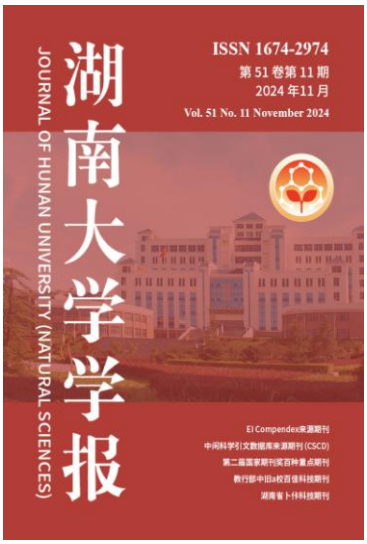

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Advantages and Disadvantages of Digitalization of Learning and Assessments of Scientific Knowledge in the Second Cycle

Najoi El Hazzat[1,2], Abderrazzak Mazouak[2,3]*

([1] Laboratory of Natural Resources and Environment, Polydisciplinary Faculty of Taza, Sidi Mohamed Ben Abdellah University, Taza, Morocco

[2] Regional Center for Training and Education Professions in Taza, Morocco

[3] Laboratory of Pedagogical Engineering and Didactics of Sciences, CRMEF, Meknes, Morocco)

* Corresponding author: mazouakabdo@gmail.com

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Abstract: The continuous evolution of technological approaches and the spread of new technologies in teaching and learning practices within schools have undoubtedly demonstrated the advantages of using digital technology in learning assessment practices within and outside the classroom. Faced with a multitude of technological choices, the trainer and teachers are called upon first to filter the teaching methods in order to plan educational scenarios capable of answering the various problematic questions of the digitalization of learning and the evaluation of scientific knowledge in the second cycle. To address this problem, we opted for export research, whose recommended methodology is based on a multidimensional survey, in which we first questioned teachers about the use of new technologies in the learning and assessment process and then identified the degree of motivation and commitment of students in innovative situations in scientific knowledge (life and earth sciences). The objective of our research is to evaluate the effect of digitalization on the teaching of life and earth sciences,

which is represented by four secondary education establishments (from the Taza delegation), with a varied population of 356 students at all levels and scientific streams, as well as 62 teachers of life and earth sciences. Finally, we confirm that despite the satisfaction of the majority of teachers and students with regard to the functional qualities and contribution of technological tools in assessment practices, drawbacks have been noted at the technical, spatiotemporal, and organizational levels.

Keywords: digitalization; evaluation practice; new technologies; advantages; disadvantages

第二周期科学知识学习与评估数字化的优势与劣势

摘要：技术方法的不断发展和新技术在学校教学实践中的传播无疑证明了在课堂内外学习评估实践中使用数字技术的优势。面对众多技术选择，培训师和教师首先需要筛选教学方法，以便规划能够回答第二周期学习数字化和科学知识评估的各种难题的教育场景。为了解决这个问题，我们选择了出口研究，其推荐的方法是基于多维调查，其中我们首先询问教师在学习和评估过程中使用新技术的情况，然后确定学生在科学知识（生命和地球科学）创新情况下的积极性和投入程度。我们的研究目的是评估数字化对生命和地球科学教学的影响，该研究由四所中等教育机构（来自塔扎代表团）代表，共有 356 名各级和科学流派的学生，以及 62 名生命和地球科学教师。最后，我们确认，尽管大多数教师和学生对技术工具在评估实践中的功能品质和贡献感到满意，但在技术、时空和组织层面也存在缺陷。

关键词：数字化; 评估实践; 新技术; 优势; 劣势

1. Introduction

The use of technologies in the educational field has been a very evolving field for several decades at the pedagogical, scientific, and professional levels. This field also contains a decisive gap between the positive expectations attributed to technological uses to transform education, on the one hand, and the relative inconveniences of digitalization, on the other hand.

Today, modern technology offers education professionals a range of new tools, processes, and resources that teachers can use to manage their lessons within the classroom and outside the school in a process of continuous communication to monitor and evaluate the results of their students throughout the school year.

The increased diffusion of new technologies has led to remarkable improvements in terms of content development and the quality management of educational interventions. However, it is surprising that technology is not equally present in the processes of educational assessment, modeling of school performance, and judgment of students' skills. At the same time, there was poor use in the analysis and dissemination of school results.

