Contribution to the multidimensional analysis of the success factors of the integration of the ICTE in higher education in Morocco: case of the MOOC ‘relational databases: understanding to master’ students’ point of view

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Abstract: In order to contribute to the successful integration of ICTE (Information and Communication Technologies for Education) in higher education in Morocco, a pilot experiment was carried out among university students (Master of Science in Computer Sciences at Hassan II University Casablanca). In this article, we assume that the integration of ICTE is justified as shown by the multidimensional analysis adopted in the treatment of informant’s responses. Thus, through an observation and application analysis of the chi-square law statistical test, we aim to consider the dependency relationships between the various modalities in the questionnaires and the various ways of monitoring the MOOC. The analysis of the results of this experiment has led to four main dimensions: teacher coaching, collaboration between learners, prerequisites in the module element and the rate of MOOC follow-up. These dimensions represent the most important factors for the integration of ICTE from a student’s point of view.

Keywords: integration of ICTE; MOOC; multidimensional analysis; success factors; hybrid learning.

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1 General introduction

Today, the use of information and communication technology (ICT) constitutes a social practice which is developing at a very high speed, encompassing all sectors of activity, especially that of education. The enormous explosion of information and the development and digitisation of knowledge and teachers’ skills render the integration and development of ICT in teaching and learning a pressing issue in education (Maaroufi, 2012).

In order to integrate itself into the global information and knowledge society, Morocco has established several major national projects for the integration of ICT in its education system:

- The GENIE program 2006–2013,
- The 2009–2012 contingency plan (Space 1, Project 10),
- The Maroc Numeric 2020 strategy,
- The INJAZ program,
- The LAWHATI program.
In this context, Moroccan universities such as Hassan 2 University in Casablanca (mooc.univh2c), Caddy Ayyad University in Marrakech (mooc.uca), Ibnou Zaher University of Agadir (mooc.uis) and Mohamed 5 University in Rabat (mooc.um5) have also contributed to this project by launching MOOC platforms for students. These initiatives are important, but learners do not benefit much from the services offered by these platforms, in terms of peer exchange, student-teacher exchange, and the exchange among the teaching team, because the platforms offer only online resources.

A number of studies are carried out on the integration of ICT in the Moroccan education system (AFD, 2010; Alj and Benjelloun, 2016; Benfaress et al., 2016; Maouni et al., 2014), and the results of these studies are not very effective in eliminating the obstacles to the integration of ICT in the sphere of the Moroccan education (Mastafi, 2014). For these reasons, we seek, through this experiment, to contribute to the study of the progress of the integration of ICTE in Morocco. We have therefore reflected otherwise on the integration of ICTE through the massive Open Online Courses (MOOC). Consequently this approach is different in terms of contributions to the studies that have already been undertaken (Lakdim, 2012; El Ouidadi et al., 2011; Alj, 2014; Ouazzani, 2014). The main objective is to find the factors which would make of the integration of ICTE, from a student perspective, a success.

In our approach, we seek, through statistical analysis methods using the chi-square law and through observation, to answer the following questions:

- Which is the right type of MOOC to facilitate the integration of ICTE in Moroccan face-to-face education?
- What is the preferred form of MOOC for learners in this experiment?
- Do MOOCs represent a factor in improving learners’ knowledge?
- What are the recommendations given to teachers for the integration of mixed formations?

The above questions come within the main objective to contribute to the development and acceleration of the process of integration of ICTE in higher education in Morocco.

2 Context of the experiment

2.1 Presentation of the experiment

To better illustrate our approach, we have launched an experiment in the public sector of higher education. This experiment is carried out on five groups of engineering sciences students in the first year of their master degree (M1 MASTER) the Hassan II University of Casablanca. The sample consists of 130 learners in five groups: Group 1 (24 students), Group 2 (23 students), Group 3 (23 students), Group 4 (28 students) and Group 5 (32 students). Students from the five groups responded to three questionnaires: MOOC questionnaire 1, MOOC weekly questionnaire 2, and MOOC follow-up questionnaire 3 post MOOC. The concerns of the three questionnaires are motivation, satisfaction, acquisition of knowledge, pace of MOOC monitoring, and constraints faced by learners during MOOC follow-up.

