Qeios

Transitioning to Hybrid Assessment: Reflections on Academic Assessment Practices Post-COVID-19

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Abstract

Assessment constitutes a crucial element of any teaching-learning process, and the COVID-19 pandemic has led to a transition to online assessment at the Faculté des Sciences Ben M'Sick (FSBM) in Casablanca, which is has become common practice. However, this transition is not without its challenges, as evidenced by the obstacles faced by students. This article aims to alleviate these challenges by promoting hybrid assessment of equivalent quality to traditional assessment. Our study combines quantitative and qualitative methods, with an online questionnaire applied to 60 FSBM teachers and an experimental study involving 176 students of the Master Instrumentation and Physico-Chemical Methods of Analysis (MIMPA), divided into experimental and control groups. . . We also developed a scenario for hybrid assessment practices and adapted student skills to a taxonomic skills model as part of a hybrid system. The results indicate a strong interest in hybrid assessment among teachers (68.7%), a high success rate among students (95.65%) also that, there is not a significant difference between the means of the two groups which were measured by the Student's T test. These results reinforce the idea that hybrid assessment can effectively replace traditional assessment while promoting student skill development. In conclusion, we strongly recommend the adoption of hybrid assessment in the higher education system to overcome the technological challenges associated with online assessment.

Keywords : online assessment, hybrid assessment, scenario, taxonomic skills, hybrid system.

1. Introduction

In recent years, our country Morocco has experienced positive, significant and rapid digital transformations in several areas, particularly in higher education. However, the health crisis has profoundly affected higher education, forcing many institutions to adopt online teaching and assessment to ensure educational continuity. Berdi and other authors (2021) by affirming that online teaching is carried out throughout the confinement period to ensure educational continuity. And, according to UNICEF data, "among 127 countries, 73% used digital platforms to ensure educational continuity" (Bourqia, 2021). After the COVID-19 pandemic, online assessment has become a common practice in higher education and education in general. Which proves, according to Yerly and Issaieva (2021) that teachers had to adapt their learning assessment practices, from a regulatory perspective but also from a certification perspective. First of all, online assessment is a systematic process that measures learners' knowledge and skills through the use of digital tools. However, the use of an instrument is said to be practical if it is used. An instrument is also said to be effective if it produces results in relation to the objectives set by the developer. However, the online assessment marked certain limitations of an experience with the students of the Ben M'Sick Faculty of Sciences during the online assessment which deserve to be taken into consideration; for example 52.78% of students encountered problems during the online assessment (Mrisse and al., 2023). Isabelle Nizet and other authors (2016) who highlighted that despite the numerous works

on online assessment, the challenges that students and teachers continue to encounter in practice and the rapid technological evolution make it necessary to continue research on assessment online. For example: Hardware problems, technical problems, massification, cheating, practical skills assessment. Meanwhile, Papi and other authors (2020) state that the tools do not make it possible to ensure the identity of the person answering it, nor the resources available to them: access to documents, communication with other students who answer the quiz at the same time. Despite these limitations, teachers at the Ben M'Sick Faculty of Sciences continued to improve their online assessment practices thanks to new educational technologies and innovative practices in critical moments of the COVID-19 health crisis or events emergency or earthquakes observed in Morocco. They opted for hybrid assessment as an effective solution to address certain limitations of online assessment.

In this paradigm shift from traditional assessment to hybrid assessment, we encounter several challenges. One of the main challenges concerns quality; the hybrid assessment must have the same quality as that carried out in person. And, to overcome this challenge, we adopted the following criteria in this study: The taxonomic skills of the students experienced on the hybrid system, the methods followed online and face to face and the success rate of the students.

Thus, the objectives of our research are to mitigate the limits of online assessment through different innovative technical and pedagogical methods and to replace traditional assessment with a hybrid assessment of the same quality; through the use of innovative technologies in online monitoring. We focused on the flow of hybrid assessment, the functions of its scenario and the different roles of the assessor in the second part and the fourth part of this article. We present an experiment involving two independent samples of 176 students from the Ben M'Sick Faculty of Sciences, divided into two groups in the second part of this article. Based on this introduction, we asked the following questions :

- What types of assessments could be implemented as part of a hybrid system ?
- How to evaluate the learner within the framework of a hybrid evaluation ?
- What measures should be put in place to promote hybrid evaluation ?
- What skills do students acquire in the hybrid setting ?

2. Literature paper

In the educational context, hybrid assessment is part of a hybrid learning environment, where learners participate in both face-to-face and online activities, both in and out of class (Gao and al., 2021). This solution consisted of combining face-to-face assessment methods and online assessment methods as Llamas and other authors (2013) pointed out that hybrid assessment combines the advantages of information and communication technologies with the traditional paper and pencil assessment. Additionally, McCabe (2006) stated that blended assessment stimulates blended learning. In other words, online assessment and blended learning imply a close connection between them. Therefore, when assessment and learning resources are mixed, students are encouraged to learn more effectively (O'Loughlin and Osterlind, 2011). Thus, the combination of different types of blended learning resources supported by online assessment is extremely effective (O'Loughlin and Osterlind, 2011). Thus, it can be said that hybrid assessment is an important step in hybrid teaching to improve the teaching-learning process of students according to different assessment methods. It emerges as a response to the limitations of online assessment by combining face-to-face assessment approaches with online ones. Also, monitoring and evaluation can serve as a driver for continuous improvement (Sanderson, 2001).

