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The Contribution of Information and Communication Technologies (ICT) to Training through an Interdisciplinary Approach to the Teaching of Health Sciences and Technology

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Abstract: The world of education and teaching is consolidating and becoming one of the sectors with a strong tendency to the growth and evolution in all areas of research and creativity. It grants itself all the necessary tools to facilitate its evolution and among them the digital tools and the techniques of information and communication (TICs), on which we carried out a prospective study on their utilities to improve the formation by the interdisciplinary approach. For this useful purpose, we have planned a study, through the establishment of a questionnaire to know: the interest of the contribution of ICTs to facilitate; the integration of knowledge of several disciplines; collaboration; communication, and interaction between teachers and students, in a cycle of scientific master. We based ourselves in the study between March 2018 and April 2019 of the seven courses of the Master's cycle of pedagogy of health sciences and techniques of the Institutes of Sciences of Nursing Professions and Techniques of Health (ISPITS). These institutes are located in seven cities of Morocco (Casablanca, Marrakech, Rabat, Fez, Tetouan, Oujda, Agadir). The students of these Masters, coming from a strain of former nurses, represented a homogeneous population of 20 students for each master, and that the total made 140 students. They were preparing to become teachers in this field of study. Following the analysis of the results, we found the need to increase the use of ICTs to help improve collaboration, interactions, and integration, which are the basic principles of training through the interdisciplinary approach. Finally, the study's objective and scientific novelty are that research aims to encourage teachers of nursing sciences and techniques to impose ICTE in their training through the interdisciplinary approach. As well as to establish a new scientific method to communicate with their students, and to create a good interaction between them for better integration of knowledge and a good collaboration between the speakers.

Keywords: information and communication technologies, training, interdisciplinary approach, teaching, health sciences.

信息和通信技术 (信息通信技术) 通过跨学科方法对卫生科学和技术教学的培训做出贡献

摘要: 教育和教学领域正在巩固并成为所有研究和创造力领域具有强烈增长和演变趋势的部门之一。它为自己提供了所有必要的工具来促进其发展, 其中包括数字工具和信息和通信技术 (TIC), 我们对其效用进行了前瞻性研究, 以通过跨学科方法改善形成。为了这个有

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用的目的，我們計劃了一項研究，通過建立問卷來了解：信息通信技術對促進的貢獻的興趣；多學科知識的整合；合作；師生之間的交流與互動，在科學掌握的循環中。我們在 2018 年 3 月至 2019 年 4 月期間研究了護理專業與健康科學研究院 (ISPITS) 的健康科學與技術教育學碩士周期的七門課程。這些研究所位於摩洛哥的七個城市（卡薩布蘭卡、馬拉喀什、拉巴特、非斯、得土安、烏季達、阿加迪爾）。這些碩士的學生，來自前護士的一系，代表了每個碩士 20 名學生的同質人口，總共有 140 名學生。他們正準備成為這個研究領域的教師。在對結果進行分析之後，我們發現需要增加 ICT 的使用，以幫助改善協作、互動和整合，這是通過跨學科方法進行培訓的基本原則。最後，該研究的目標和科學新穎性在於研究旨在鼓勵護理科學和技術教師通過跨學科方法在他們的培訓中實施 ICTE。以及建立一種新的科學方法與學生交流，並在他們之間建立良好的互動，以更好地整合知識和演講者之間的良好協作。

关键词：信息和通信技术、培訓、跨學科方法、教學、健康科學。

1. Introduction

We aim by this study first of all:

- to specify the users of ICT in this training;
- to evaluate ICT and personal use;
- to approach the degree of satisfaction of the students with the use of ICT in the scientific courses;
- to have an overview of the students' perception of the effectiveness of ICT in science education and to know their opinions on the use of ICT.
- to finally know the interest of the contribution of these ICTs to the improvement of the collaboration between the speakers, their interactions, and the integration of knowledge, which are the basic principles to the training by the interdisciplinary approach.

To give an overview of the digital programs that the Moroccan state has committed to integrating digital in the school and university curriculum, we begin by giving a general overview of the contribution of information and communication technologies (ICT) [1, 3]. Then we give some definitions of the interdisciplinary approach and show the difference between the disciplinary levels [2, 3]. To give our study a scientific value, we use a questionnaire that considers both the quantitative and qualitative sides of the study. For the study, we take the students of the Master of Nursing and Technical Health Education as a sample population at the Institutes of Nursing and Technical Health Education in Morocco. These students come from different specialties of nursing and multidisciplinary training, have chosen to convert by training in this Master to become teachers of pedagogy of health sciences and techniques.

We choose these institutes because we have already conducted a study on the students of the master of

pedagogy of nursing sciences and health techniques at ISPITS in Casablanca. We based our study of this Master's degree on the concepts of Rege Colet in 2002 [4, 5, 6] to calculate the interdisciplinary index of this training. We were certain that the training is based on the principles of the interdisciplinary approach and that it is of a relational interdisciplinary.