The elements that were necessary to start our experiment are summarised in Table 1.
Table 1: Elements of the experiment

<table>
<thead>
<tr>
<th>Class of Students</th>
<th>Number of students</th>
<th>Class of learners</th>
<th>Signing of the MOOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>24</td>
<td>M1 MASTER</td>
<td>MOOC only</td>
</tr>
<tr>
<td>Group 2</td>
<td>23</td>
<td>M1 MASTER</td>
<td>MOOC with accompaniment of the teacher</td>
</tr>
<tr>
<td>Group 3</td>
<td>23</td>
<td>M1 MASTER</td>
<td>MOOC with additional external resources (other MOOC, YouTube...)</td>
</tr>
<tr>
<td>Group 4</td>
<td>28</td>
<td>M1 MASTER</td>
<td>MOOC with weekly report</td>
</tr>
<tr>
<td>Group 5</td>
<td>32</td>
<td>M1 MASTER</td>
<td>MOOC with collaboration between learners</td>
</tr>
</tbody>
</table>

The experiment of integrating ICTE in the Moroccan higher education system, which we propose, is initiated through a mixed learning based on a pedagogical scenario composed of several stages for motivation, appreciation (Maaroufi, 2016), satisfaction and involvement of learners in MOOC. These learners benefit from classroom training and distance learning on the international FUN MOOC platform. The experiment is carried out on a major module in initial training. The module is entitled “Relational databases” published by INRIA and UTOP (Université de Technologies Ouvertes Pluripartenaires).

During this experiment, learners of the five groups follow a distance training on the FUN MOOC in an asynchronous way, that is to say in a delayed time from the period of diffusion of the course. It happens that, on this platform, the course is already finished, but it has remained archived in the accounts of the learners. In this case, learners do not benefit from real-time interaction, direct meetings with the teaching staff, or feedback on assignments and quizzes, but they have only benefited from the learning experience and competence of teachers who have put all their innovative pedagogical skills into this course.

2.2 Different forms of MOOC follow-up by learners

In our approach, we have adopted five forms of monitoring MOOC:

- **MOOC only:** the learners do not use any other external alternatives except the course details available on the MOOC platform.
- **MOOC with the accompaniment of the teacher:** the learners are supervised by a teacher. They can ask questions in forum and interaction space.
- **MOOC with additional external resources:** learners use other external alternatives for more information about the course. These external resources can be social networks, YouTube, other MOOC platforms, etc.
- **MOOC with weekly report:** learners are obliged to write a report each week in the form of a summary on the chapter of the week, in which they report the main obstacles met.
- **MOOC in collaboration with learners:** learners are obliged to be invited to collaborate with other learners on the MOOC course in case of need, or to discuss the course sections that are not clear in the MOOC.
2.3 Theoretical framework and problematic

Within the framework of ICTE integration, there are several theoretical models, such as TPACK (Technological Pedagogical Content Knowledge), SAMR (Substitution, Augmentation, Modification and Redefinition), PST (Pedagogical Social and Technological Accessance). All the models cited above are based on the use of ICTE and are linked to the pedagogical, social and technological dimensions (Vekout, 2013). These models operate, depending on their type, on administrative and pedagogical aspects of education. However, their adoption and integration is still problematic in most education systems.

In our approach, we have proposed a model that is inspired from the main rules of the theory of activity. It is a model that integrates almost all the main entities of the previous models, with a communication towards all the senses and between all its entities in order to reach a precise objective.

Jonassen and his colleagues have taken up and applied the theory of activity to the field of education with digital. This theory, derived from the Soviet historical-cultural current (Vygotski, Luria, and Leontiev), can be described as constructivist in that any learning activity takes place in a context, whether social or material. The fundamental question is the level of analysis of the activity. Every activity, according to this theory, is organised in systems (Figure 1). The triplet (Subject, Object, and Tool) is the minimal framework for analysing activity.

![Figure 1 Modelling of mixed learning according to the theory of activity](image)

The subject of the activity can be either a person or a group. In our approach, it represents the learners of the five groups.