As part of an initiative aimed at paving the way for change in assessment and the integration of innovative tools in all stages of the learning management process in scientific disciplines, we developed this work, which presents the state of play for teachers' use of new technologies in their assessments and measures the feedback from the latter and their students vis-à-vis innovation in pedagogies and judgment models in the classroom and outside the school context.

2. Theoretical Framework

To better explain the terminology and approaches of our work, our theoretical framework positions the inputs and evaluation in relation to the act of digitalization.

2.1 Digitalization of Educational Knowledge

Educational technology (ET) refers to the various tools, processes, documents, and material support used by teachers and students for educational purposes; it is the study of different ways of arranging and mobilizing computer resources at different levels to manage educational situations [1].

The integration of technology in the act of teaching and learning is framed by three approaches to the study of its uses: the diffusion approach, innovation approach [2], and appropriation approach. For each, the following are specified: the intellectual context that made them emerge, the postulates on which they were based, and the paradigm in which they were inscribed. This reality places the teacher before a triple methodological choice to succeed in his teaching practices.

Putting the evaluation face-to-face with technology consists of choosing between the three models of the integration of new technologies in the educational sector, a deterministic model [3] directs the researcher towards the pragmatic aspect of the technology from

which he must benefit to develop the process of evaluation, against the innovative model, which consists of introducing the evaluation as a means to develop technological practices; and third, we present the constructivist model, which is based on the win-win relationship whose conciliation between technology and evaluation will allow the development of both processes simultaneously. This last approach is the basis of our intervention while seeking to verify the existing relationship between evaluation and technology in order to try to facilitate the act of judging through digitalization on the one hand and to accelerate the integration of new technologies in particular to guarantee more certainty and objectivity in the evaluation.

2.2 Digitalization of Assessments

The management of assessments in a digital regime generally calls upon the many possibilities offered by technological innovations. Indeed, with the digitalization of assessment tools and the rise of distance learning, space and time are no longer conceived in the same way. Are these changes in design also felt at the level of assessment, methods, and approaches of teachers, either to diagnose, pilot, or certify learning? [4]

The following model, the remote assessment cube, presents the dimensions of digital assessment and explains the components of this process, particularly in the digital mode.

The assessment of learning in digital training involves three initial dimensions that seem central to us in addressing Question 5:

Axis A: Evaluate why? In this axis, we determine the functions of digital evaluation (diagnostic, formative, summative, formative (and co-evolution))

B-axis: Evaluate what? This section defines the objects of digital assessment (knowledge that know-how, know-how, attitudes, and skills) [3], [5].

C-axis: Assess from where? This axis specifies the assessment methods used (face-to-face, enriched face-to-face, hybrid, and online).

This model specifies the presence of 64 choices for evaluation in digital mode, depending on the objective set, tool used, and location chosen, which demonstrates the dynamic and complex aspects of the evaluation, particularly in digital mode.

2.3 Assessment of Learning

Assessments can have various purposes. They include providing feedback, giving grades and motivating [6], improving student learning, monitoring the learner more individually [7], identifying strengths and weaknesses, and communicating with stakeholders. or individualizing educational paths.

Assessments, even those of similar forms, can therefore have different purposes. The most common distinctions are as follows.

• Diagnostic assessment carried out before or at the beginning of a course or program. A distinction is sometimes made between diagnostic and prognostic assessments. The former primarily serves the learner, allowing them to adapt to their course or take remedial measures. The latter served as an evaluator. Among other things, it is used to check prerequisites and control access to courses or programs.

• Formative assessment aims to improve learning. Therefore, feedback plays a key role. It is often continuous or repeated at regular intervals during training. According to [8], there are two types of formative assessments, the latter leading to self-regulation by the learners of their progress.

• Summative assessments, which link quantitative results or ratings to a task, are often assigned to several individuals in the same group. Summative assessment generally occurs at the end of the process and is used for monitoring. This terminal function aims to "categorize, certify, and validate practices, behaviors, or knowledge" [9] and to report on them.

Formative and diagnostic assessments are generally referred to as assessments for learning, as opposed to summative assessment, which is seen as an assessment of learning. E-Learning also refers to the concept of Assessment as Learning [10], which is similar to the concept of formative assessment and can include diagnostic elements.