Despite the difficulties in accessing the 140 students of the seven master's programs in the seven cities of Morocco, we finally managed to send our questionnaire by email to a representative sample of 51 students, using Google Form software to receive their answers and analyze the results obtained.

2. Theoretical Framework

We start our theoretical framework by giving a general vision on what is done as programs in Morocco to integrate ICT in schools and universities and at the same time define ICT and its uses. Then we define the interdisciplinary approach by showing the difference between the disciplinary levels to avoid confusing them. We also focus on studying the contribution of ICT to the training by the interdisciplinary approach by studying the degree of this contribution to the integration of the basic principles of the approach, which are the collaboration and the integration of knowledge and interactions.

Indeed, confrontations with others generally represent crucial moments that employees look for justifications to consolidate in the way of interaction [20].

The training of nursing and health techniques is based on theoretical and practical scientific disciplines and the interaction of these disciplines to train experienced and well-equipped caregivers on all levels of their professions [7, 9, 10]. The Casablanca Institute

of Nursing and Technical Health Professions follows the same path and adheres to the same training programs as all the world's training institutes in this field.

Despite the difficulties encountered and the lack of means and specialists in training these professionals, these institutes do everything to train health professionals with great skills in the field.

Our study was made on a sample of students chosen among those of the first promotions, which came from the nursing staff, which were reforming in a master of pedagogy of the sciences of nurses and techniques of health to become teachers in these fields of formations. Thus, they prepared themselves in these institutes to fill the lack of teachers and bring a new breath to this branch of training.

2.1. The Contribution of Digital Technology to School and University Training in Morocco

To encourage the integration of digital technology into school and university curricula, the Moroccan government has launched several projects:

- The Digital Morocco 2013 project (2020) [8];
- The project of integration of ICT in education (2020) [35];
- The LAWHATI project and the INJAZ project (2019) [2].

Distance learning can help breathe new life into face-to-face teaching and remedy its shortcomings, especially since it gives the learner the time to follow the course at ease. It also allows to improve the academic level by the diffusion of explanatory lessons and even allowing to follow the learners by establishing a system of remote evaluation. This model of teaching and education can be adopted in all cycles if the Moroccan state creates a favorable environment to involve learners in the use of ICT.

Simulation can be adopted formally in science and technology in general. In fact, in physics and chemistry, virtual environment laboratories allow the study and description of different experiments and manipulations, such as in crystallography or determining the orders of chemical reactions in chemical kinetics [21, 22, 33].

In addition, simulation environments can be adapted according to the study context; computers or smartphones represent a motivating and engaging space in a pedagogical and didactic framework by adopting the principle of mobile learning and social learning [23].

On the other hand, the digital practices of environments depend on certain factors that seem to influence these practices. Indeed, the students' reflection on the modalities of digital use gives rise to several debates [24].

Thus, several pedagogical approaches can reinforce the play-based learning approach, especially at a

distance, which thus represents a powerful vector for promoting socio-professional skills [25].

In addition, a study aimed to identify the obstacles hindering the use of the CAEx "Computer-Assisted Experimentation" in science. Indeed, the results showed that the integration of the CAEx comes up against several obstacles despite the efforts made by the Ministry of Education and Vocational Training [26].

2.2. Interdisciplinarity in Education

The world around us is becoming more and more complex and the disciplines more and more specialized. The hyperspecialization of disciplines and their division does not help build a global vision of natural, scientific, and social phenomena specific to the society of the 21st century. The complexity of the problems we encounter makes it increasingly necessary to establish relationships between disciplines [11].

The complexity of the problems we face makes it more and more necessary to establish relationships between disciplines [11]. Given the little and often artificial knowledge imposed by university disciplines, the scarcity of collaboration between professors of different disciplines in planning teamwork, the lack of conceptual links between subjects, the increasing appearance of themes or disciplinary contents that are more or less relevant, and the extent of redundancy in and between the subjects taught to the point that disciplinary territories overlap without much logic [12]. It becomes necessary to question the degree of interaction, integration, and understanding that educational institutions adopt concerning the curriculum they teach [13].

Training through an interdisciplinary approach is becoming a necessity to respond to the complex issues of contemporary life. It favors the integration of knowledge from several disciplines and collaboration between the different members of a work team to solve better complex problems encountered in their fields of teaching and research [14].

Lenoir and Sauvé consider that interdisciplinary is an approach to fill the gaps in disciplinary teaching in all fields of education, training, and learning, on all levels, whether social or biophysical. This approach creates the motivation to study and learn since it creates a favorable environment to test his learning achievements and commit himself totally to reach his objectives in 2020.