The object of the activity is the mental or physical product sought. In our approach, it is hybrid learning (face-to-face/distance).
The object is transformed into results with the help of instruments (tools, MOOC, other external resources: social networks, supports, etc.).

The tools can be both material and cognitive, and modify the activity as much as they can be modified by it. In our approach, they are represented by MOOC and other material resources (social networks, documents and supports of the course in face-to-face).

The other elements that make up our approach in the same theoretical framework are:

The rules (accompaniment, supervision, follow-up and collaboration) refer to the implicit and explicit ways of regulation, convention, standards that constrain actions in the system under consideration.

The community (teachers and teaching staff) comprises the different individuals (learners) and subgroups sharing the same object and the division of labour (administration of the university) which refers to the division of tasks, work, and status.

The division of labour refers to the division of tasks, work, status (the roles of administrative actors).

The rules refer to the implicit and explicit ways of regulation, convention, standards that constrain actions in the system considered as coaching and accompaniment of learners, commitment of teachers and learners, follow-up and traceability of learners in learning platforms.

The different parts of our approach involved in this theory are: a subject (learner), tools (MOOC, other external resources, supports), a goal (mixed learning), rules of (coaching, accompaniment, commitment, monitoring and collaboration), and a community (teachers and teaching teams) in which a division of labour (roles of administrative actors) contributes to the objective.

3 Hypothesis

Our approach attempts to test the following hypothesis:

The integration of ICTE in higher education in Morocco throughout the example of “Relational databases” allows the acquisition of knowledge among the learners and increases their motivations thanks to the opportunities offered by the MOOC when they are used in an adequate way and in a good pedagogical scenario.

4 Scenario of the experiment

Step 1: To conduct this experiment, we invited the learners of the five groups to register for the MOOC entitled “Relational databases: understanding to master” on the FUN platform. This is done after a detailed presentation of the structure of the MOOC, the different ways of using the options of the platform (discussion forum, downloading documents, realisation of online work and quizzes), initiatives of Moroccan universities in MOOC, as well as the initiatives of the Ministry of Higher Education in Morocco in the integration of ICT in education (Messaoudi and Talbi, 2008). We distributed the first questionnaire to the learners as a preliminary step consisting of six items with several modalities revolving around the following points:
Their knowledge of MOOC platforms in general;

Their MOOC interest of relational databases;

Their needs and expectations during the follow-up of the MOOC entitled “relational databases” (Raby et al., 2011);

Their opinions on the different modes of teaching (face-to-face, distance or mixed).

These four points constitute the fundamental elements for the involvement of the learners in the use of the MOOC and the appropriation of the ICT in their teachings.

Step 2: In this stage, a weekly follow-up of the MOOC used by the learners of the five groups was carried out by the pedagogical team. Each week, learners are asked to answer a second questionnaire of five items with different modalities to assess their MOOC follow-up patterns, motivation, problems encountered, progression and advice to follow other MOOC trainings.

Step 3: A third questionnaire, consisting of 12 items of different modalities, was distributed to the learners of the five groups to measure their opinions on mixed learning, motivation, satisfaction, follow-up of the MOOC, the problems encountered during the follow-up and their assessment of MOOC. The results of this questionnaire are analysed by relying on observation and the chi-square statistical law to identify the dependencies between the different qualitative and quantitative variables of this experiment.

5 Analysis of results and discussion

5.1 Questionnaire 1: before launching the MOOC

The results as a percentage of the responses in questionnaire 1 of the first stage of this experiment are presented as follows:

In this preliminary stage and based on analysis of the responses of the five groups, the learners showed in a first stage their interests, implications, expectations and motivations for the follow-up of the courses in the form of MOOC and to test their first experiments of follow-up of the MOOC.

In advance, the learners do not have much knowledge and clear ideas about the MOOC. The “No” answers of the first question represent the highest percentage (58.33% of group 1, 65.22% of group 2, 69.57% of group 3, 64.29% of group 4 and 53.13% of group 5), but after presenting advantages, innovations of the MOOCs by the pedagogical team, it is noted that learners prefer change and innovation in teaching by integrating MOOC into modules of training. Furthermore, their answers to the question “You are for which mode of education for your training?”; the learners opted for mixed training with the highest percentage: (66.67% of group 1, 73.91% of group 2, 65.22% of group 3, 53.57% of group 4 and 65.63% of group 5).