3. Methodological Framework

3.1. Research Typology

Our research is part of export research, the recommended methodology of which is based on a multidimensional survey, in which we first questioned teachers about the use of new technologies in the assessment process, then identified the degree of motivation and commitment of students in innovative situations, and finally framed all the advantages and limits of this reconciliation between technology and assessment.

3.2. Research Context

Our research context is represented by four secondary education establishments (from the Taza delegation) with a varied population of 354 students at all levels and streams, as well as 72 life and earth science teachers, without forgetting the important role played by the heads of these establishments.

Data collection tools

To conduct our surveys, we combined elements from both qualitative and quantitative research. For this reason, we adopted a mixed methodology based on the results of the three questionnaires:

Questionnaire 1: Teachers tended to assess the benefits of using technology in the act of learning and assessment

Questionnaire 2: Always administered to teachers to measure the limits of the use of technology in the assessment of learning.

Questionnaire 3: intended for students to judge their feedback regarding the use of technology in scientific knowledge.

The questionnaire was created from the template proposed by the Google Forms tool and distributed online by email and WhatsApp for teachers (principals) between January and March 2023 and for students (by their teachers) between April 10 and 30, 2023.

The average response rate was 79% for teachers (51 out of 72 targeted teachers) and 90% for students (318 out of 354 selected students), which reflects the interest given to our research.

3.3. Results Analysis Tools

To proceed with our analysis and interpretation of the results we adopted the Krippendorff 2003 model, the latter mobilizes a set of data collection means and mixed results methods that are both quantitative and qualitative and to detail the remarks we will rely on technological tools (Sphinx, Trideux and Excel). This will help confirm the validity of our results.

4. Results

The questionnaire for teachers was made up of five sub-parts, four of which aimed to analyze the technological practices of teachers in terms of evaluations.

The results of this survey are as follows:

4.1. The Levels Represented

The questionnaire appealed to the three levels of students (Table 1).

Table 1. Sectors represented in the questionnaire (compiled by the authors)

	Scientific sectors	Literary streams	International sectors
In person	30%	15%	100%
In enriched face-to-face	60%	5%	71%
In hybrid mode	38%	5%	31%
Online	0%	0%	25%

Our sample is composed of 160 students from scientific branches with a percentage of 37% of 176 students, representing 41% of our population and 22% for the international branch.

4.2. Use of technology in teacher assessment

Our second question in the questionnaire focused on the use of technology in the learning of life and earth sciences by teachers, whose responses are listed in Table 2.

Table 2. Use of technology in assessment by teachers (compiled by the authors)

Sector	All sectors	Scientific sectors	Literary streams	International sectors
Yes	61%	87%	15%	84%
No	39%	13%	85%	16%

Innovative methods for evaluation. Unlike 39%, those who still preferred to evaluate with classic methods.

Similarly, the use of new technologies is frequent in the scientific and international branches, compared to the weak presence of literary disciplines.

4.3. Timing of Technology Use in SVT Learning

The third question of our questionnaire measures the use of technological tools in the different phases of learning and assessment (diagnostic, formative, summative, and certification).

Table 3. Timing of technology use in teacher assessment (compiled by the authors)

	Scientific sectors	Literary streams	International sectors
Group work	30%	15%	50%
Presentations	100%	25%	100%
Experiments	60%	15%	80%
Diagnostic evaluation	87%	15%	84%
Formative assessment	63%	5%	72%
Summative assessment	87%	15%	84%
Certification Assessment	31%	0%	66%

The rethinking of this question revealed that the modes of diagnostic and summative evaluation are the most concerned by the integration of new technologies (84% and 87%, respectively), followed by formative evaluation with a percentage varying from 63% to 72%.

4.4 Typology of Assessments Used by Teachers

According to the results of table 4, the use of digital technology in the assessment varies; for international courses, the face-to-face mode had the highest percentage, but the online mode was also present in the oral tests either for entrance exams or for defending end-of-study projects; for scientific courses, the values are representative of the training mode used, but with a total absence of online assessment.