Evaluation of hybrid learning and teaching must take into consideration the specific contexts of their implementation. For example, the level of technological development of the region and

educational institution can influence the effectiveness of implementation (Rodriguez, 2022). Blended learning and teaching integrates the use of technologies to engage and involve students in the teaching, learning and assessment processes (Stabback, 2016), with the aim of adapting to their different learning preferences and improve their educational experiences (Linder, 2017). Creating a sense of connection and community is necessary that facilitates engagement in learning (Young and Bruce, 2011). Spurred by educational practices occurring during the COVID-19 pandemic, the approach of online learning fused with offline components (OMO) has emerged as one of the new forms of blended learning (Huang and al., 2021). This mode leverages hybrid infrastructure and open educational practices (OEP) to merge online and offline learning spaces in real-time while simultaneously and seamlessly teaching students in physical classrooms and online. The evaluation of blended learning and teaching is essential to guide education practitioners in their choices of planning and carrying out these methods. This specifically concerns the selection of students suitable for hybrid teaching, the structuring of courses, the development of teaching materials and the evaluation of results (Billy TM Wong and al., 2023). When implementing hybrid education, institutions can develop essential evaluation indicators to evaluate and monitor the quality of hybrid teaching and learning, track learning outcomes, and analyze factors relevant factors that influence this quality (Tabor, 2007).

In addition, the educational scenario allows teachers to manage their theoretical practices and their evaluation approaches. However, a learning scenario is a teaching and learning situation (fictitious or anchored in reality) which describes the context in which learning occurs, based on its constituent elements: the organizational design of the environment ; roles and objectives of actors; scenario, work strategy, performances and proposals; and reflection and regulation (Matos, 2014).

3. Materials and methods

3.1 Measuring tool

To answer the questions above, we opted for a quantitative methodology through a questionnaire that we wrote to be intended for teachers and then administered to 60 teachers at the Faculty of Sciences Ben M'Sick in order to enrich our problematic.

3.2 Sample

The experiment was carried out in the Faculty of Sciences Ben M'Sick, with Master Instrumentation and Physico-Chemical Methods of Analysis (MIMPA) students in the second semester of the module: Management and tools, to answer the research questions above. Table 1 presents the selection of two samples for this research, divided into two types of groups: an experimental group composed of 84 students (47.73%) and a control group composed of 92 students (52.27%) (see Table 1).

Table 1. Table of population groups studies

Group	Number	Percentage
Control group	84	47,73%
Experimental group	92	52,27%
Total	176	100%

3.3 Methods of Experimentation

3.3.1 Scenario

To limit the difficulties of online assessment after the unfolding of COVID-19, we proposed hybrid assessment as a solution which combines online formative assessment and face-to-face

summative assessment while taking advantage of the the use of emerging technologies in this combination such as: Online formative assessment follows online monitoring and face-to-face summative assessment follows face-to-face monitoring; these two hybrid assessment practices, which can be observed in relation to the hybrid system put in place, have different objectives.

First of all, the design of hybrid devices (face-to-face and remote) was based on the ADDIE model (acronym for analysis, design, development, implementation, evaluation) **(Ghirardini, 2012).** To ensure the hybrid assessment runs smoothly, we considered modeling a scenario for this hybrid assessment. In computer science, a scenario is a description of the interactions between users and the system **(Sommerville,2004).** It differs from predictions about how the system will function, focusing instead on how the system will be employed in daily activities **(Armstrong, 2001).** These scenarios are generally written in natural language with minimal technical details for ease of use **(Looker & al., 2008)**.