We analysed the results of the first questionnaire with interpretations by observation as a point of entry into the body of experiment. The learners of the whole population tested in this experiment are required to answer a second weekly questionnaire (questionnaire 2), with the aim of extracting results justifying their opinions, implications, motivations and participations during the follow-up of the MOOC entitled “Relational databases: understanding to master”. Finally, a third questionnaire was given
to justify their overall assessments, their final motivations, their satisfactions, their mode of face-to-face, distance-learning or mixed-mode, and their chronological follow-up of MOOC (El Ouidadi et al., 2011).

Figure 2  Percentage of learners’ answers to questions of the first questionnaire

Table 2  Questions from the first questionnaire

<table>
<thead>
<tr>
<th>Q1</th>
<th>Are you aware of MOOC platforms (Massive Open Online Courses)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2</td>
<td>Before the course of MOOC, your level of interest in the database was:</td>
</tr>
<tr>
<td>Q3</td>
<td>What is your level of knowledge on the subject of this MOOC?</td>
</tr>
<tr>
<td>Q4</td>
<td>What are your expectations for this MOOC?</td>
</tr>
<tr>
<td>Q5</td>
<td>How do you follow this MOOC?</td>
</tr>
<tr>
<td>Q6</td>
<td>Which mode of education you prefer for your training?</td>
</tr>
</tbody>
</table>

5.2  Questionnaire 2: weekly during the MOOC

In this step, the follow-up of the learners in the MOOC was weekly by the pedagogical team. Each week, learners are asked to answer a five-question questionnaire to assess their MOOC follow-up patterns, motivations, problems encountered, progressions, and advice to follow other MOOC training.

The overall analysis of the results of the MOOC six-week responses, and according to the five dimensions: MOOC monitoring rate, motivation, problems encountered, MOOC sufficiency and follow-up of other MOOC courses.
The first question of the questionnaire handles the rhythm of follow-up of the MOOC. It is with the progress of the MOOC during the last five weeks, which the groups 1, 2, 3 and 5 are satisfied that the MOOC is completely adapted except the group 4 which claims that the MOOC is too fast. Group 4 has to write a weekly report about the part of the MOOC of the week. This Group has more work in comparison to the other groups. For this reason, the respondents of this group claim that the rhythm of progress of the MOOC is too fast during the six week experiment of the MOOC by the following percentages (46.43% in week 1, 39.29% in week 2, 39.29% in week 3, 35.71% in week 4, 21.43% in week 5 and 17.86% in week 6).

Figure 3  Percentage of observed enrolments according to three dimensions: week, student group and multiple choice questions

From the analysis of the results, the MOOC requires a higher rhythm at the start of the MOOC, and this rhythm decreases afterwards. However, the group 4 learners who have more work have claimed that faster rhythm is required during the six weeks of the MOOC. Group 1 also claimed that MOOC is too fast during the first 4 weeks by the following percentages (50% week 1, 20.83% week 2, 12.50% week 3 and 16.67% week 4. Therefore, the results of this question show that MOOC demands a higher pace at the outset.
The second question of the questionnaire deals with MOOC motivation. It is noted that the learners of the five groups are highly motivated to use MOOC, during the six weeks of their MOOC follow-up. Their motivation increases weekly along the MOOC progression. This means that learners are also very motivated to participate in MOOC learning experiments. This is the first time that they have followed a MOOC under a specific control of the teaching team, and this shows a validation of our hypothesis in relation to the motivation dimension (El Ouidadi, 2012). The highest percentages of motivation are “high” and “too high”.

The percentage results of respondents from the five groups are given in the following graph:

**Figure 4** Percentage of personnel observed according to three dimensions: week, group of students and titles of the question “This week your motivation for following MOOC was?”

![Graph showing percentage of replies by three dimensions: week, groups of students, and responses modalities](image)

Others Questions in the second questionnaire deal with the problems encountered, the inadequacy of the MOOC and the opinions of learners on this new pedagogical dimension.