Table 4. Assessment methods used by teachers (compiled by the authors)

Common core	1st BAC	2nd BAC
37%	31%	32%
131 students	110 students	113 students

4.5 Assessment Methods Used by Teachers

For the fourth question, we presented the different methods of assessment used by teachers from different sectors as follows (Table 5):

Table 5. Assessment methods used by teachers (compiled by the authors)

	Scientific sectors	Literary streams	International sectors
Oral and practical assessment	20%	25%	31%
Written evaluation	80%	75%	68%
Evaluation by project	42%	15%	71%
Social assessment/Co-assessment	37%	0%	62%
Self-assessment	27%	10%	34%
Certification Assessment	63%	5%	72%

The results in Table 5 show that oral and practical assessments are frequent in professional sectors (31%); similarly, literary teachers use written assessment at 75%, and assessment by project is used by professional sectors at 71%.

In another section, social assessment characterized professional sectors with 62% and a high self-assessment percentage of 34%.

4.6 Technological Tools Used in Teacher Assessment

The last question of our first questionnaire aimed to identify the technological tools used by our population of teachers in their evaluation practices (Table 6).

The comparison of the results presented in Table 6 highlights the marked gap between international sectors and other sectors in relation to the tools used, particularly social networks and videoconferencing methods.

Table 6. Technological tools used in learning by **teachers (compiled by the authors)**

Scientific sectors	Literary streams	International sectors	Scientific sectors
Save time	100%	65%	100%
Workforce management (group – pairs)	100%	75%	90%
Makes corrections easier	100%	80%	100%
Comparison and classification of levels	100%	80%	100%
Performance monitoring and management	100%	100%	100%
Identifying students in difficulty	100%	80%	100%

We also note that the use of serious games in assessments is almost non-existent among our population of teachers.

4.7 Benefits of Teachers' Use of Technology in Learning

In the 2nd questionnaire, we asked teachers (61% who have already had the opportunity to integrate ICT into their learning practices) about the benefits of using new technologies in their assessment practices (Table 7), their feedback on the use of ICT (Table 8), and the nuances encountered in the implementation of the digitalization of the assessment process (Table 9), whose responses were as follows:

Table 7: Benefits of teachers' use of technology in learning (compile by the authors)

		Scientific sectors	Literary streams	International sectors
PTT Quiz		42%	0%	71%
Specific software		27%	10%	41%
Serious games		15%	0%	0%
Social networks	WhatsApp	24%	10%	62%
	Facebook	24%	10%	54%
Video conference	Skype	11%	0%	12%
	Zoom	5%	0%	14%
	Google Meet	8%	0%	24%

The benefits of using technology noted by 61% of teachers in our population who have integrated technology are significant in the different dimensions of learning management within the classroom and in monitoring the performance of students in the establishment.

4.8 Teacher Feedback on the Use of Technology in Learning

The results in Table 8 show that the majority of

teachers value the advantages of technology and adhere to its integration; moreover, comparing these results with Table 2, we deduce that there is a great will of the teachers but limited by a set of obstacles and limits.

Table 8. Teacher feedback on the use of technology in learning (compiled by the authors)

	All branches	Scientific sectors	Literary streams	International sectors
For	**83%**	100%	65%	100%
Against	**17%**	0%	35%	0%

4.9 Limitations of Digital Assessment: By Teachers

We grouped the limitations proven by the teachers into categories, and the results are listed in Table 9.

Table 9. Limitations of digital learning: By teachers (compiled by the authors)

Criteria	Percentage
Humans	6%
Materials	16%
Epistemological problems	4%
Techniques (technological skills)	32%
Spatiotemporal	22%
Organizational	20%

We note that the majority of the limitations revealed by our sample reside in technological and technical skills (32%), followed by problems related to spatiotemporal organization (22%) and programming and fixing of evaluation times (20%).

4.10 Student Feedback on the Use of Technology in Learning

Our third questionnaire was reserved for student feedback regarding the numerical assessment, the results of which are mentioned in Tables 10 and 11.

The use of digital technology in assessment is a practice estimated and preferred 100% by the entire study population (Table 10).

Table 10. Student feedback on the use of technology in learning (compiled by the authors)

	All branches	Scientific sectors	Literary streams	International sectors
For	**100%**	100%	100%	100%
Against	**0%**	0%	0%	0%

4.11 Benefits of Digital Assessment: By students

Let us now look at the advantages noted by students regarding digital assessment. The answer to this question was that the use of technology motivated all the students in our sample and thus participated in ensuring the physical and psychological comfort of those assessed by facilitating comparison, regulation, and complementarity.

