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Learning Topography and Its Impact on Student Behavior: The Use of Microsoft Excel and AutoCAD as an Innovation in an Algerian University

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Abstract

Background Aims: The fast expansion of information and communication technology is altering higher education, and professional software is increasingly replacing conventional, textbook-centered knowledge transfer in technical topics such as topography. This study examines the integration of computer-aided design (CAD) and spreadsheet-based tools in teaching topography, with a focus on how Microsoft Excel and Autodesk AutoCAD influence student learning preferences and behavior at the University of Science and Technology Houari Boumediene (USTHB), Algeria.

Methodology: A student cohort engaged in topography learning activities utilizing Microsoft Excel and AutoCAD. Students' software preferences and perceptions of the learning environment were ascertained by statistical analysis of data gathered through investigations and surveys.

Result: According to the analysis, pupils are not very interested in Microsoft Excel and strongly favor Autodesk AutoCAD as their main tool for completing projects involving topography. The findings also reveal institutional constraints that may hinder the modernization of topographical training.

Conclusion: In order to maintain long-term educational quality and sustainability, effective deployment of educational technology necessitates regular evaluation and monitoring by public and academic institutions. These technologies offer evident advantages by permitting flexible learning options and increasing instructional assistance.

Keywords: Learning, **T**opography, Microsoft Excel, AutoCAD software**,** Student behavior

Introduction

Traditional pedagogical methods of teaching are becoming obsolete, and new methods must be implemented with the changing times (OECD, 2010). Higher education trains teachers for all levels of the system and depends on the good level of the students trained by the sectors of primary and secondary schools, which will in turn become students (Richey, 2008). The personalized instruction imagined by some proponents remains the exception to the rule (Herold, 2015). According to the Cultural Comparison of Teachers' Views upon Integration and Use of Technology in Classroom, "Almost every part of our lives is convoluted by technology". It directly affects the way we shop, connect, socialize, play, and most importantly, learn" (Kayalar, 2016). The new technologies in the United States during the 1990s to 2000 years are analyzed and reported by some authors as Scalise (Scalise, 2016; University of Waterloo, 2006; Altinok & Burdon, 2012).

The technological age has given many new opportunities and challenges in the world of education. The introduction of information science and information technology in education and training has created a powerful momentum, evidenced among others by the inclusion of this dimension in educational programs, the proliferation of educational sites, the mobilization of actors around the creation of a digital campus, and the massive purchase of personal computers. Aware of this evolution, the Algerian public authority has led, since 2005, through the Ministries of Education and Higher Education, a proactive policy to develop the use of information technology and communication within the school and higher education. This global vision has not followed by the actualization of the matters of programs nor the adaptation of the pedagogical tools in the teaching (Skinner, 1968).

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This work aims to analyze the introduction of new techniques in the teaching in universities, in particular computer-aided design (CAD) in the teaching of Topography matter and its impacts on the students. The tool given as an example is the AutoCAD software.

The work begins with an overview of the history of the practice of the new technology in some countries. These experiences can help Algerian Universities to adapt them to the Algerian context. The school and education are not immune to the new information and communications technology: Knowledge transfer is no longer only by the book and the mediation of a teacher, but now goes through professional software. The challenges are twofold: mastering the new technologies by the student in their cultural and economic context, in which they are increasingly present on the one hand; and on the other hand, the diversification of forms of learning in relation to reforms in the education system in Algeria. After investigations and statistical analysis, some remarks and deductions are made. The students are not interested in using Microsoft Excel and prefer to use Autodesk AutoCAD as a tool to solve their problems. This real situation has allowed me to launch a study about the impacts of the use of professional software on the behavior of my students.

Objectives

This work aims to analyze the introduction of new techniques in the teaching in universities, in particular computer-aided design (CAD) in the teaching of Topography matter and its impacts on the behavior of students. This study aims to develop the learning of topographic surveying techniques using AutoCAD and Microsoft Excel software within the University of Science and Technology Houari Boumediene (USTHB) in Algeria. Academic committees and teachers are invited to analyze the challenges and obstacles to implementing innovations in universities. Learning the subject of Topography requires the best way to transmit knowledge in light of new technologies.