So, our scenario describes in technical and pedagogical detail the role of the main user and the main functions for each hybrid assessment practice. Figure 1 provides a description of how the Hybrid Assessment Scenario (HAS) unfolds. This scenario refers to an approach combining different hybrid assessment practices, according to two levels: the technological level and the educational level. The main objective of the HAS is to provide a more comprehensive and balanced assessment of learners' skills by exploiting the advantages of different methods.
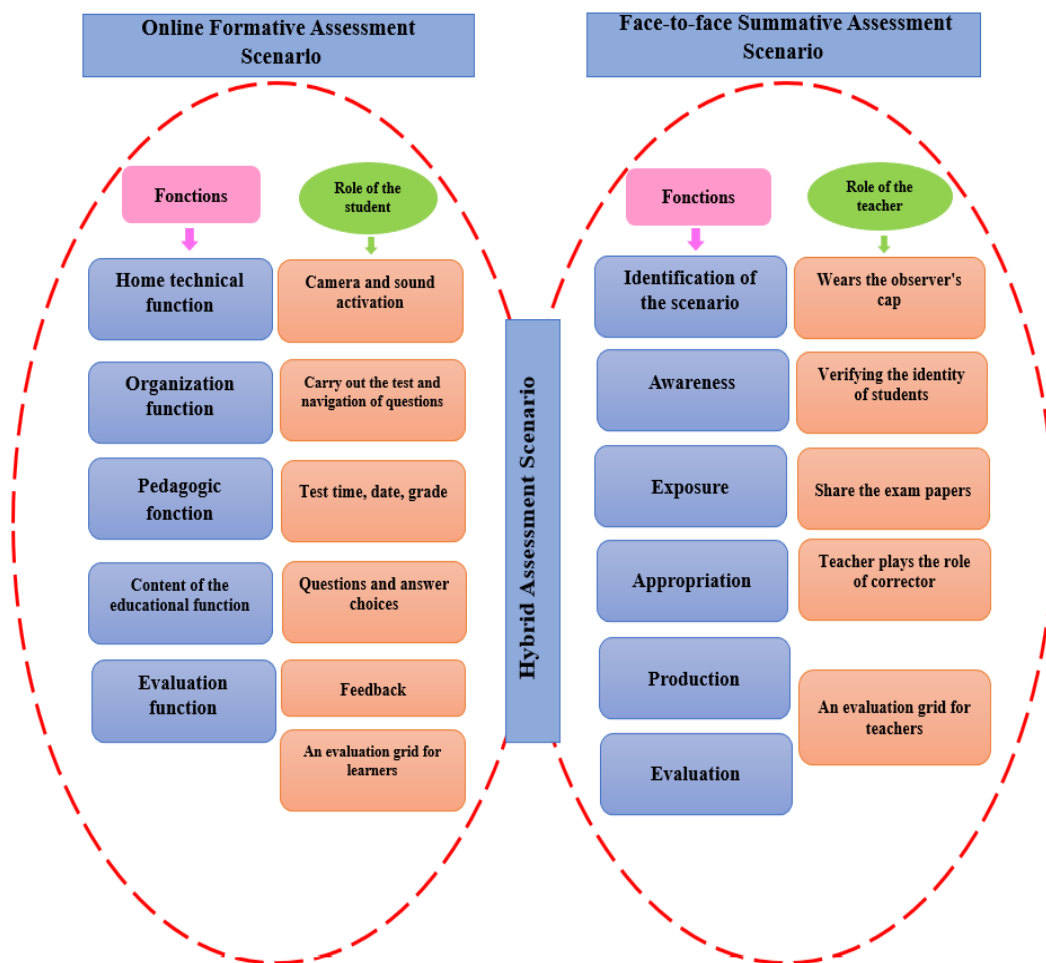

Fig. 1. Hybrid scenario

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In the following paragraph, we define the combination elements of Hybrid Assessment Scenario and its levels:

A. Hybrid evaluation practices

Online formative assessment through online proctoring: is a semester-long exam monitored by using emerging technologies to detect any attempts at cheating and to ensure academic equality among all students. On the other hand, this practice allows students to receive feedback on their results. This, this assessment aims to track students' learning progress throughout the semester.

Summative face-to-face assessment through face-to-face supervision: is a traditional written exam on paper and pencil at the end of the semester monitored face-to-face. This practice is a way to mark students' performance, knowledge and understanding of the course they are studying. Therefore, this assessment aims to compare the results obtained by the students learned to what they were supposed to learn in the course.

Additionally, using this combination of practices could provide a more comprehensive view of student performance. Also, emerging technologies offer teachers many opportunities to teach and better assess their students in a hybrid context.
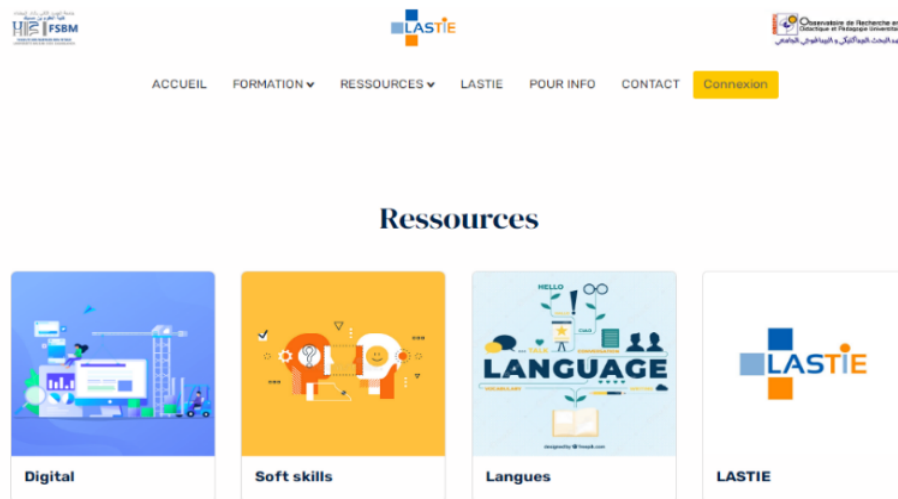
B. The levels of the hybrid evaluation scenario

Fig. 2. Hybrid Device Overview

At the level technological, for the first type of assessment is based on two modalities : behavioral modalities through the recognition of the learner's voice and, morphological modalities through the recognition of the learner's face. We have set up a hybrid system with emerging technologies "see Fig. 2". We have developed this device by the latest version of the online Moodle platform and, with the help of the XAMP server. Then, we integrated two plugins for online proctoring: One to block the search browser window during online formative assessment. And the other, to ensure online identification through the students' camera and microphone. Then, we experimented with this device with the 92 participants in the experimental group.

