

# Assessing the Practicality of Practical Courses in Online Education

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**Abstract:** *The delivery of education and learning experiences using the internet or other digital technologies is referred to as online education, often known as e-learning. It enables students to access learning resources, communicate with teachers, and take part in schoolwork from anywhere with an internet connection, usually from the comfort of their own homes. During the corona pandemic, there was a huge increase in enrolment in online courses. In most fields, it was established and accepted as a replacement for traditional education, but in courses involving practical topics, laboratory work, or experimental procedures, flaws were found in the methods used to convey the lessons, the practical work, and the evaluation procedures. This paper is an attempt to understand the limitations involved in online education viz technical and practical subjects. Authors have prepared an assessment on various practical based courses in different domains of education which can be delivered and evaluated using online mode. This paper also focusses on challenges involved in delivery and assessment of subjects which authors believe are not suitable for online model.*

**Keywords:** E learning, Digital Technologies, Technical Learnings, Challenges on Online mode

## I. INTRODUCTION

Online education, also known as e-learning, refers to the delivery of education and learning experiences through the internet or other digital technologies [1]. It allows students to access educational materials, interact with instructors, and participate in coursework remotely [2], [3], typically from their own homes or any location with an internet connection [4]. Online education can take various forms, including:

1. **Synchronous Learning:** In synchronous online education, students and instructors engage in real-time interaction. This can include live video lectures, webinars, and virtual classrooms where everyone participates simultaneously [5].
2. **Asynchronous Learning:** Asynchronous learning does not require real-time participation. Students can access course materials, assignments, and discussion boards at their convenience. They have the flexibility to study and complete assignments on their own schedule [6].
3. **Hybrid or Blended Learning:** This approach combines both online and traditional in-person instruction [7]. Students may attend some classes on campus and others online [8].
4. **Massive Open Online Courses (MOOCs):** MOOCs are large-scale online courses that are often open to anyone who wants to enrol. They usually consist of video lectures, quizzes, and discussion forums. They can be free or paid, and they're provided by universities, institutions, or online learning platforms [5], [9].

Online education can encompass a wide range of educational levels and subjects, from middle school to higher education and professional development. It is often facilitated through learning management systems (LMS), [10] which are platforms that host course materials, assignments, assessments, and communication tools.

Advantages of online education include flexibility in scheduling, accessibility for a diverse range of learners, the ability to choose from a wider variety of courses and programs, and reduced geographical barriers. However, challenges such as maintaining student engagement, ensuring access to necessary technology, and providing adequate support for students who may struggle with self-directed learning are also associated with online education [11]. The growth of online education has been significantly accelerated by advances in technology, and it has become increasingly popular

as a mode of learning, especially in situations where physical attendance at a traditional educational institution is not possible or practical. It was further necessitated with the spread of Corona virus pandemic in 2019-20 when the whole world realized the importance of online education [12][13]. It was during this time that students also realized [14], [15] that learning a subject via online mode is a valid alternative for offline regular education. This validation was encouraged by Universities all across the globe when they started their own online education platforms in the market which was predominantly occupied by private education-technology companies [10].

## II. TECHNICAL SUBJECTS OF SCIENCES

Many courses in the sciences require a practical or hands-on approach because experimentation [16]–[18], observation, and application of theoretical concepts are essential components of understanding and advancing in these fields [19]. Here are some major scientific disciplines and examples of courses within them that often require a practical approach:

- Biology:**
  - Laboratory Techniques in Biology:** This course focuses on developing practical skills in biological research, including microscopy, DNA analysis, and cell culture.
  - Field Biology:** Students engage in fieldwork to study ecosystems, organisms, and biodiversity in their natural environments.
- Chemistry:**
  - Organic Chemistry Lab:** This lab course involves synthesizing and analysing organic compounds, providing hands-on experience with chemical reactions.
  - Analytical Chemistry:** Students learn techniques for chemical analysis, such as spectroscopy and chromatography, and apply them in the lab.
- Physics:**
  - Physics Laboratory:** Lab sessions complement theoretical physics courses, allowing students to perform experiments in mechanics, optics, electromagnetism, and more.
  - Astrophysics Observations:** Students use telescopes and other instruments to observe celestial objects and phenomena.
- Earth and Environmental Sciences:**
  - Geology Field Camp:** Participants spend several weeks in the field studying geological formations, mapping, and conducting research on earth processes.
  - Environmental Science Practicum:** Students work on real-world environmental projects, such as water quality assessments or ecological restoration efforts.
- Engineering:**
  - Mechanical Engineering Lab:** Students design and build mechanical systems, conduct stress tests, and evaluate prototypes.
  - Civil Engineering Materials Lab:** Participants test the properties of construction materials like concrete and steel.
- Computer Science:**
  - Programming and Software Development:** While primarily theoretical, computer science courses often include coding assignments and projects to apply programming concepts [20].
  - Computer Networking Lab:** Students configure and troubleshoot computer networks in a hands-on lab environment.
- Psychology:**
  - Experimental Psychology:** This course involves designing, conducting, and analysing experiments to investigate psychological phenomena.
  - Cognitive Neuroscience Lab:** Students use neuroimaging and electrophysiological equipment to study brain function.