Literature review

The analysis concerns some experiences and reports published by some institutions affiliated with UNESCO. For example, the International Telecommunications Union (ITU) (2013, 2018) publishes an annual report on the state of use of technology by societies in the world called “Measuring Information Society Report”. Education is organized around five broad themes: the dynamics of globalization; evolving social challenges; the changing world of work; the transformation of childhood; and the next generation (OECD, 2010). Some authors have published information on the obstacles encountered in implementing new technologies in education, such as Jones and Kahn, "Many schools struggle to invest in comprehensive programs, training, and resources due to budgetary constraints" (Jones & Kahn, 2017).

1. The US experience

The idea of using computers in education dates back to the early 60s when there appeared, following the theories of Skinner (1968), teaching machines, already media, since resulting from the assembly of a computer, a tape recorder, and still image projectors and/or films. The only material that had a commercial life was the IBM 1500 system, but its career was extremely short. The invention of the "time-sharing operation", that is to say, the ability to connect to a powerful computer a large number of terminals that share the processing power of the computer, led the company Control Data Corporation (CDC) to fund the project PLATO (Programmed Logic for Automatic Teaching Operations) from the University of Illinois. Pantages (1976) reports that Morris, Vice President of Executive Administration Office for the CDC company, did not hesitate to predict that by about 1985, PLATO would be the cause of half the turnover of CDC. The countries formulate, increasingly, national policy on the use of computers in education as a response to the increasing number of computers used in the private sector and in response to domestic political pressures that are emerging as a result of the global information revolution. Such a national policy is also necessary to introduce computers in public education because of the relatively high cost of operation. According to Hebenstreit (Hebenstreit, 1969, 1984, 1992 and 1998), in the early 70s, It is are launched various projects including French project known as the " Experience des 58 lycées " and the English project NDPCAL "(National Development Program for Computer Assisted Learning) under Authority of the Council for Educational Technology of Waterloo

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University which will be the first experimental ground for a semi-massive use of computers in education in Europe.

The massive arrival of computers and the lack of instructional teacher preparation have led experts to address several optimistic findings: (A) The Carnegie Report "The Fourth Revolution" (Carnegie Commission on Higher Education, 1972) indicates that, compared to initial assumptions, the New Information Techniques (NIT) in education come more slowly than expected, cost more than expected, and add to what exists rather than replace it. (B) The Office for Technological Assessment (OTA) of the US Congress (OTA, 1994) considers that the computer needs more creativity and more time spent with the teacher (Office for Technological Assessment 11). (C) According to the *Office of Technology Assessment* report *Teachers and Technology: Making the Connection* (1995), teachers who invest significant time and effort in developing educational software and technology-based instructional materials are **rarely institutionally rewarded**, as such activities are often not recognized in promotion, tenure, or formal evaluation systems. (D) The report of the OTA of the US Congress (OTA, 95) concludes: " Although much educational software is judged favorably by rating agencies and by professional magazines, the most widespread opinion among teachers (and also among publishers of educational software) is that quality educational software could be much better ".