At the pedagogical level, we opted for the hybrid scenario which combines two different assessment scenarios : In the first scenario for online formative assessment, the student begins by activating the camera and sound. Afterwards, the must start answering the test questions within the set time. Then, the must formulate a list of questions that will be asked in class. And, in the

second scenario in face-to-face summative assessment, the teacher plays two roles; firstly, the wear the cap of the observer who checks the identity of the students and divides the exam sheets and, secondly, the teacher plays the role of corrector of the exam sheets.

This approach generally integrates assessment practices: online formative and face-to-face summative, as well as various methods to assess learners' skills and, according to technological and pedagogical levels. Whereas, hybrid assessment seeks to balance the measurement of theoretical knowledge, practical skills and problem-solving abilities of learners.

3.3.2. Taxonomic skills

In our hybrid system, we planned to assess students' skills using Bloom's taxonomy **(Benjamin, 1956)**. Taxonomy is a classification of skills into different levels of complexity, ranging from the simplest to the most complex. In our article, we adopted a differentiated approach where "taxonomic skills" are divided into two distinct groups according to two types of assessment "see Fig. 3".

For the online formative assessment, we will virtually measure lower-level skills such as memorization, comprehension, and application through multiple-choice questions. The application level represents the higher level of automatic MCQs. In contrast, during the summative face-to-face assessment, we will measure higher-level skills such as analysis, evaluation, and creation through open-ended written questions.
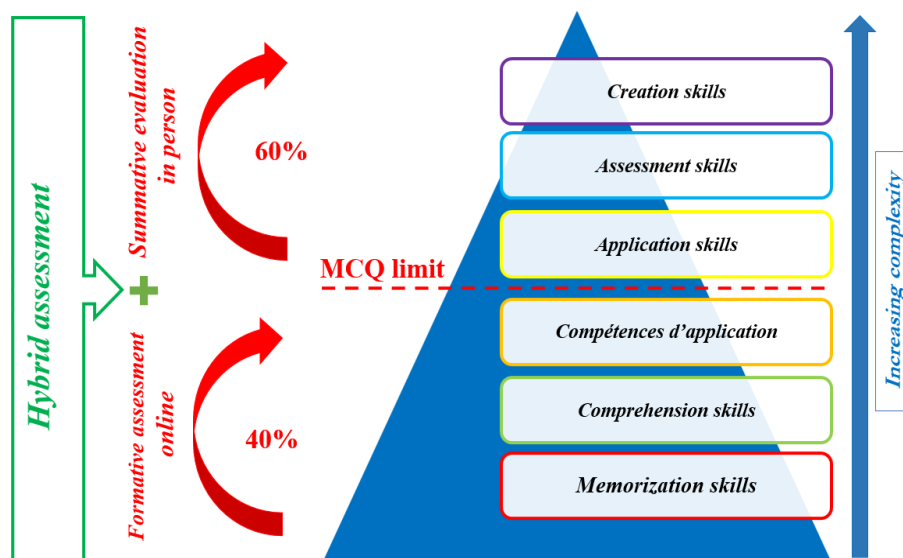

Fig. 3. Taxonomic skills approved in the hybrid system

These skills refer to a learner's ability to memorize, understand, apply, analyze, evaluate and create information, thereby contributing to their logical thinking and in-depth understanding. The use of Bloom's Taxonomy, or taxonomic skills, is essential for assessors so that they can create structured and well-defined MCQs in hybrid assessments. Also, the implementation of Bloom's taxonomy can promote learning progression and develop students' skills.

3.3.3. Evaluation modality

In our study context, the evaluation method will be in two modes: Mid-semester exam and final exam at the end of the semester. In this module, mid-semester students will take online formative assessments with 40% of the final mark, in the form of a MCQ of 20 multiple choice questions, each question with 3 answer choices in a period of 20 min. And, at the end of the semester, students will take summative assessments face-to-face with 60% of the final mark in the form of written questions in a period of 45 minutes.