With regard to the problems encountered, with the advancement of the MOOC during the six weeks, responses of the learners focus on the lack of relational databases progressively: the highest percentage during week 1 is 31.25% and 81.25% during week 6. The MOOC presents a course database that is a bit complex in weeks 3, 4, 5 and 6. The second problem faced by learners from all groups is language, but this problem diminished in the last weeks. During week 4, it was 4.35%, and 4.35% during week 5 and
0% during week 6. The third problem is the rhythm of video parts of the MOOC course. The learners of all the groups have claimed that the rhythm of the videos was fast during the six weeks and the learners were obliged to replay the videos several times to master the course.

Regarding MOOC inadequacy, the learners of the five groups claimed the MOOC is largely sufficient during the first week. With the weekly progression of the MOOC most group learners have changed opinions. They prefer MOOC with the use of external resources or with accompaniment of the teacher or collaboration between learners.

Learners from all groups have benefited from the good knowledge and experiment of MOOC, their use of external resources such as YouTube, Social Networking, collaboration with other learners, and from the help of the teaching team. An analysis of the results of this question shows that learners using MOOC with other resources, accompanied by the teacher and in collaboration with each other benefited them more than using MOOC alone. These results confirm a validation of our hypothesis with respect to the knowledge improvement dimension. Because of the MOOC, learners have opted to use other external resources to improve their knowledge.

The population studied in this experiment is very motivated by this new pedagogical dimension in their training courses and are ready to follow other MOOC courses. This also validates our hypothesis with reference to the motivation dimension.

5.3 Questionnaire 3: after the end of the MOOC

The final satisfaction questionnaire is distributed to the learners of the five groups to measure their opinions on mixed learning, motivation, satisfaction, MOOC follow-up rate, problems encountered in their MOOC follow-up and MOOC assessment. The results of the questions in this questionnaire are analysed and justified according to observation interpretations and the chi-square statistical law to identify the dependencies between the different qualitative and quantitative variables of this experiment.

The results of the third questionnaire are:

- Question 1: Give your overall appreciation for this MOOC course:

![Figure 5](image)
According to the answers, we note that the appreciation is rather positive (all the answers are over 5/10) (Droui, 2015; Ait Kaikai, 2014).

- Question 2: Did you miss any prerequisites in the relational database subject to follow the MOOC?

**Figure 6** Percentage of responses by student group and by question

The results of this question show that learners demand the relational database requirements for MOOC tracking, the highest percentages are concentrated in the response “Yes” and “Some basics”.

- Question 3: Did you learn knowledge at the end of the MOOC Relational databases?

**Table 3** Observed respondent size by student group and by question name

<table>
<thead>
<tr>
<th>Groups of students/ Items of responses</th>
<th>Groups</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Little</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Medium</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Many</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Enormously</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Overall</td>
<td>24</td>
<td>23</td>
</tr>
</tbody>
</table>

To justify the dependence between different groups of learners and the degrees of acquisition of knowledge (wording of the question), we propose the following hypotheses:

**H0:** There is no link between the level of knowledge acquisition and the groups of learners

**H1:** There is a link between the degree of knowledge acquisition and the groups of learners

In terms of learners ‘knowledge and cross learning between learners’ groups and the levels of knowledge acquisition, we find that the statistical index evaluating the link between these two variables (X = 6, 29, ddl = 16, p = 0.10) is less than the critical value (X = 23.54, ddl = 16; p = 0.10). This result indicates that there is no link between the degrees of knowledge acquisition and the groups of learners, so we validate the hypothesis H0.
Thanks to a more detailed analysis of the results we find that the improvement of knowledge of the learners of the five groups is very positive. Percentages are concentrated on 41.67% of group 1, 52.17% of group 2, 47.83% of group 3, 39.29% of group 4 and 50% of group 5. Then 33.33% in Group 1, 30.43% in Group 2, 34.78 in Group 3, 25% in Group 4 and 25% in Group 5. Groups 4 and 5 were also satisfied with the improvement of knowledge with the choice “Enormously” by 21.43% of group 4 and 15.63% of group 5. This confirms our hypothesis according to the knowledge acquisition dimension.

The percentage results are shown in the graph in Figure 7.