2. The French experience is characterized by the following actions

The development of the French supply of the Open and Distance Higher Education: (A) Two calls for proposals for the establishment of digital campuses were launched in 2000 and 2001 to support and structure the national offer of open and distance training. Universities, institutes, engineering schools, and colleges have responded massively to it. Consortia thus constituted include corporations (50), associations, and local authorities (48). An Amount of 12.12 million Euros was allocated to them to study and implement the Open and Distance Training. (B) Information and communication: the specialized site for information and communication technologies has emerged since 1997. Educnet: Opened in 1998, this site of information and communications technology for teaching gathers reference texts, examples of teaching practices, lists of resources, as well as a legal topic to guide users, a topic standby documentary, and a new section. He welcomes every month more than 300,000 visitors. (C) The research effort: The whole French experience strategy is based on two axes: Innovation Audiovisual and Multimedia Network; (1) Support for Educational Research: The need for a database of all research groups working on these issues is now available. (2) Anticipation and foresight actions: Permanent technological monitoring, missions, seminars, and conferences are organized. Studies are also being conducted on some emerging themes. (3) Support the creation and enterprise development: Law on innovation and research in July 1999: It allows offering, for civil servants of public services, the opportunity to exercise their skills with French companies, creation or development of the educational multimedia sector. (4) National Incubator "Belle de Mai" dedicated to educational and cultural media: Created in 2000, following the call for "Incubation and seed capital for technology companies" projects, the Incubator of educational multimedia products and services and business cultural "Belle de Mai" in Marseille, provides support to entrepreneurs in this sector. (5) Seed capital "C-source": Established in 2000, the C-Source seed capital fund has an estimated amount of about 15.25 million euros. A quarter of the contribution comes from the Government, associations public (mainly INRIA, ENSET Cachan, and the Caisse des Dépôts et Consignations), and private investors. It can support young companies in the media sector, including education, for the acquisition of shareholdings. (D) The International partnership; (1) International electronic learning networks: The networks of schools are woven around common projects such as the hands-on, or "Mesoe", that respect the environment. France organized, in November 2000, as part of its EU Presidency, the conference and exhibition "eEducation". Numerous actions have also been undertaken in the framework of the European Union and the "eEducation" initiative launched by President Romano Prodi: European Schoolnet, mentioned above, participation in the European Year of Languages, Netdays, E- Schola. Multilateral and bilateral relations. (2) Multilateral relations: The Ministry of Education actively participates in work conducted in international organizations in which France is represented: Council of Europe, OECD, G8, UNESCO, SEAMEO.

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Conceptual Framework

The academic learning of topography in education requires a Normative decision making (Jonassen, 2012) and is a process founded on these steps:

The figure1 shows a conceptual framework illustrating the integration of AutoCAD and Microsoft Excel in topography education, showing the progression from core competencies and software implementation to student outcomes, with institutional evaluation and the moderating influence of implementation challenges.

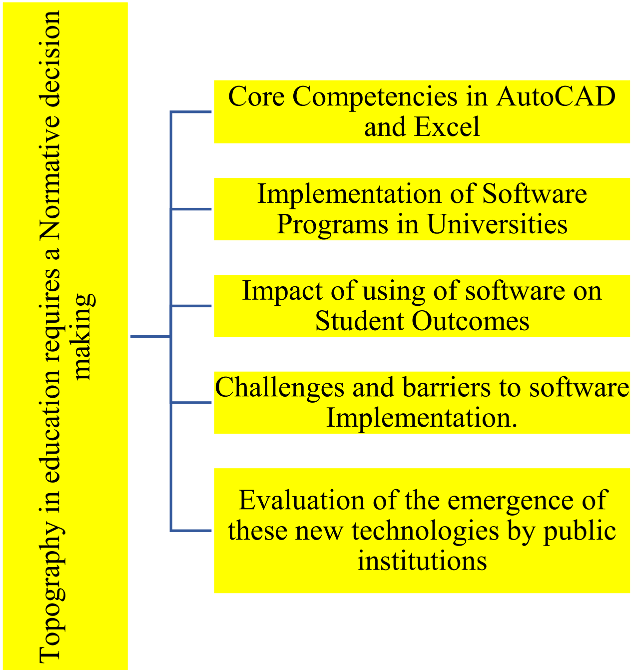

Figure 1: Conceptual framework illustrating the integration of AutoCAD and Excel in topography education.

Methodology

The material taken as an object is a collective of students during the learning of Topography matter and their behavior in relation to the AutoCAD and Microsoft Excel.
The methodology of the study is founded on the statistical method of their preference for using either AutoCAD or Microsoft Excel.

This investigation was conducted during two years with my Students in a graduate degree program during 2021 and 2022 at the Faculty of Civil Engineering in the University of Science and Technology Houari Boumediene (USTHB) of Bab Ezzouar, Algiers, Algeria. On a population composed of 100 persons, the answers are illustrated by Tables 1 and 2.