Table 2. Table of evaluation mode

Nature of the evaluation	Percentage
Mid-semester exam	40%
Final exam	60%

It should be noted that the maximum score obtained in the evaluations is 20 points, (a score lower than 10/20 is insufficient, a score higher than 10/20 is sufficient and a score higher than 15/20 is very good) to measure the success rate of students. In this experiment, the collected data were analyzed based on IBM SPSS Statistics software **for Windows.**

4. Results

4.1 Results of the questionnaire

To answer the above questions, we wrote a questionnaire for teachers then, we administered these questionnaires for 60 teachers at the Faculty of Sciences Ben M'Sick in order to enrich our problematic. From this questionnaire intended for teachers, we present some of the following results:

From this diagram, we observe that 12.5% of teachers do not think at all that the coronavirus crisis has changed their perspective on higher education. Meanwhile, 31.2% of teachers believe it had a slight impact, while 56.2% believe that the crisis had a significant impact. Therefore, we can see that more than half of the respondents are in favor of changing the evaluation system in education in Morocco "see Fig.4".
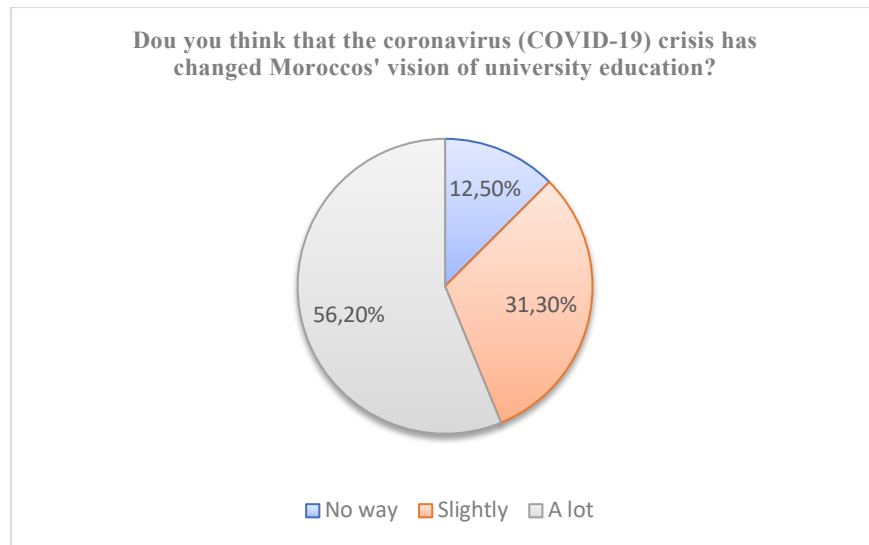
Fig.4. Teachers' vision after the coronavirus crisis

In total, 87.5% of teachers say that hybrid teaching in Morocco has become necessary to better manage possible crises ; however, only 12.5% of teachers are disinterested "see Fig. 5"
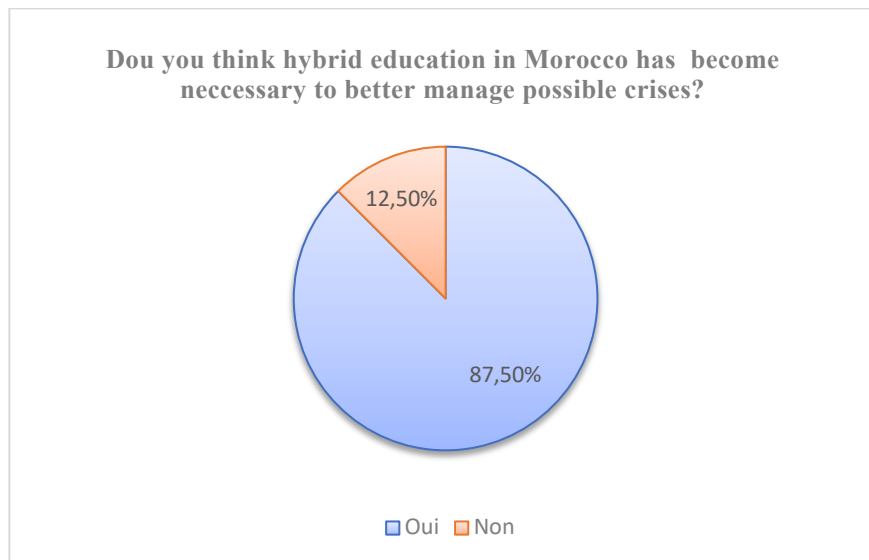

Fig. 5. The need for hybrid teaching

After the COVID-19 pandemic, we observed that 68,7% of teachers prefer hybrid assessment, while the remaining 31,3% opt for traditional assessment "see Fig. 6".
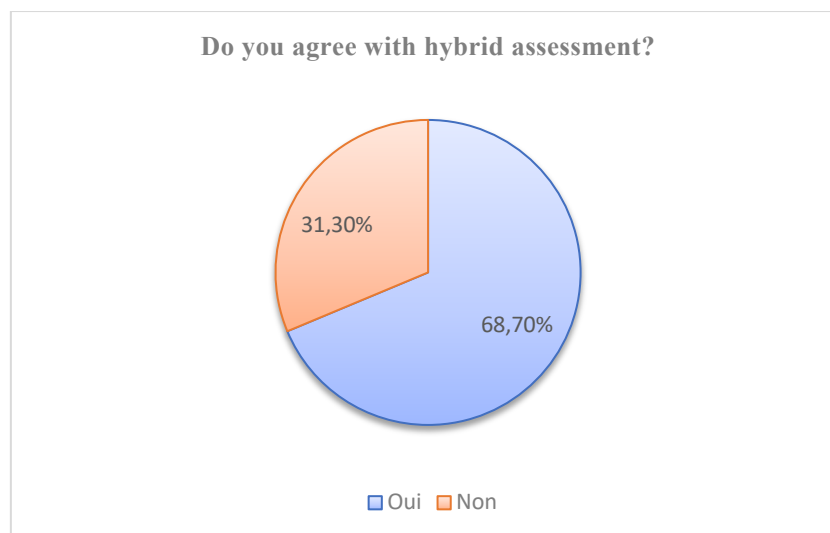
Fig. 6. The choice between hybrid assessment and traditional assessment