**Figure 7** Percentage of responses by group and by question

- Question 4: This MOOC was followed in a batch mode compared to the course. Do you sometimes block on questions or parts that are unclear?

**Figure 8** Percentage of responses by group and by question
From the results to this question, it is noted that the learners of the five groups do not need assistance in the follow-up of MOOC by the highest percentage 41.67% of group 1, 39.13% of group 2, 43.48% of group 3, 35.71% of group 4, 31.25%. Then they need help a few times by an interesting percentage 33.33% of group 1, 39.13% of group 2, 39.13% of group 3, 35.71% of group 4 and 37.50% of the group 5. Then answers by “Yes” need help by 25% of group 1, 21.74% of group 2, 17.39% of group 3, 28.57 of group 4 and 31.25% of group 5. The analysis of the results of the answers shows that most of the learners do not need help in their follow-up of the MOOC in this experiment but there is an interesting part of the learners who prefer assistance from time to time during the follow-up.

- Question 5: Are you satisfied with the MOOC “Relational databases”?

Figure 9  Percentage of responses by group and by question

First, is there a link between the different groups of learners and the degrees of satisfaction, via the statistical index? For this, we propose the two internal hypotheses:

**$H_0$: There is no link dependency between learner groups and levels of satisfaction.**

**$H_1$: There is a dependency relationship between learner groups and levels of satisfaction.**

After a cross-analysis of the results of respondents in terms the two variables 1 and 2, we find that the statistical index evaluating the link between these two variables is very small ($X = 7.85$, $ddl = 20$, $p = 0.1$) the critical value ($X = 28.41$, $dd1 = 20$, $p = 0.1$).

Since the theoretical value is less than the critical value, then the hypothesis $H_0$ is validated. It seems that there is no dependency between the two variables (learner groups and degree of satisfaction).

Based on a detailed analysis of the results of this question, it can be seen that the learners in the five groups are satisfied with the highest percentages: ‘Enough’, ‘Many’ and ‘Enormously’.
The observed and theoretical results of question 5 of the questionnaire show that all groups of learners are satisfied with the MOOC and the most satisfied groups of learners with the choice “Many” are groups 2 (group 4), 43.48% of group 2 and 50% of group 5. That is, interaction with either the pedagogical team or learners has a very important role in learner satisfaction during MOOC follow-up. This result validates our hypothesis with respect to the satisfaction dimension.

- Question 6: What difficulties do you encounter?

Figure 10 Percentage of responses by group and by question

To justify the dependence between different groups of learners and the choices of the question, we opt to use the statistical index and we propose the two internal hypotheses:

$H_0$: There is no link between dependency between the groups of learners and the choices of the question.

$H_1$: There is a dependency link between the groups of learners and the choices of the question.

The calculated value ($X = 5.38; dd1 = 16; p = 0.1$) is less than the critical value ($X = 9.31; dd1$ is calculated after a fine analysis and calculates theoretical and critical values according to the statistical index $=16, p = 0.1$). So we validate our hypothesis $H_0$ and it seems that there is no dependency between the two variables 1 and 2.

The results of the analysis of the answers show that the learners of the five groups stress their difficulties in the prerequisites of the relational databases for the monitoring of the MOOC and the rate of advancement of the MOOC by the highest percentages.

Question 6 of the questionnaire addresses the difficulties encountered during trainees’ follow-up of the MOOC. After a detailed analysis of the observed and theoretical results,
and according to the calculated and critical statistical index of this question, we find that the learners of the five groups claim their needs in the prerequisites in the relational databases and the pace of MOOC follow-up is somewhat high. Results that confirm the follow-up of the MOOC needs the prerequisites in the subject in question and a somewhat high pace of learners compared to the follow-up of the course in face-to-face.

- **Question 7:** How would you prefer to take this MOOC course?

It is an optional question, and according to the observed results of this question, it can be seen that the learners of the five groups in this experiment followed the asynchronous MOOC, that is, in delayed time to the launch of the MOOC. But during the presentation of the MOOC all the advantages and positive points of MOOC follow-up in a synchronous way compared to the asynchronous way are presented to the learners; namely, the interaction in real time with all the learners of the MOOC, teaching team, automatic evaluation, real-time quizzes and quizzes, etc. For these reasons, it is found that the learners of the five groups prefer to follow the MOOC in a synchronous way so that they benefit from the advantages and the positive points of the MOOC.