2.3. The Different Disciplinary Levels

It is necessary to know how to differentiate between the different disciplinary levels and understand the links between these levels. Each level is only the continuity of a logical sequence between them. For this purpose, we need to know the definitions of these different levels [15]:

- Disciplinarily is an approach based on a single

discipline's knowledge; it is limited to a specific and particular field of knowledge, which is called mono-disciplinarily or specialty [16]. The speakers in this discipline do not tolerate going outside their disciplinary fields of knowledge to work on a subject. It can be said that it is the basis at all disciplinary levels;

- Pluridisciplinarity can be summarized in the association of several disciplines by juxtaposing their knowledge to work on the same theme [17];

- Interdisciplinarity is necessary "as soon as we perceive the world as an entanglement of systems" as E. Morin says [14], it is the approach that designates the decompartmentalization of disciplines. It makes the knowledge of two or more disciplines interact, creating interactions and complementarity between them to integrate their knowledge. It requires the collaboration and coordination of stakeholders from these disciplines to solve a complex problem or carry out a common project;

- Transdisciplinarity is the approach that increasingly requires interaction and integration between the knowledge of two or more disciplines. It is based on the transfer of concepts and tools from one discipline to another; to create a new disciplinary field, to carry out a new project, or to solve a new problem [18].

2.4. Information and Communication Technologies (ICTs)

ICTs are a set of technologies used to process, modify and exchange information, more specifically digitized data, to establish a good education and training system. Laptop computers, television, cell phones, interactive tablets, interactive whiteboards, and the Internet constitute the set of information and communication technologies [19].

3. Materials and Methods

3.1. The Problematic

Our problem consists of knowing if the contribution of ICTs to the improvement of the integration of knowledge of several disciplinary fields and their interactions and the collaboration between the intervening parties in these disciplines will facilitate training through an interdisciplinary approach in these training environments.

3.2. Hypothesis

We assume that using these ICTs will improve the integration of knowledge, interactions, and collaboration between students and between them and the stakeholders in their training.

To answer the problem of the contribution of ICT to the training by the interdisciplinary approach in the university education, we proceeded to a study at the

same time qualitative and quantitative aiming at the evaluation of the perception of the students of the Master of PSITS to the use of ICT for teaching in the interdisciplinary approach and knowing their opinions concerning the subject.

We selected a representative sample of $n = 51$ future teacher students, from a population of students ($N = 140$) of the Masters of Pedagogy of Nursing Sciences and Health Techniques (PSITS) of the 7 Institutes of Nursing Professions and Health Techniques (ISPITS) spread over seven cities; (Casablanca, Rabat, Fez, Oujda, Tetouan, Marrakech, and Agadir) of the Kingdom of Morocco. We established a questionnaire in the form of questions with the statistical aim for the quantitative study and other explanatory for the qualitative study. We sought through the questionnaire, the evaluation of the mastery of computer tools, the perception, the degree of collaboration and integration, and interaction among students of the Master of PSITS through the use of ICTs, for good teaching in an interdisciplinary approach [2, 4]. This questionnaire is anonymous; the results will only be used for our study.

3.3. The Questionnaire

It is presented as follows. Please answer frankly and without hesitation.

Table 1 Question-answer mode: Groups of questions I - Personal information, ICT, and personal use

Group of questions I - Personal information	
Questions	Answer
1- You are?	- Male ; - Female
2- What is your establishment?	Short answer
3- What is your level of study?	- First year; - Second year.
Group of questions II - ICT and personal use	
4- Do you have a personal computer?	- Yes; - No.
5- Do you have an internet connection?	-Yes; - No
6- On average, how much time do you estimate you spend each day in front of a computer	- Less than 1 hour; - Between 1 and 2 hours; - Between 2 and 4 hours; - More than 4 hours
7- How important is the computer in your life?	- Unnecessary; - Not really important ; - Quite important; - Indispensable
8- How would you rate your level of mastery of computer and multimedia tools?	- Very poor; - Rather poor; - Average; - Good; - Very good.
9- Do you use the computer? (You can check several boxes)	-Entertain yourself (games, music, movies...); - Communicate with your colleagues (chat); - Participate in social networks (Facebook, Twitter...); - Collaborate with other students; - Participate in forums; - Access complementary

content related to the course (demonstrations, simulations, filmed experiments ... Doing exercises, problems, and old exams related to the course content; - Preparing presentations; - Taking online courses (e-learning); - Improving your intellectual level; - For your general culture and broadening your field of knowledge in science

your participation during the course; - ICT helps you to do more application exercises during the course sessions; - ICT positively influences your results and increases your chances of success.
Short answer

14-2: If other, please specify

Group of questions IV - Students' perception of the effectiveness of ICT in science teaching

15- Are you in favor of - Yes; - No.

teaching science (courses, practical work, TD) integrating ICT at your university?

15-1: Justify your answer: Short answer
16- Would you like your teachers to use ICT more in a teaching session? - Yes; No.

16-1 Justify your answer: Short answer

17- For better science learning, do you opt for: (You must check only one box)?
- Traditional teaching (lessons given on the blackboard); - Modern teaching based on ICT; - Hybrid teaching integrating several media (blackboard, handout, ICT).
Short answer

17-1 Justify your answer Short answer
18- Do you think teachers must be better trained in using and integrating ICT in a teaching session? - Yes; - No.

18-1 Justify your answer Short answer

19- How important do you think the use of ICT is to create a good integration of knowledge from two or more disciplines for the realization of a common project? - Low; - Medium; - High; - High.