1. The opinion poll N°1

Five questions were put to the students:

- Are you satisfied with the learning of the Topography matter?
- Are you satisfied with the use of the Microsoft Excel software in this domain?
- Do you want to use other software in place of the Microsoft Excel software?
- Accept Autodesk AutoCAD as your preferred Software?

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Table 1: Evaluation of Responses in %

Answers	Questions			
	1	2	3	4
Yes	30%	30%	60%	80%
NO	50%	40%	10%	10%
NO Answer	20%	30%	30%	10%
Total	100%	100%	100%	100%

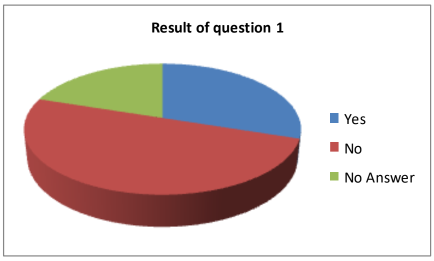

Figure 2 Answers for question 1

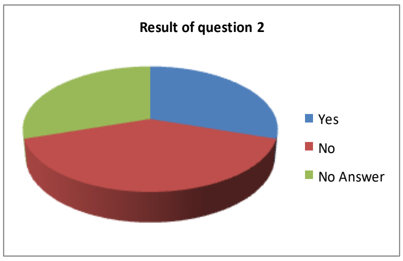

Figure 3 Answers for question 2

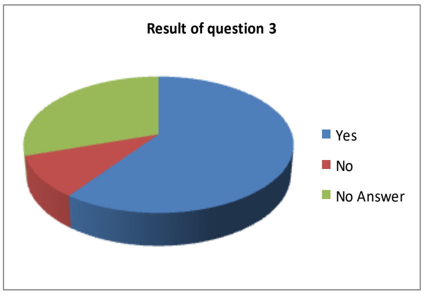

Figure 4 Answers for question 3

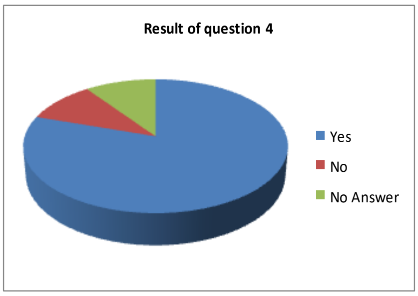

Figure 5 Answers for question 4

An explanation of the results of Opinion Poll No. 1

To find out how satisfied students were with learning topography and how they felt about the software tools used in the classroom, Opinion Poll No. 1 was carried out. Four essential questions were presented to the students, and their responses are summarized in Table 1.

Only 30% of students reported being satisfied with their topographical education, compared to 50% who were dissatisfied and 20% who did not respond, according to the findings. This suggests that students are usually dissatisfied with the way topography is currently taught.

Regarding the use of Microsoft Excel, the findings are comparable. Only 30% of respondents were satisfied, whereas 40% were dissatisfied, and a comparatively large number (30%) did not answer. This implies that students' expectations and preferred methods of learning in this area may not be entirely satisfied by Microsoft Excel.

Sixty percent of pupils showed a strong desire for other technological tools when asked if they would like to utilize software other than Microsoft Excel. The majority of students believe that Excel is not the best program for learning topography, as evidenced by the fact that just 10% disagreed with this notion and 30% did not reply.

Finally, students were asked whether they accepted Autodesk AutoCAD as their favorite software. The results reveal significant support, with 80% saying “Yes”, while just 10% rejected this option, and 10% did not answer. This demonstrates that students strongly favor AutoCAD as a more suitable and interesting tool for jobs involving topography.

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Overall, the statistics reveal a mismatch between present teaching resources and student expectations, and strongly suggest the inclusion of Autodesk AutoCAD to boost student happiness, engagement, and learning effectiveness in topographical education.

2. The opinion poll N°2

To the same hundred students, four questions were put:

- Are you satisfied with the availability of computer material?
- Are you satisfied with the knowledge of teachers in this domain?
- Are you satisfied with the availability of technical software?
- Do you know that the tutorials and workshops concerning these tools are widely available?