- **Question 8:** Is the support of the students by the teacher or the teaching staff in the MOOC important?

Figure 11  Percentage of responses by group and by question

To justify the dependence between the different groups of learners and the items of importance in teacher support, we opted for the statistical index according to the following internal hypotheses:

- **H0:** There is no dependency between the groups of learners and the choices of the question.
- **H1:** There is a relationship between dependency between the groups of learners and the choices of the question.
After a thorough analysis and calculation of the theoretical and critical value, the statistical index of the calculated value \( (X = 9.33, \text{ddl} = 16, p = 0.05) \) is higher than the critical value \( (X = 7.96, \text{ddl} = 16, p = 0.05) \). Therefore, we find that there is a strong dependency link between the groups of learners and the choices of the question. For this reason, we reject the hypothesis \( H_0 \) and we validate the internal hypothesis \( H_1 \).

Based on a detailed analysis, it is noted that the presence of the teacher or the teaching staff during the follow-up of the MOOC is indispensable for the accompaniment of and the help of learners. Group 2 and Group 4 confirmed this great importance by a rate of 56.52% with the choice “Much” of group 2 and a rate of 42.86% with the choice “Much”.

- Question 9: Would you prefer to take further courses in your online university training on MOOC?

To justify the dependency relationship and the groups of learners and the choices of the question, we use the statistical index and we propose the following two internal hypotheses:

\( H_0: \text{There is no dependency between the groups of learners and the choices of the question.} \)

\( H_1: \text{There is a relationship between dependency between the groups of learners and the choices of the question.} \)
After calculating the statistical index, we have found the calculated value (X = 4.00, ddl = 8, p = 0.05) to be greater than the critical value (X = 2.73, ddl = 8, p = 0.05). So we reject the hypothesis H0 and we validate H1; that is to say, there seems to be a strong link between the groups of learners and the choices of the question.

After a detailed analysis and computation of the statistical index, we note that group 5 (collaborative) prefers some courses on MOOCs by the highest percentage is 62.50%, then group 4 by a percentage of 50%, group 3 by a percentage of 47.83%, group 1 by a percentage of 41.67% and finally group 2 by a percentage of 39.13%.

Thus, the choice between face-to-face, distance and some courses on MOOC depends on the mode of follow-up of the MOOC, and according to a fine analysis of this question, the collaborative group is the group model that prefers mixed courses, followed by group 4 with weekly report.

- Question 10: Would you prefer to receive training from your university studies?

Figure 13  Percentages of responses by group and by question

The analysis of the results of the answers to this question according to the three dimensions: Learner group, type of training and choice of the question gives the following confirmations:

- Face-to-face training is “little” and “very little” appreciated by the learners of the five groups. The percentages of the word “little” range from 28.13% to 30.43%, and the percentages of “very little” are between 33.33% and 59.38%.

- Mixed training moderately and fairly well appreciated by the learners of the five groups. The percentages of the “average” rating between 26.09% and 37.50%, and the percentages of the “fair” rating between 29.17% and 56.25%.
- Distance learning is “little”, “very little” and “medium” appreciated by learners in the five groups. The percentages of the choice “very little” between 15.63% and 53.57%, the percentages of the choice “little” between 25% and 33.33%, the percentages of the choice “average” between 14, 29% and 28.13%.

Wen note also that groups 2 and 5 are motivated with regard to distance training with the choice “enough” by 30.43% for group 2 and 25% for group 5. Knowing that groups 2 and 5 are accompanied either by a pedagogical team, collaboration between learners.

- Question 11: What was your motivation level for this MOOC course?

Figure 14 Percentages of responses by group and by question

\[ H_0: \] There is no link between dependency between learner groups and motivation statements.

\[ H_1: \] There is a link between dependency between learner groups and motivation statements.