20- How important is the use of ICT to create interactions between students to achieve a good understanding of the course? - Low; - Medium; - High; - Intense.

21- How important is the use of ICT to create interactions between students and teachers for a good understanding of the course? - Low; - Medium; - High; - High.

22- How important is the use of ICT to create a good collaboration between teachers of two or more disciplines to realize a common project? - Low; - Medium; - High; - High.

23- Do you have any other useful comments or information to share about integrating ICT in teaching? Short answer

Table 2 Question-answer mode: Group of Questions III - Level of satisfaction with the use of ICT in science courses

Group Questions III- Level of satisfaction with the use of ICT in science courses

10- During your training, did you follow one or more scientific courses integrating Information and Communication Technologies (ICT)? - Yes; - No.

11- Have you taken one or more science courses presented using PowerPoint - Yes; - No; - No, but I would like to.

11-1 If yes, did you enjoy this use? - Not satisfied; - Not very satisfied; - Satisfied; - Very satisfied.
Short answer

11-2 Why? Short answer
12- Have you taken one or more science courses that include simulations? - Yes; - No; - No, but I would like to.

12-1 If yes, did you enjoy this use? - Not satisfied ; - Not very satisfied ; - Satisfied ; - Very satisfied

13- Have you taken one or more science courses that include filmed teaching sequences? - Yes; - No; - No, but I would like to

13-1 If yes, did you appreciate this use? - Not satisfied; - Not very satisfied; - Satisfied; - Very satisfied.

14- Are you in favor of the use of ICT in science classes - Yes; - No

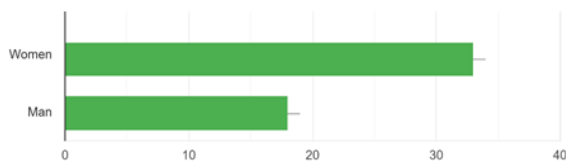
14-1 If yes, why :(You can tick more than one box)
- ICT enriches and energizes the content of the course; - ICT generates a deep understanding of the abstract concepts of the course; - ICT accelerates your learning and helps you to receive the maximum amount of information in a short time - ICT increases your concentration to follow the course; - ICT increases your motivation to learn the course; - ICT increases

4. Results and Discussions

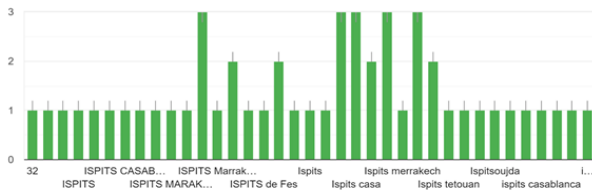
The analysis of the collected data was organized in four interdependent dimensions that cover the main issues of the research practices on the contribution of ICT to training through the interdisciplinary approach in university teaching.

We spread out each group of responses and present the results in the form of curves, and then analyze them as we go along. We start with the basic questions as an introduction to the questions related to our basic problem, which studies the role of ICTs and their degree of usefulness. Do they facilitate collaboration between students, the integration of knowledge, and interactions between stakeholders?

1- You are:



2- What is your establishment?



3- What is your level of study?

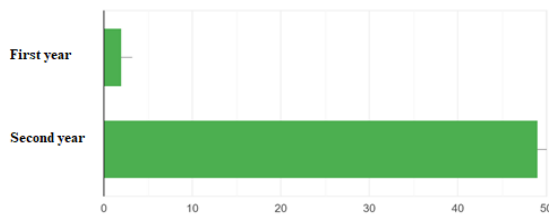


Fig. 1 Answer Group I - Personal Information

The responses on personal information are: the number of students who answered the questionnaire is 51 students.

1- In response to question 1 on gender, the number is: 35.3% of women and 64.7% of men. Analysis: we notice that there is a dominance of the answers about women more than men.

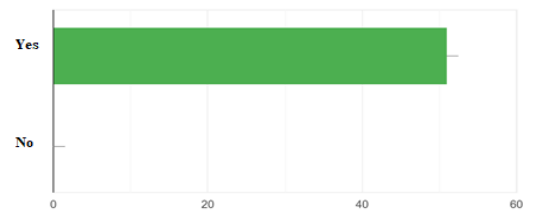
2-Inresponsetoquestion (2) on the different institutions (ISPITS) among which their students participated in this experience are: seven in statutes each is from the following cities of Casablanca, Marrakech, Rabat, Fez, Tetouan, Oujda, Agadir.

3- In response to question (3) on the study levels of the students who answered the questionnaire; are 96% in Master 2 and 3.9% in Master 1.

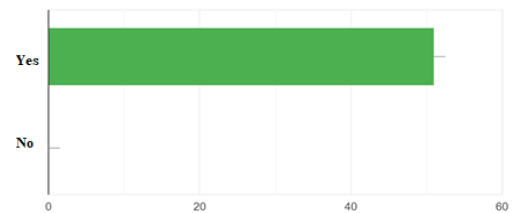
Analysis of Answers 1, 2, and 3

We note that the respondents come from the seven institutes of Morocco and that women are dominant, and that almost all the students are at Master 2 levels.