The responses are formulated as follows:

- Yes=3,
- Well enough=2,
- NO =1.

The results are represented by Figures 6 to 9.

Table2: Answers to questions

Questions	Answers			
	1	2	3	Total
1 Satisfied with the availability of computer material?	40	30	30	100
2 Satisfied with the knowledge of teachers in this domain?	50	30	20	100
3 Satisfied with the availability of technical software?	60	20	20	100
4 Tutorials and workshops concerning these tools are widely available?	70	20	10	100

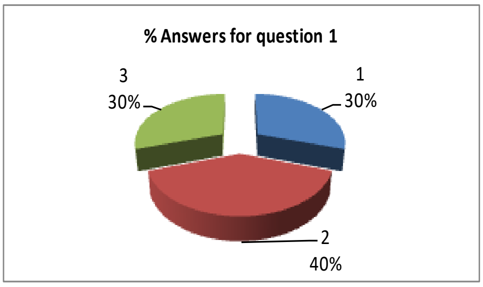

Figure 6 Answers for question 1

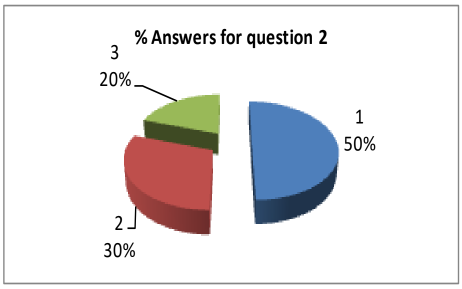

Figure 7 Answers for question 2

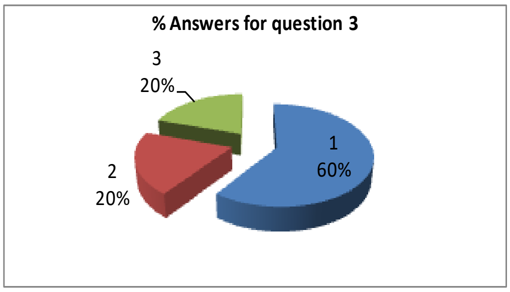

Figure 8 Answers for question 3

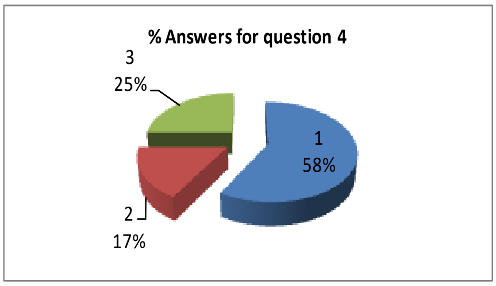

Figure 9 Answers for question 4

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An explanation of the results of Opinion Poll No. 2

Opinion Poll No. 2 was done among the same sample of one hundred students to evaluate institutional and instructional assistance linked to the use of computer-based tools in topographical teaching. Four questions were posed, concentrating on the availability of resources, instructor competence, and access to learning assistance tools. Responses were scored on a three-point scale: Yes (3), Well enough (2), and No (1).

According to the findings, 40% of students were happy that computer equipment was available, 30% thought it was sufficient, and 30% were unhappy. This distribution implies that while basic computing resources are present, students' needs may not be entirely met by the number or quality.

50% of respondents said they were satisfied with instructors' understanding in this area, 30% said it was adequate, and 20% said they were not. These results suggest a generally positive impression of instructors' technical skill, albeit a considerable proportion of students identify space for development.

Regarding the availability of technical software, the conclusions are more encouraging. 60% of pupils claimed satisfaction, while 20% regarded it sufficient, and 20% were unsatisfied. This shows that important software tools are largely available, although access may still be inconsistent or limited for some students.

Finally, awareness of tutorials and workshops connected to these technologies was the most positively rated element. 70% of students agreed that such learning tools are readily available, 20% assessed availability as adequate, and just 10% indicated a lack of awareness or access. This demonstrates significant institutional support in terms of supplemental learning possibilities.