From this diagram, according to this figure, 37.5% of respondents share the same opinion on this question. The difference lies in the level of their certainty about effectiveness. Twenty-five percent believe that this method of assessment can effectively improve the teaching-learning process, and 12.5% claim that the impact of hybrid assessment will be ineffective. Meanwhile, 62.5% of teachers remain neutral towards this question "see Fig. 7".
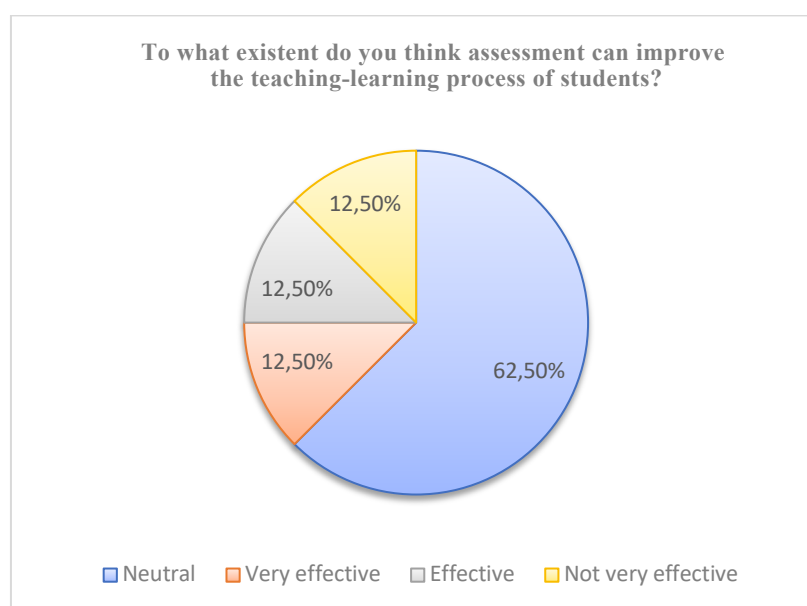

Fig .7. Familiarization between the hybrid assessment concept

This raises the question : What measures should be put in place to promote hybrid assessment ?

4.2 Experiment results

We present below the results of this experiment, these are the general data relating to: gender, average, Student's T test, success rate of the hybrid evaluation in comparison with the classic assessment. As well as, the taxonomic skills that hinder hybrid evaluation practices, in order to determine the educational and technical measures aimed at promoting the implementation of the digital system.

- **Representation of the sample**

Table 3. Table of the gender

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Group	Gender					
	Female		Male		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Control group	48	57.14%	36	42.86%	84	47,73%
Experimental group	64	69.57%	28	30.43%	92	52,27%
Total	112	63.64%	4	36.36%	176	100%

This population is divided into two types of groups: a control group of 84 students which represents 47.73% of the population and an experimental group of 92 students representing 52.27% of the population (see Table 3.). For the control group we have 57.14% of female students and 42.86% of male students. Concerning the experimental group, we have 69.57% of female students and 30.43% of male students, which shows that the female students surveyed outnumber the male students.

- **Average**

Table 4. Table of average student score table

Genre	Average					
	Control group			Experimental group		
	Assessment formative	Assessment summative	Average Final	Assessment formative online	Assessment summative face-to-face	Average final
Female	12.00	12.00	12.00	13.06	13.13	13.10
Male	12.14	12.86	12.50	13.11	13.61	13.36
Total	12.07	12.43	12.25	13.09	13.37	13.23

For the average passing mark of the control group in the formative assessment and the summative assessment, we have 12.00 for female students and 12.5 for male students and, 12.25 for the final passing mark of the students in the control group. Also, regarding the average passing score of the experimental group in the online formative assessment and the face-to-face summative assessment, we have 13.10 for female students and 13.36 for male students and, 13.23 for the final score of students' passages of the experimental group. To sum up, the final average of the experimental group is higher than that of the control group.

Therefore, we can see that the online formative assessment had a positive effect on the face-to-face summative assessment of the experimental group compared to the classic formative assessment of the control group. This suggests that the hybrid assessment improved students' performance in the summative assessment. As a result, it has a positive effect on the final average of students compared to the classic assessment of the control group.

- **Student's T-Test: Significance level, Hypothesis theory**

We performed the Student's T Test to compare the means of the two groups of experimental and control samples. The standard Student's T Test assumes that the variances of the two groups are equal, to estimate the standard error of a sample mean.

Statistical hypotheses:

We make a decision on the assumptions with 95% certainty.

- For the population P_1 with a mean μ_2, we test the hypothesis H_0 ($\mu_1 = \mu_2$).