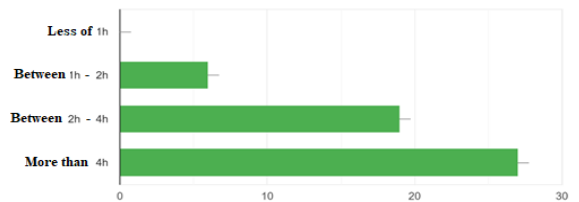
4- Do you have a personal computer?



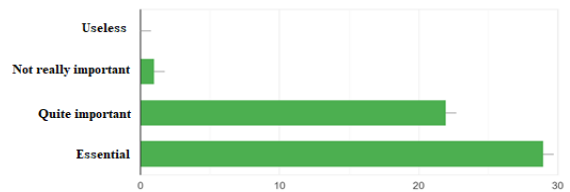
5- Do you have an internet connection?



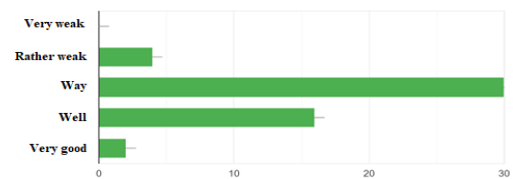
6- How much time on average do you estimate to spend each day in front of a computer?



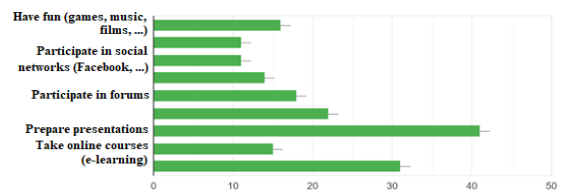
7- What place does the computer occupy in your life?



8- How do you estimate your level of mastery of computer and multimedia tools?



09- Do you use the computer for: (You can tick several boxes)



09-1 If Others; specify:



Fig. 2 Response Group II - ICT and personal use

4 - In answer to question (4), if the students all have

a personal computer, 100% of the students answered yes, they have a personal computer.

5 - In answer to question (5), if they all have an internet connection, 100% of the students answered yes, they have an internet connection.

Analysis of Answers 4 and 5

All respondents own a computer and have an internet connection.

6 - In response to a question (6) on the average time that each student estimates spending each day in front of a computer; the results are in this order: - Less than 1 hour = 0%; - Between 1 hour and 2 hours =11.8%; - Between 2 hours and 4 hours =37.3%; - More than 4 hours = 52.9.

Analysis of the answers to Question 6

Most students spend more than 4 hours in front of a computer every day.

7 - In response to a question (7) on the place of the computer in the life of each student, the results are as follows: - Unimportant = 0%; - Not really important =2%; - Quite important = 43.1%; - Indispensable = 56.9.

Analysis of the answers to Question 7

Most of the students answered that the computer is fairly important to indispensable in their life.

8 - In response to question (8), how do students rate their level of mastery of computer and multimedia tools? - Very poor = 0%; - Somewhat poor = 7.8%; Average = 58.8%; - Good = 31.4%; - Very good = 3.9%.

Analysis of the answers to Question 8

Most students consider their level of mastery of computer and multimedia tools to be average to good.

9 - In response to a question (9) on; for what reason, or how do students use their computers? And that students can check several boxes the answers are as follows; - Entertainment (games, music, movies...) =31.4% of students; - Communicate with colleagues (chat) = 21.6% of students; - Participate in social networks (Facebook, Twitter...) = 21.6% of students; - Collaborate with other students = 27.5% of students.

- Participating in forums; accessing additional course-related content (demonstrations, simulations, filmed experiments ...) = 36.3% of students.

- Doing exercises, problems, and past exams related to the course content = 43.1% of students.

- Prepare presentations 80.4% of students.

- -Taking online courses (e-Learning) = 29.4% of students.

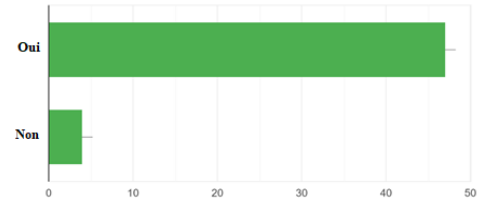
- Improve your intellectual level, general knowledge and broaden your field of knowledge in science = 60.8% of students.

Analysis of the answers to Question 9

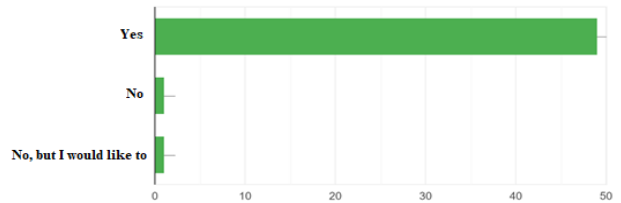
We notice that communication between colleagues and collaboration between students through ICT does not represent a large percentage (21.6% and 27.5%). While their use in the preparation of presentations

(80%) and for the improvement of the intellectual level. General culture and broadening the field of knowledge in science (60%) represent the most important part.