Overall, the results of Opinion Poll No. 2 indicate that while teaching expertise and learning support resources are generally well perceived, improvements are still needed in computer hardware availability and software accessibility to ensure equitable and effective technology-enhanced learning in topography education.

Descriptive statistics

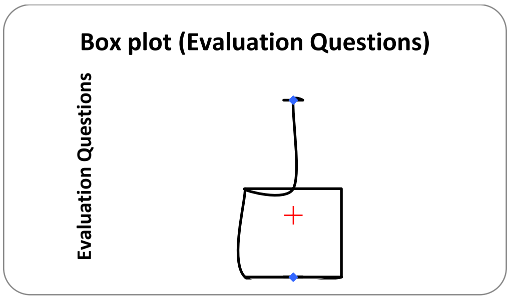

Figure 10 Evaluation of answer for question 1

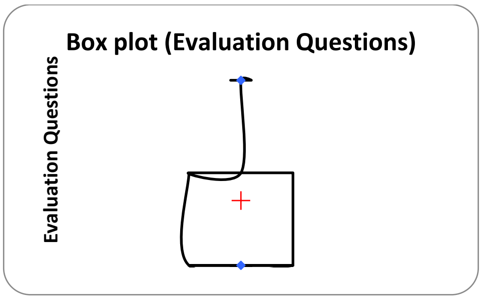

Figure 11 Evaluation of answer for question 2

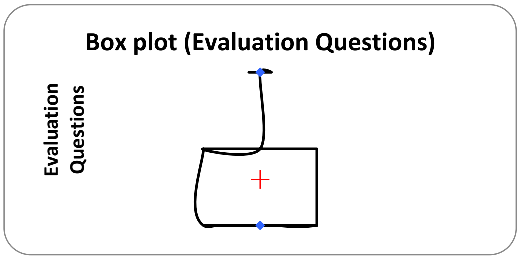

Figure 12 Evaluation of answer for question 3

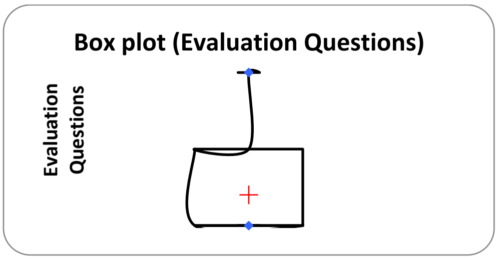

Figure 13 Evaluation answer for question 4

Descriptive statistics were applied to summarize and evaluate students' replies obtained through the two opinion polls. These statistics provide an overall assessment of students' perceptions of

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topographical learning, the software tools utilized, and the availability of institutional and instructional support.

According to the findings of Opinion Poll No. 1, students are not very satisfied with using Microsoft Excel or with traditional topographical training. A considerable minority of students reported discontent or unwillingness to react, while a solid majority demonstrated a clear preference for Autodesk AutoCAD as the principal software tool for learning topography.

Data from Opinion Poll No. 2 reveal generally positive impressions of teachers' knowledge, software availability, and access to tutorials and seminars. However, satisfaction with the availability of computer equipment was considerably lower, showing constraints in infrastructure that may hinder the proper integration of technological instruments.

Overall, the descriptive statistics reveal a substantial discrepancy between students' expectations and the existing teaching approaches in topographical education. While instructional assistance and learning materials are seen as appropriate, students exhibit a strong tendency toward the usage of advanced professional software, underlining the need for improved technological integration and resource allocation.

Conclusion

The responses to the cited questions show that, except for question number one (1), a large part of students are not satisfied with the actual situation about the teaching of engineering software. Indeed, the obtained mean score varies between 2.0 and 1.4. The bad score is obtained by question 4, which illustrates the lack mastering of the software because there are not enough tutorials and workshops. The availability in number of computers and cyberspace is satisfying. Concerning the low level of knowledge of the teachers, it is necessary to enhance their expertise. The difficulty to accessibility to the technical tools (software) can be explained by the absence of free software. Globally, the mean score for all answers is 1.68; this value is inferior to the value "well enough".