  If $t_{exp} < t_{th}$, then the means of the two groups are identical ($\mu_1 = \mu_2$).

- For the population P_2 with mean μ_2, we test the hypothesis H_1 ($\mu_1 \neq \mu_2$).
  If $t_{exp} > t_{th}$, then the means of the two groups are not identical ($\mu_1 \neq \mu_2$).

The test value t_{exp} can be calculated as follows:

$$t_{exp} = \left| \frac{\overline{X_1} - \overline{X_2}}{\widehat{s} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \right|$$

- The symbols $\overline{X_1}$ and $\overline{X_2}$ represent respectively the average of the values of the experimental and control groups, where: $\overline{X_1} = \frac{\sum x_i}{84}$ and $\overline{X_2} = \frac{\sum x_i}{92}$
- The values n_1 and n_2 represent the sizes of the experimental and control groups, respectively.

And, we can calculate the estimator $\widehat{s}$ is of the standard deviations of the two groups as follows:

$$\widehat{s}^{\,2} = \frac{(n_1 - 1)\widehat{s_1}^2 + (n_2 - 1)\widehat{s_2}^2}{n_1 + n_2 - 2}$$

- With $\widehat{s_1} = \frac{n_1}{n_1-1}\left[\frac{\sum x_i^2}{n_1} - \overline{X_1}^2 \right]$ and, $\widehat{s_2} = \frac{n_2}{n_2-1}\left[\frac{\sum x_i^2}{n_2} - \overline{X_2}^2 \right]$

- The number $n_1 + n_2 - 2$ represents the degree of freedom.

Table 5. Table of estimators and t-test

E_1	$n_1 = 84$	$\widehat{s_1} = 36{,}846$	$t_{exp} = 0{,}45$
E_2	$n_2 = 92$	$\widehat{s_2} = 34{,}35$	$t_{th} = (\alpha - 5\%; n_1 + n_2 - 2)$ $t_{th} = 2{,}001$

Given that $t_{exp} < t_{th}$, then we keep H_0 ($\mu_1 = \mu_2$). Therefore, there is no significant difference between the two evaluation methods (traditional and hybrid) at the 5% error level. So, we keep the hybrid evaluation. In other words, we can conclude that the mean values of the experimental and control groups do not show a significant difference.

- **Success rate**

Table 6. Table of success rate students

	Success rate			
	Control group		Experimental group	
	Number	Percentage	Number	Percentage
Successful	80	94.24%	88	95.65 %
Not successful	04	4.76%	04	4.35%
Total	84	100%	92	100%

We experimented with the hybrid scenario; we interpreted the success rate results of the students in the two groups based on the final grade of the two tests completed:

For the control group, we obtained 94.24% of students who passed and 4.76% of students who failed in this module. Likewise, in the experimental group, the success rate is even higher, with 95.65% of students passing but, the failure rate is lower with 4.35% of students failing in this module. So, the percentage of success rate of successful students of both groups is slightly higher. So, hybrid assessment has very good results, it can be said that it can replace classic assessment in difficult times like COVID-19. Then, we can deduce that the hybrid evaluation is feasible. But it is necessary to take into consideration students who have failed or those who have encountered difficulties in hybrid assessment practices.

4.3 Results of taxonomic skills in the hybrid assessment context

Table 7. Table the levels skills

Level of skills	Correct answers		Wrong answers		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Memorization skills 50%	95	39.58%	25	10.41%	120	50%
Comprehension skills 30%	43	17.92%	29	12.08%	72	30%
Analytical skills 20%	21	8.75%	27	11.25%	48	20%
Total	159	66.25%	81	33.75%	240	100%

We experimented with the hybrid scenario carried out with the Mater MIMPA students and studied the results obtained according to the taxonomic levels: 50% of the questions for memorization skills, 30% of the questions for comprehension skills and, questions for 20% analytical skills. Among the 120 respondents, we obtained 39.58% of students who had true answers compared to 10.41% of students who had false answers so we can deduce that this is an excellent percentage of memorization skills.

Among the 72 respondents to the comprehension questions, there are 17.92% of students who have correct answers and 12.08% of students who have false answers, so we have a good percentage of comprehension skills.

As for analysis skills, we verified 8.75% of students who had corrects answers and 11.25% of students who had false answers. Which shows that there are a few difficulties with analytical skills. So, we propose adding more formative assessments with more analysis questions in order to support students at this level.

5. Discussion

Let us first recall that the objectives of our research is to mitigate the limits of online assessment and to measure the skills and knowledge of students in the context of hybrid assessment with the same quality as that carried out during the classic assessment. So, we recommend that teachers implement hybrid assessments on hybrid devices particularly, in periods of crises such as the spread of pandemics or during earthquake events... Hybrid assessment is a combination of online and in-person assessment with reduced classroom time for students in different contexts. So, hybrid assessment uses different teaching methods than face-to-face assessment.

For the question **"What types of assessments could be implemented as part of a hybrid system?"**, we advise teachers to implement online formative assessments and face-to-face summative assessments on the hybrid devices. But it is necessary to take into account the obstacles which may be encountered during hybrid evaluations such as: loss of light, poor quality of the Internet network, overload of server quality or even error messages which arise following a server overload, malfunction of hardware equipment for example: camera, microphone, etc.