The calculated value (\(X = 11.14, \text{ddl} = 20, p = 0.5\)) is more than the critical value (\(X = 4.57, \text{ddl} = 20, p = 0.5\)). Therefore, we reject the hypothesis \(H_0\) and we validate the hypothesis \(H_1\). And in this case, there seems to be a dependency between the modes of follow-up of the groups of learners and the statements of motivation of follow-up of the MOOC.

After a detailed analysis of the observed and theoretical results, the learners of the five groups show their motivation for MOOC follow-up, the highest percentages are “Medium”, “Good” and “Much” groups 2, 4 and 5 respectively. Therefore, after a dependence check by the chi-2 statistical law between the MOOC monitoring modes (groups of learners), it is noted that the statement of motivation corresponds to the mode
of follow-up of the MOOC. The results of this question confirm the motivation of the learners on the follow-up of the MOOC courses, and this validates our hypothesis in relation to the motivation dimension (El Ouidadi, 2012).

- Question 12: Would you be willing to recommend MOOC to others?

**Figure 15** Percentage of responses by group and by question

![Percentage of responses by group and by question](image)

The results of the observed enrolment analysis of this question show that learners in the five groups confirm their positive opinions of following MOOC courses to others, knowing that this motivation gives the highest percentage to group 2 accompanied by the teacher by 69.57% and the collaborative group 5 by 68.75%.

In order to justify the dependence between learner groups and motivation, we have chosen to calculate the statistical index according to the following two internal hypotheses:

### 6 General conclusion

The results of the three questionnaires used in this experiment confirm and justify the motivation, appropriation, satisfaction and positive opinion of the learners of the whole population.

To achieve the integration objectives of ICTE in some training modules of higher education in Morocco, we note in this experiment, that the most specific groups with positive opinions represent the highest percentages in the results of their answers are: group 2 accompanied by teaching and group 5 collaborative.

According to MOOC’s motivation, accompaniment, recommendation to other learners and positive opinion on this new pedagogical approach mixed training, there is a strong dependency link between the dimensions and different ways of monitoring MOOC (groups of learners). But on the other hand, learners of the five groups according to the appropriation dimensions need prerequisites, acquisition of knowledge and satisfaction. We find that there is no link of dependence.
So, for a better success of the integration of ICTE in some training modules in Morocco from the perspective of students, the following factors are essential:

- Accompaniment of learners’ MOOC by a pedagogical team,
- Collaboration between learners during MOOC follow-up,
- Higher learning rhythm during MOOC follow-up,
- Prerequisites of learners in relation to the MOOC training module.

In addition to these success factors in order to arrive at an objective of mixed learning through the MOOC tools, the teacher must follow an educational scenario, according to rules such as the accompaniment of the learners during the follow-up of the MOOC. These lessons are carried out according to a good pedagogical scenario which is innovative and authorised by the educational establishment or division of labour if the following conditions are put in place:

- Collaboration between learners is reinforced by the interaction, chat and follow-up of the MOOC in real time, that is to say in a synchronous way;
- The learner makes an effort, increases his/her rhythm and prepares the MOOC psychically in relation to the face-to-face class;
- Appropriate prerequisites represent the main profile in the learner.

In order to arrive at a good pedagogical scenario and to produce a mixed learning for the benefit of Moroccan university learners, we recommend the theory of activity which is based on a set of channels of two-way communication between all the teaching entities, namely the learner, the teacher, the knowledge, the MOOC tool and other administrative parties. On the other hand, the results of the experiment also confirm the same principles of this theory.

In this paper, we presented the success factors for a good integration of ICTE in some training modules in Morocco from a student perspective. These factors are inspired by the results of the analysis of the answers of the learners in our experiment. On the other hand, learners confirm and justify their positive opinions and implications for migration from traditional teaching methods to innovative teaching methods using ICT in an adequate way in some training modules.

Finally, our final conclusion also shows the correspondence between the entities of our theoretical framework (subject, tool, object, division of labour, working community and rules), and success factors for the good integration of ICTE despite the obstacles associated with this problem in the Moroccan education system (Mastafi, 2014).

In perspective, we propose other experiments on the MOOC in higher training modules of the different courses, to increase the spectrum of integration of the ICTE, while respecting the factors of success from the student’s point of view.
Contribution to the multidimensional analysis

References