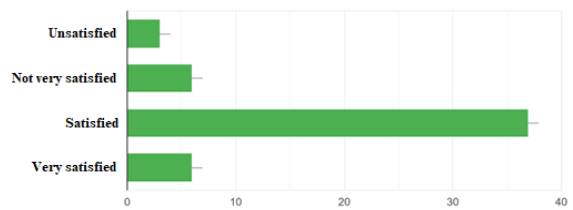
10- During your training, did you take one or more scientific courses integrating Information and Communication Technologies (ICT)?



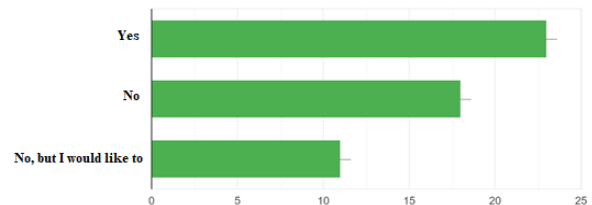
11- Have you taken one or more scientific courses presented using PowerPoint?



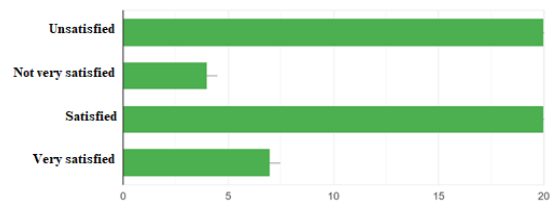
11-1 If yes, did you like this use?



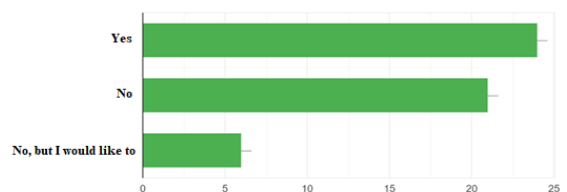
12- Have you taken one or more scientific courses integrating simulations?



12-1 If yes, did you like this use?



13- Have you taken one or more scientific courses incorporating filmed teaching sequences?



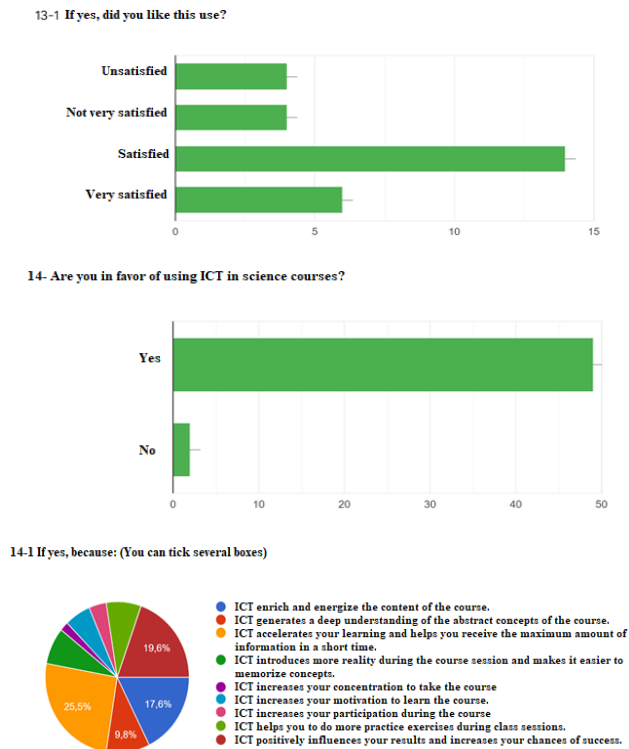


Fig. 3 Response Group III - Degree of student satisfaction with the use of ICT in science courses

10- The answers on the follow-up of the courses integrating ICT during the students' course is: 92.2% of cases: yes and 7.8% of cases: no.

Analysis of the answers to Question 10

We note that during training, in 92% of cases, students have taken courses integrating ICT.

11- The answers on the presentation of scientific courses on PowerPoint are: 96.1% answered: yes; 2% answered: no, and 2% answered: no (but never will).

Analysis of the answers to Question 11

We deduce that almost all students use PowerPoint.

11.1- The answers on the appreciation of the use of PowerPoint are: 72.5% satisfied; 11.8% very satisfied; 11.8% little satisfied; and 5.9% little satisfied.

Analysis of the answers to Sub-question 11.1

We note that most students appreciate the use of PowerPoint, but through the answers to the sub-question 11.2, by a qualitative study, we will know what the students think about the appreciation of PowerPoint and its use.

11.2 - For those who answered the question (11.2) concerning the appreciation of the use of PowerPoint, each one justified their answer on the fact that PowerPoint: allows for a learning curve, it is another discovery that requires a lot of time to know how to use it and that afterward, it becomes a monotony and a habit. It is attractive, visual, helps in presentation, interactive; it is an important tool in teaching/learning. Some presentations are up to the task, while others are poorly organized and unattractive.