4.12 Limitations of Digital Assessment: By students

The difficulties mainly raised by the students (Table 11) are difficulties that we will qualify as material and economic with 34% explained by the socio-economic level of the majority of families, also adding the pedagogical difficulties linked to the communication relationship in class in parallel with the use of digital technology, and finally noting the epistemological difficulties 26% explained by the lack of knowledge of digital vocabulary.

Table 12. Limitations of digital learning: By students (compiled by the authors)

Criteria	Percentage
Epistemological problems	26%
Educational problems	21%
Material and economic problems	34%
Evaluation planning problem	7%
Technical problems	7%
Social and communication problems	5%

5. Discussion

Currently, there is great interest among teachers to integrate new technologies into teaching practices, which is confirmed by the results of our research, which have defended the advantages of digital technology in the organization and management of evaluation actions.

From the same perspective, digitalization has given more opportunity to vary and diversify the means and moments of the evaluation, offer choices to better exploit the results and the performances of the students, and plan support situations automatically.

In general, we have shown how the digitalization of assessment has influenced teaching practices. Despite all the difficulties declared by those who have resorted to this approach, the latter requires a significant investment in time and effort, and a basic technical and technological deepening.

In another aspect, the feedback collected by the students who are the subject of our research clearly explains the students' appreciation of this method of assessment; this reality is well founded by the possibilities of self-socio construction of the learning offered to the students and of changing the learning paradigm towards a vision centered on a student actor in the didactic-pedagogical process.

From another perspective, the use of digital assessment has allowed students to develop their autonomy and sense of responsibility as well as an increase in their motivation and essential social integration.

In conclusion, the illustrated results reflected an indisputable satisfaction of the teaching staff and students with regard to the progression and development of the pedagogical relationship by

positively judging the implementation of this model of digital assessment in the new paradigms of teaching to ensure an improvement in the quality of teaching and the transformation of the role of the school and the teacher in the Moroccan educational system on the one hand and to transform the pedagogical and didactic practices valuing students in real social situations.

6. Suggestions

Undoubtedly, the use of digital assessment has shown its contribution to the didactic -pedagogical relationship and the development of students' skills. However, the operationalization of this assessment method requires three-dimensional and coordinated intervention.

- At the macrostructure level:

The digitalization of digital technology requires a revision of the official texts governing the assessment of learning in Morocco, alongside the integration of technology into the assessment modules in training centers for future teachers.

- At the mesostructure level:

At this level, the implementation of digital technology in assessment practices requires the implementation of an interdisciplinary establishment project promoting the use of digital resources and technological assessment tools in parallel with the programming of specific training sessions for teachers and students.

- At the microstructure level:

The integration of digital technology at this level depends more on organizational factors and the teaching capacity of teachers; in other words, it is interesting to choose the moment, tools, and conditions to use digital technology and translate all the practices into a feasible educational project.

7. Conclusion

Digital learning undoubtedly offers students the opportunity to make choices and break the routine while promoting their motivation to learn. In other words, the use of innovative teaching strategies will be able to respond to the diversification of learning styles and, from the same perspective, propose motivating content for students and have a positive effect on their academic success and perseverance.

Through our research, we have shown that the use of technology in assessment practices has made it possible to break with traditional practices and provide content likely to develop cultural skills along with other socio-professional and communication skills.

We believe that the implementation of this model of assessment in teaching practices will have several advantages for the academic performance of students. However, it is important to remember a set of precautions taken to implement this educational model, such as respect for the principle of harmony, the balance between the different strategic models of digitalization, and especially the choice of times to use these methods in relation to academic progress and the spatiotemporal organization of learning projects.

Declarations

Author Contributions

Conceptualization, N.E.H.; methodology, A.M.; validation, A.M.; formal analysis, A.M.; investigation, A.M.; resources, N.E.H.; data curation, N.E.H.; writing—original draft preparation, all authors contributed equally; writing—review and editing, A.M.; visualization, N.E.H.; supervision, N.E.H.; project administration, N.E.H. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are openly available in Scopus.

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Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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