Discussion

A gradual drop in student interest in computing, restricted access to computer labs, and a lack of funds to buy licensed software could all contribute to some instructors' decreased optimism about implementing new information technologies (NIT) in the classroom. The perceived value of using digital resources is frequently diminished by these pragmatic limitations, particularly when educators are expected to modernize instruction without dependable infrastructure or institutional support.

This position is further influenced by broader economic and labor-market dynamics. The crisis impacting the computer sector and the lowering of employment prospects in associated fields have diminished the social and economic incentives that formerly promoted large-scale investment in educational technologies (OECD, 2010). As a result, the external pressure that once encouraged the spread of computer-based education has reduced, which may contribute to insufficient desire for government institutions to implement large technology programs. For example, official declarations stated that roughly 60% of Algerian secondary schools lacked computer science facilities in 2011 (INRE, 2010), indicating how structural restrictions in earlier education stages may also affect student preparedness and expectations at the university level.

Additionally, difficulties with teachers should be understood in this context. Instructors may lament the lack of available technical software or claim difficulties in understanding these tools, although these concerns are frequently indicators of greater systemic problems rather than just human limitations. Effective pedagogical integration is challenging when computer use is limited to planned lab sessions. According to Guité (2016), computer rooms might inadvertently restrict the use of technology in education because they impose logistical constraints (limited time, availability, and flexibility), which discourage ongoing practice and limit opportunities for active learning.

The educational benefits of technology integration are nevertheless substantial in spite of these obstacles. Students can be better prepared for academic advancement as well as future professional and social obligations by using an organized method that blends conceptual learning with useful digital tools

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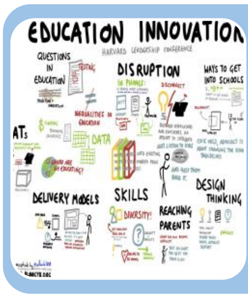
(Jones & Kahn, 2017). Crucially, these arguments are supported by the study's findings, which indicate that, in addition to software availability, accessible infrastructure, faculty training, and ongoing institutional commitment are necessary for the successful use of digital technologies. The internal investigation carried out by our faculty also supported these interpretations, confirming that the success of technology-enhanced topographical instruction is influenced by both implementation conditions and material constraints.

Knowledge Contribution

This study is the result of extensive experience in teaching topography and aims to provide practical and theoretical benefits for educators and educational institutions. The findings offer valuable insights into the effective integration of innovation in higher education. The main contributions of this work are summarized in the figure 14. Figure 14 illustrates the key knowledge contributions of the study in the domain of education.

Contributions of the Study

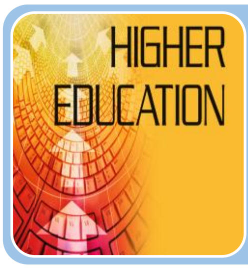


1. Challenges and barriers to Innovation

- Identification of key institutional, financial, and pedagogical barriers that hinder the adoption of innovative teaching practices.
- Academic Performance: Demonstrates that addressing these challenges can enhance student motivation, engagement, and academic achievement.
- Long-Term Benefits**:** Highlights the positive long-term effects of innovation on students' career prospects, professional development, and interpersonal skills.

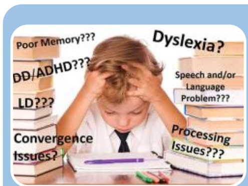
2. Core Competencies in Introducing Teaching Innovations

- Emphasizes the importance of effective communication and collaboration among all educational stakeholders (teachers, administrators, and students).
- Highlights the role of normative and adaptive decision-making in selecting and implementing appropriate innovative teaching strategies.



3. Implementation of Innovation Programs in Universities

- Advocates for the integration of innovation-based teaching principles into university curricula.
- Stresses the necessity of continuous teacher training and professional development.
- Encourages universities to promote and reward innovation as a core component of educational research and teaching excellence.



4. Impact of Innovations on students

- Demonstrates that innovative teaching approaches significantly improve student motivation, engagement, and academic performance.
- Confirms the role of innovation in enhancing learning effectiveness, critical thinking, and practical skill development.