People find that all the courses on using PowerPoint they look for, especially on YouTube, are very

practical, useful, and clear. PowerPoint summarizes the course a bit, especially if the slide is precise and concise; it improves the quality of the course. Facilitates: the appropriation of knowledge and its use; communication and learning; assimilation of the course; and helps the teaching and learning process and meets the needs requested. It is more interactive and lacks formal opportunity.

But the disadvantage is that PowerPoint; decreases the relational and human contact, does not really integrate the learner, that it is time-consuming, especially at the beginning, and often there are poorly done presentations, cluttered slides, striking colors, which harm the attention of the student. In addition, some teachers take the PowerPoint as a shelter and read all the time, and thus they fall into the transmissive

12 - The answers to question (12) about following scientific courses with simulations are: 45.1% yes; 35.3% no; 21.6 no but never well.

Analysis of the Answers to Question 12

We note that a significant number of students (45.1%) have taken courses integrating simulations through ICT.

12.1- For the answers to the question concerning the appreciation of the use of simulation for those who answered yes: 39.2% not satisfied; 7.8% little satisfied. 39.2% satisfied; 13.7% very satisfied.

Analyzing the answers to sub-question 12.1, we note that the number of non-satisfied students is equal to that of satisfied students and that there is a small tendency to be very satisfied (13.7%).

13 - For the answers to question (13) concerning those who have taken one or more courses integrating filmed teaching sequences are: 47.1% answered yes; 41.2% answered no; 11.8% answered no but never well.

Analysis of the answers to Question 13

There is a dominance of students who have taken one or more courses integrating filmed teaching sequences.

13.1 - For the answers to question (13-1) on the appreciation of the use of those who have taken one or more courses integrating filmed teaching sequences, those who answered yes are 14.3% not satisfied; 14.3% not very satisfied; 50% satisfied; 21.4% very satisfied.

Analysis of responses to Sub-question 13.1

There is a dominance of students who appreciate courses that integrate filmed teaching sequences (50%).

14 - For the answers concerning questions (14) on ICT use in science courses: 96.1% are for, and only 3.9% are against.

14.1 - For the question (14-1), we retain the following answers of those who are in favor of the use of ICT in science courses and who maintain that ICT is useful in science courses: 25.5% answered that ICT accelerates learning; 9.8% answered that they generate a better understanding, 19.6% answered that they

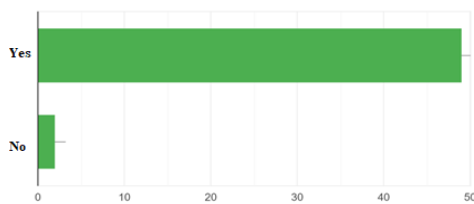
positively influence learning, and 17.6% answered that they enrich and dynamize the course content.

14.2 - For the answer to the question (14-2) concerning the other points of view of ICT use. Some answered that ICT is part of current events, that it is becoming necessary to accompany the current pedagogical trend, and that it affects several learning profiles and saves time and space.

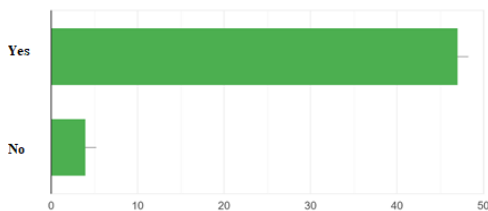
Analysis of the answers to Question 14 and Sub-questions 14.1 and 14.2

Statistically, 96.1% of the students are in favor of the use of ICT in science courses; 25% consider that they accelerate learning only; 9.8% of them see that they generate a better understanding; 19.6% confirm that they positively influence learning, and 17.6% say that they enrich and dynamize the course content. Of the quality of the study, some students think that ICT is part of the current trend and is becoming a necessity to accompany the pedagogical trend that affects several learning profiles and saves time and space.

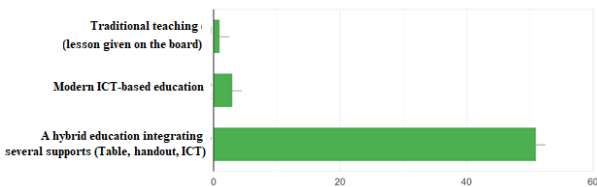
15: Are you in favor of a science education (Course, TP, TD) integrating ICT within your university?



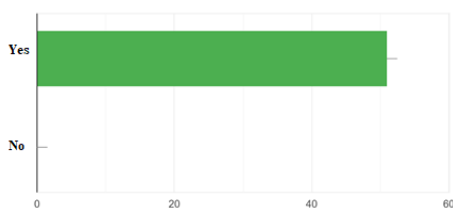
16- Would you like your teachers to use ICT more in a teaching session?



