part 1)        | Rice University                                   | Coursera  | 5 weeks  | Paid certificate | Free            | USA      | English   |
| 169 | Programming        | Introduction to Programming with MATLAB                              | Vanderbilt University                               | Coursera  | 9 weeks  | Paid certificate | Free            | USA      | English   |
| 170 | Programming        | Programming for Everybody (Getting Started with Python)              | University of Michigan                              | Coursera  | 7 weeks  | Paid certificate | Free            | USA      | English   |
| 171 | Programming        | Learn to Program: The Fundamentals                                    | University of Toronto                               | Coursera  | 7 weeks  | Paid certificate | Free            | Canada   | English   |

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| #   | Scientific subject | Topic                                      | Provider      | Platform | Duration  | Certified       | Cost     | Country | Language |
|-----|--------------------|--------------------------------------------|---------------|----------|-----------|----------------|----------|---------|----------|
| 172 | Programming        | Learn to Program in Java                   | Microsoft     | edx      | 4 weeks   | Paid certificate| Free     | USA     | English  |
| 173 | Programming        | Java Programming Basics                   | Udacity       |          | 6 weeks   |                | Free     | USA     | English  |
| 174 | Programming        | Introduction to Python: Absolute Beginner  | Microsoft     | edx      | 5 weeks   | Paid certificate| Free     | USA     | English  |
| 175 | Programming        | Android Basics: User Interface             | Google        | Udacity  | 2 weeks   |                | Free     | USA     | English  |
| 176 | Programming        | Programming Foundations with Python        | Udacity       |          | 6 weeks   |                | Free     | USA     | English  |
| 177 | Programming        | Developing Android Apps                    | Udacity       | Self-paced | 5 weeks   |                | Free     | USA     | English  |
| 178 | Public Health      | The Challenges of Global Health            | Duke University | Coursera | 5 weeks   | Paid certificate| Free     | USA     | English  |
| 179 | Public Health      | Discover Dentistry                         | The University of Sheffield | FutureLearn | 6 weeks   | Paid certificate | Free     | UK      | English  |
| 180 | Quantum Mechanics  | Quantum Mechanics for everyone             | edx           |          | 4 weeks   |                | Free     | USA     | English  |
| 181 | Robotics           | Artificial Intelligence for Robotics       | Stanford University (GeorgetownX) | Udacity | 8 weeks   |                | Free     | USA     | English  |
| 182 | Science            | Nuclear Energy: Science, Systems and Society | edx           |          | 8 weeks   | Paid certificate | Free     | USA     | English  |
| 183 | Science            | Introduction to Complexity                 | Santa Fe Institute | Complexity Explorer | 10 weeks | Certificate available | Free     | USA     | English  |
| 184 | Science            | The Science of Everyday Thinking           | University of Queensland | edx | 12 weeks |               | Free     | USA     | English  |

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| #  | Scientific subject | Topic | Provider | Platform | Duration | Certified | Cost         | Country | Language |
|----|-------------------|-------|----------|----------|----------|-----------|------------|----------|----------|
| 185 | Statistics        | Fundamentals of Statistics | Massachusetts Institute of Technology (MITx) | edx      | 14 weeks | Paid certificate | Free     | USA      | English  |
| 186 | Statistics and Probability | Bayesian Statistics | Duke University | Coursera  | 5 weeks  | Paid certificate | Free     | USA      | English  |
| 187 | Statistics and Probability | Linear Regression and Modeling | Duke University | Coursera  | 4 weeks  | Paid certificate | Free     | USA      | English  |
| 188 | Statistics and Probability | Introduction to Probability and Data | Duke University | Coursera  | 5 weeks  | Paid certificate | Free     | USA      | English  |
| 189 | Statistics and Probability | Statistics with R Capstone | Duke University | Coursera  | 8 weeks  | Paid certificate | Free     | USA      | English  |
| 190 | Statistics and Probability | Teaching Statistical Thinking: Part 1 Descriptive Statistics | Duke University | Coursera  | 5 weeks  | Certificate available | Free     | USA      | English  |
| 191 | STEM              | Assessment for Learning in STEM Teaching | University of Leeds | FutureLearn | 6 weeks  | Certificate available | Free     | UK       | English  |
| 192 | STEM              | Inspiring Young People In STEM (Program) | National STEM Learning Center | FutureLearn | 8 weeks  | Paid certificate | Free     | UK       | English  |
| 193 | STEM              | Assessment for Learning in STEM Teaching | National STEM Learning Center | FutureLearn | 6 weeks  | Paid certificate | Free     | UK       | English  |
| 194 | STEM              | Teaching STEM Subjects: Planning for Learning | National STEM Learning Center | FutureLearn | 5 weeks  | Paid certificate | Free     | UK       | English  |
| 195 | STEM              | Teaching Primary Science: Getting Started | National STEM Learning Center | FutureLearn | 3 weeks  | Paid certificate | Free     | UK       | English  |

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| #   | Scientific subject | Topic                                                                 | Provider                                      | Platform       | Duration | Certified       | Cost        | Country | Language |
|-----|--------------------|----------------------------------------------------------------------|-----------------------------------------------|----------------|----------|----------------|-------------|---------|----------|
| 196 | STEM               | Teaching STEM Subjects: Differentiation for Learning                  | National STEM Learning Center                 | FutureLearn    | 5 weeks  | Paid certificate | Free        | UK      | English  |
| 197 | STEM               | Linking STEM Curriculum Learning to Careers                          | National STEM Learning Center                 | FutureLearn    | 4 weeks  | Paid certificate | Free        | UK      | English  |
| 198 | STEM               | Maths Subject Knowledge: Proportional Reasoning                       | National STEM Learning Center                 | FutureLearn    | 4 weeks  | Paid certificate | Free        | UK      | English  |
| 199 | STEM               | Teaching Practical Science: Physics                                  | National STEM Learning Center                 | FutureLearn    | 3 weeks  | Paid certificate | Free        | UK      | English  |
| 200 | STEM               | Teaching Practical Science: Biology                                  | National STEM Learning Center                 | FutureLearn    | 3 weeks  | Paid certificate | Free        | UK      | English  |
| 201 | STEM               | Planning for Learning in STEM Teaching: Formative Assessment for Tailored Learning | National STEM Learning Center                 | FutureLearn    | 5 weeks  | Paid certificate | Free        | UK      | English  |
| 202 | STEM               | Coding in your Classroom, Now!                                       | University of Urbino                          | EMMA           | 13 weeks |               | Free        | Italy    | Italian  |
| 203 | Urban Planning     | Transport Systems: Global Issues and Future Innovations               | University of Leeds                           | FutureLearn    | 2 weeks  | Paid certificate | Free        | UK      | English  |