Figure 14: Knowledge Contribution of the study

The Contributions of the Study model gives a complete framework that summarizes the important theoretical and practical contributions of this research to the field of higher education and teaching innovation. The model is structured around four interconnected elements, as shown in Figure 14, which

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together explain how innovation can be successfully incorporated, encouraged, and assessed in university instruction.

1. Challenges and Barriers to Innovation

The first component of the methodology focuses on identifying the primary constraints that prevent the implementation of innovative teaching practices. These impediments are institutional, financial, and pedagogical in character and include limited infrastructure, insufficient budget, and resistance to pedagogical change. The study shows that eliminating these limitations can result in quantifiable gains in academic performance by clearly recognizing them. Addressing these problems promotes student motivation, engagement, and achievement. Additionally, the model emphasizes the long-term advantages of innovation, highlighting its favorable effects on students' professional development, career prospects, and interpersonal skill development.

2. Core Competencies in Introducing Teaching Innovations

The competencies necessary to successfully implement educational innovation are highlighted in the second component. Key stakeholders—teachers, administrators, and students—must collaborate and communicate effectively for change to occur. In order to guarantee that creative teaching methods are both pedagogically sound and contextually relevant, the model also emphasizes the significance of both normative and adaptive decision-making processes. This work supports the notion that innovation is organizational and human-centered in addition to technological.

3. Implementation of Innovation Programs in Universities

The institutional and structural facets of innovation implementation are covered by the third dimension. Instead of focusing on isolated or experimental projects, the study promotes the methodical incorporation of innovation-based teaching approaches into university curricula. It also emphasizes how important it is for teachers to have ongoing training and professional development in order to maintain creativity throughout time. Furthermore, the model fosters a supportive institutional culture by encouraging institutions to acknowledge, value, and reward innovation as an essential component of teaching quality and educational research.

4. Impact of Innovations on Students

The model's last element emphasizes how pupils are directly impacted by creative teaching methods. The data reveal that innovation greatly boosts student motivation, engagement, and academic success. Furthermore, by encouraging critical thinking, problem-solving skills, and the development of practical abilities, the model demonstrates how innovative approaches improve learning effectiveness. These results are consistent with the overarching goal of educating students for social and professional issues that arise in the real world.

Conclusion: When combined, the model offers an integrated viewpoint that connects student results, institutional initiatives, competencies, and obstacles. It provides educators, administrators, and legislators with a transferable framework to help them plan, carry out, and assess innovation in higher education. The study offers an organized and practical methodology for promoting instructional innovation in technical and applied subjects by tying theory to actual data.

Recommendation

Based on our experience in teaching topography, the following ideas are given to promote the effective integration of technological advancements in higher education:

1. Encourage Innovation in Education. The use of new instructional approaches can dramatically enhance learning experiences and promote student engagement within academic environments.

2. Implement Adaptive Learning Technologies. To support individualized learning pathways, monitor student progress, and dynamically modify instructional content to match the needs of each learner, adaptive learning systems should be used.

3. Improve the Allocation of Funds and Resources. Increased financial investment is important to obtain professional-grade software, modernize technical infrastructure, and provide appropriate learning tools, thereby inspiring both students and instructors.

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4. Keep an eye on students' participation and learning habits. Continuous evaluation of student conduct, engagement, and motivation is essential for honing instructional techniques and enhancing learning objectives in general.

5. Give faculty development and training a priority. Targeted training programs centered on technical and instructional software should be addressed to ensure educators are confident and proficient in the use of digital technologies.

6. Present Microsoft Excel for Basic Surveying Activities. Instruction should begin using Microsoft Excel, since it allows step-by-step problem-solving and facilitates a thorough knowledge of fundamental computing processes.

7. Integrate AutoCAD to Complete the Learning Cycle. AutoCAD should be added thereafter to automate calculations and provide a visual depiction of outcomes, thereby strengthening conceptual comprehension through actual application.

8. Assure Ongoing Observation and Assessment. The adoption of educational technology should be routinely monitored and assessed by academic committees and appropriate public entities to ensure quality, efficacy, and long-term sustainability.

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