And, for the question **"How to evaluate the learner in the context of hybrid evaluations?"** indeed, the educational scenario makes it possible to verify the relevance of the different elements retained. It makes it possible to validate the intervention of human resources according to their skills, at a given time. Finally, it makes it possible to check whether the implementation of the activity is realistic **(Koper, 2003 ; Kobbe, 2005 ; Dillenbourg &Tchounikine, 2007).**

Finally, the educational scenario makes it possible to check whether the different forms of scaffolding have been properly woven into it. Whether it is conceptual scaffolding, metacognitive, support, motivation or in relation to evaluation **(McLoughlin, 2002 ; Sharma, 2007 ; Jonassen, 2005).**

We advise teachers to practice hybrid assessment following the organization of the proposed hybrid scenario model, respecting the technical and pedagogical functions for each of the online assessment scenario, as well as the roles of the face-to-face assessment scenario according to their orders of importance. For the online evaluation scenario, we can cite the major functions:

- **Technical functions** such as the use of biometric methods: facial recognition by the camera and voice recognition by the microphone with a limited number of students and, the use of technological tools which allow the search window to be blocked in order to limit the phenomena of plagiarism and cheating, as in our case we used plugins.
- **Organizational functions** such as the use of navigation tools on the Moodle platform.
- **Educational functions such** as test time, date, number of attempts, lessons that will be examined.

And, for the face-to-face assessment scenario, we have three main roles for teachers who engage in the hybrid system: educational designer, observer and corrector. Indeed, in hybrid evaluation the role of the evaluator is more complicated, for this reason we have specified his roles in the online formative evaluation and in the face-to-face summative evaluation according to the following table:

Table 8. Table of the different roles of the evaluator in a hybrid system

Role	Online formative assessment	Face-to-face summative assessment
Designer pedagogic	He creates a multiple-choice question on the platform.	He prepares the written assessment on paper
Observer	He verifies the identity of the student and observes the students through the camera and microphone.	He verifies the identity of the student according to the identity card.
Corrector	The platform provides on-time grade feedback on MCQ answers.	He corrects the exam papers according to an evaluation grid.

We can deduce that the success of a hybrid evaluation is conditioned by the development of the functions of its scenario and the different roles of the evaluator. As a result, hybrid assessment

evaluators must be ready for change and adapt to the many opportunities offered by the rapidly evolving digital world.

Then, for the question "What measures should be put in place to promote the hybrid assessment?", students must be informed of their roles in the hybrid system in order to promote the smooth running of the hybrid assessment, at the start of the course, semester and explain to students the method of composing the hybrid assessment: the online formative assessment (OFA) throughout the semester and the face-to-face summative assessment (FSA) at the end of the semester, and, explain the modalities of the percentages of the score then, the monitoring mode for each assessment:

- The hybrid assessment score percentages are 40% OFA and 60% FSA.
- OFA follows online monitoring and FSA follows face-to-face monitoring.

Then, for the question "What skills are acquired for students in the context of hybrid assessment?", we analyzed the results of the experiment according to the criteria of average, standard deviation, success rate and, the acquisition of taxonomic skills, which is confirmed by the results obtained.

Experience has shown that the average results of the formative and summative assessment were improved in the hybrid assessment compared to the classic assessment. In addition, it showed that the final average obtained by the experimental group (13.23) is higher than that of the control group (12.25). So, experience showed that students were able to achieve good grades in hybrid assessments on hybrid devices compared to traditional assessments. Also, the 95.65% success rate of the experimental group is very close to the 94.24% success rate of the control group, which can confirm that hybrid assessment can replace classic assessment with the same quality.

The hybrid assessment can also develop the acquisition of taxonomic skills among students, which was validated by the percentages of memorization skills (39.58% of 50%) and comprehension (17.92% of 30%) obtained according to the system hybrid. Although the percentage of analytical skills (8.75% of 20%) is not of great importance. This experience showed that hybrid assessment has a positive influence on the development of taxonomic skills among students.

Finally, we can conclude that the hybrid assessment can improve the average of the students and, can replace the classic assessment with the same quality then, it is useful and feasible and, can develop the acquisition of taxonomic skills.

6. Conclusion and perspectives

Online assessment is constantly evolving and assessors are constantly looking for new technologies and must be prepared for the rapid changes in the digital world. Hybrid assessment was proposed as a solution in our university teaching framework. So, to properly practice hybrid assessment, designers must model a structured and very specific hybrid assessment scenario including the technical and pedagogical functions as well as the roles of the teacher and the student. The success of a hybrid assessment is conditioned by the development of the functions of its scenario, the different roles of the assessor and the effectiveness of technology used at the online monitoring level. Also, to promote the smooth running of the hybrid assessment, teachers must explain to students at the start of the semester how the hybrid assessment is composed, the grade percentages and the monitoring method. We also recommend that designers further develop the technologies integrated into the online monitoring level so that evaluators can monitor automatically without online observation obligations and, to save more time.

Acknowledgements

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