8. **Nursing and Healthcare Sciences:**

- **Clinical Practicum:** Nursing students gain practical experience by working in hospitals, clinics, or healthcare settings under supervision [21], [22].
- **Medical Laboratory Techniques:** Students learn to perform clinical tests and analyse patient samples in a lab setting [23].

9. **Agriculture and Agronomy:**

- **Crop Science Fieldwork:** Students cultivate and study crops, manage pests, and explore agricultural practices in the field.
- **Soil Science Lab:** Participants analyse soil samples for properties like pH, nutrient content, and texture.

These examples illustrate the diverse range of scientific disciplines that require practical, hands-on components to complement theoretical knowledge. Hands-on experience is often crucial for developing problem-solving skills, critical thinking, and a deeper understanding of scientific concepts. It also prepares students for careers in research, industry, healthcare, and other science-related fields.

### III. IMPACT OF ONLINE-EDUCATION ON PRACTICAL ORIENTED COURSES

The impact of online education on the knowledge level of students in practical-oriented courses can vary depending on various factors, including the quality of the online program, the discipline of study, the resources available to students, and the student's individual learning style and motivation[24]. Here are some key points to consider:

1. **Practical Component:** Online education for practical-oriented courses typically includes a theoretical component that can be delivered effectively through digital platforms. However, the practical aspect, which involves hands-on skills, experiments, or real-world application, can be more challenging to replicate online[18].
2. **Simulation and Virtual Labs:** Some online courses integrate virtual labs and simulations to mimic practical experiences. While these tools can be beneficial, they may not fully replace the hands-on experience provided in traditional in-person settings[25].
3. **Access to Resources:** The effectiveness of online education for practical courses can depend on the availability of resources and equipment. Students may need access to specific tools, materials, or technologies to gain practical skills. Limited access to such resources can be a barrier to learning.
4. **Instructor Interaction:** Quality online programs often include opportunities for students to interact with instructors through video conferences, discussion boards, or email. Regular communication with instructors can help clarify doubts and provide guidance on practical aspects [26].
5. **Self-Motivation and Discipline:** Online education requires students to be self-motivated and disciplined in managing their time and coursework. This can be challenging, especially for practical courses that demand hands-on practice and experimentation.
6. **Assessment Methods:** Assessing practical skills in an online environment can be more complex than traditional methods like in-person lab evaluations. Some courses use video submissions, online quizzes, or project assessments to evaluate practical knowledge [27].
7. **Blended Learning:** Many institutions use a blended learning approach, combining online instruction with periodic in-person lab sessions or practical workshops. This can help bridge the gap between theoretical online learning and hands-on experience.
8. **Fieldwork and Internships:** Some practical-oriented courses may require students to participate in fieldwork or internships, which can be challenging to coordinate online. Institutions often work to find suitable arrangements for such experiences [28].

### IV. PRACTICAL ORIENTED COURSES SUITABLE FOR ONLINE MODE

While many practical-oriented courses traditionally involve hands-on experiences that are challenging to replicate entirely online, advancements in technology have made it possible to offer online versions of several practical courses. Here are some examples of practical-oriented courses that students can study in online mode:

- 1) **Computer Science and IT:**
  - a) **Programming and Software Development:** Students can learn coding languages and develop software applications through online coding platforms and virtual development environments.
  - b) **Cybersecurity:** Online courses often include hands-on labs for learning how to secure computer systems and networks.
  - c) **Database Management:** Students can practice creating and managing databases using virtual database systems.
- 2) **Healthcare and Medicine:**
  - a) **Telemedicine and Telehealth:** Some aspects of healthcare, like teleconsultations and remote patient monitoring, can be learned and practiced online.
  - b) **Medical Coding and Billing:** Courses on medical coding and billing can be taught online, and students can practice with coding software.
- 3) **Data Science and Analytics:**
  - a) **Data Analysis:** Students can learn data analysis techniques using online tools and datasets, and they can practice through hands-on projects.
  - b) **Machine Learning:** Online courses often provide access to machine learning platforms for students to develop and test algorithms.
- 4) **Business and Entrepreneurship:**
  - a) **Entrepreneurship and Business Planning:** Students can learn how to create business plans and analyze markets through online courses.
  - b) **Digital Marketing:** Practical skills in digital marketing, including running online ad campaigns, can be taught and practiced online.
- 5) **Design and Creative Arts:**
  - a) **Graphic Design:** Students can use design software and tools remotely to create graphics, illustrations, and layouts.
  - b) **Web Development:** Courses in web development often include hands-on projects to build websites and web applications online.
- 6) **Environmental Science and Sustainability:**
  - a) **Environmental Impact Assessment:** Students can learn to assess environmental impacts and conduct impact studies using online resources and data.
  - b) **Sustainability Planning:** Sustainable practices and planning can be taught and discussed online, although some fieldwork may still be required.
- 7) **Language Learning:**
  - a) **Foreign Language Courses:** Language learning platforms offer practical language courses that include speaking and listening exercises.
  - b) **Sign Language:** Courses in sign language can be taught online, and students can practice through video interactions.
- 8) **Cooking and Culinary Arts:**
  - a) **Online Cooking Classes:** Virtual cooking classes allow students to follow recipes, learn culinary techniques, and cook dishes in their own kitchens.
- 9) **Education and Teaching:**
  - a) **Online Teaching and Instruction:** Teachers and educators can learn how to create effective online courses and use virtual teaching tools to engage students.
- 10) **Construction and Home Improvement:**
  - a) **DIY and Home Improvement Courses:** Students can learn practical skills related to construction, carpentry, plumbing, and electrical work through online tutorials and courses.

## V. RECOMMENDATIONS FOR CONDUCTING ONLINE COURSES ON TECHNICAL SUBJECTS

Conducting technical and practical courses online can be difficult, but it can also be profitable if the correct techniques and resources are used. Following are some tips for successfully teaching technical and practical subjects online:

1. Choosing the appropriate learning management system (LMS) Select an LMS that is capable of supporting a range of content formats, interactive tools, and exams. Moodle, Canvas, Blackboard, and Google Classroom are all well-liked choices.
2. Structured Course Design: Set explicit learning objectives, resources, and assessments for each module or unit of your course. Students can better comprehend the expectations and course structure thanks to this.
3. Engaging Content: Produce or compile interesting multimedia content, such as interactive quizzes, simulations, and video lectures. Make sure that all pupils can access the material.
4. Live Online Sessions: Hold live meetings using Microsoft Teams or Zoom video conferencing software. To make learning more interactive, use these sessions for debates, Q&A sessions, and demonstrations.
5. Simulations and Virtual Labs: If appropriate, use simulations and virtual labs to give students practical experience in a secure online setting.
6. Projects and tasks: Create relevant projects and tasks that students can do online. Encourage them to put their newfound knowledge into practise and submit their work electronically.
7. Encourage peer collaboration by using online discussion boards, group projects, or virtual study groups. Learning in groups can improve comprehension and involvement.
8. Comments and Assessment: Offer prompt, helpful comments on assignments and exams. Create tests, examinations, and quizzes using online assessment tools, and think about using alternative assessment methods like open-book exams or project-based assessments.
9. Accessibility and Accommodations: Ensure that all students, including those with impairments, can access your course materials and technological platforms. As required, make arrangements.
10. Establish clear channels for communication, such as email, discussion boards, or LMS messaging, to quickly respond to inquiries and handle problems.
11. Tech Support: Provide tools and technical support to assist students in navigating the online learning environment, resolving problems, and accessing course materials.
12. Recorded Sessions: You should record live sessions so that absent students can access them later or for future reference.
13. Feedback Loop: Gather student feedback during the course to make the necessary changes and enhancements to the online learning environment.
14. Instructor Training: Ensure that instructors receive training and professional development to ensure their proficiency with the techniques and online tools of choice.
15. Stay Current: To consistently improve your teaching strategies, stay up to current on new technological developments and industry best practises.
16. Participate in Online forums: Educators and subject matter experts who can offer insightful advice and resources for teaching technical and practical courses online can be found in online forums.

## VI. CONCLUSION

It's important to note that while many practical courses can be adapted for online learning, some may require in-person components, lab work, or internships to fully develop practical skills and gain hands-on experience. Additionally, the quality of online practical courses can vary, so students should carefully evaluate the course content, resources, and support provided by the institution or platform offering the course. The key to successful online teaching is creating an engaging and interactive learning environment that fosters student participation and understanding. It is also established that no successful model for teaching technical subjects is in place and more efforts are required in this direction. The impact of online education on the knowledge level of students in practical-oriented courses can be positive when well-designed, but it also presents challenges, especially in replicating hands-on experiences. The effectiveness of online education in practical courses can be enhanced through the use of simulations, virtual labs, regular instructor interaction, and a strong focus on assessment methods that evaluate practical skills. However, it's essential to recognize



that some courses may still benefit from a blended approach or in-person components to ensure students receive the necessary practical training and experience.

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