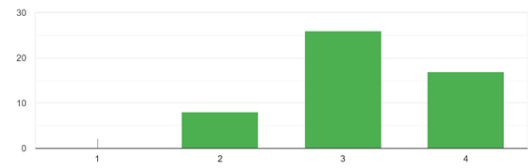
17- For a better learning of science, opt for: (You must tick only one box)



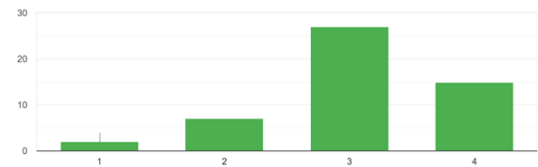
18- Do you think it is necessary for teachers to be better trained in the use and integration of ICT in a teaching session?



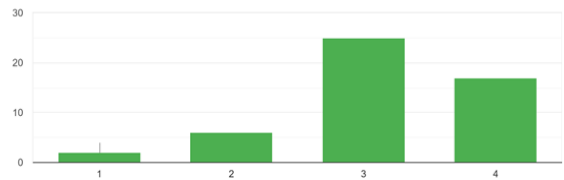
19 - What importance do you give to the use of ICT to create a good integration of knowledge from two or more disciplines for the realization of a common project?



20- What importance do you give to the use of ICT to create interactions between students to achieve a good understanding of the lessons?



21- What importance do you give to the use of ICT to create interactions between students and teachers for a smooth course and to achieve good understanding?



22- What importance do you give to the use of ICT to create a good collaboration between teachers of two or more disciplines for the realization of a common project?



Fig. 4 Group IV: Students' perception of the effectiveness of ICT in science education

15 - For the answers to question (15) on the teaching of sciences (Courses, TP, TD) integrating ICT within the university, 96.1% answered yes, and only 3.9% answered no.

Analysis of the answers to Question 15

Statistically, 96.1% favor teaching science (courses, practical work, and field trips) integrating ICT. For the qualitative study, the answers to sub-question 15.1 inform us about the students' thoughts which are as follows.

15.1 - In response to question (15-1) on those who answered yes to the integration of ICT in the teaching of science (courses, practical work, and field trips). The justification for these answers is that ICT manages time and space; it internalizes the computer scientist; it helps to achieve the assimilation of knowledge; it encourages motivation and interest, and it helps to get away from the monotony of the classical course. They allow for better focus on problem situations and exchanges. It is attractive and motivating; it helps to integrate the information. These tools make it possible to target all student learning styles. They allow interaction between teachers and students, even virtually, to follow the

development and innovation that the profession is experiencing.

ICTs have become indispensable in our current context, helping and facilitating learning centered on the technique of sensory channels (VAKOG system) to better reach the different learning styles of the learners. This is a trend that is appreciated by students, as it facilitates learning. ICTs allow diversity; their use is easy and motivating, helps and guides students in their learning process, and creates dynamism in them. They are indispensable in a digital world like ours.

They facilitate the task for the teacher and the learner and allow the optimization of temporal-spatial resources.

They improve the didactics of the concepts and simplify the task of the teachers. They are dynamic and active methods that improve and enhance the relationship between teacher and learner.

These tools also save time and vary the teaching/learning methods.

To be better involved and have a good concentration, the learners must be equipped with digital skills to better adapt to the technological evolution that the health field is experiencing because practices are increasingly done with advanced and cutting-edge technologies.

The use of ICTs must not be overused, as they must be properly integrated into teaching and learning, not to neglect the human side that is the basis of creativity and innovation.

16- In response to a question (16) on the wish that teachers use more ICT in a teaching session: 92.2% of the students wish teachers use more ICT in the teaching session, and 7.8% are against.

Analysis of Question 16

Statistically, 92.2% of the students want teachers to use ICT more in the teaching session. For the qualitative study, the following answers to sub-question 16.1 confirm this.

16.1- Concerning the justifications of the answers to question (16-1), the students answered with the following justifications

ICT is very beneficial, efficient, and indispensable for teaching, avoids boredom, allows active teaching, creates a kind of fun that makes learning more motivating and allows learning at the learner's pace, helps to understand and animate the course. They allow for better understanding and time saving, keep up with the evolution of technology, satisfy the needs of the hyper-connected generation and give more choice to diversify the course delivery. They are the currency of our era, are useful to make teaching /learning real, as they increase learning opportunities, ease of learning, and motivation among learners. They are effective for the environment and offer an advantage in targeting various types of knowledge, enriching learning sessions, and making them rationally. They avoid

monotony as they diversify tools and facilitation techniques, making learning as meaningful as possible. ICTs ensure a good: concentration; comprehension; assimilation; interaction; integration of knowledge; as well as create a great dynamism of the courses and allow to diversify the ways of building knowledge to reach a better innovation in this native digital generation that has the advantage of easy access to a good, efficient and fast learning that makes the abstract more concrete.

17 - In response to question (17) on the type of teaching students should opt for, only 2% of students opted for traditional teaching (blackboard) and 5.9% of modern teaching based on ICT. In comparison, 100% preferred hybrid teaching integrating several media (Blackboard, Handouts, ICT).

Analysis of the answers to Question 17

Statistically, 100% of the students prefer a hybrid teaching integrating several supports (Tables, Handouts, ICT).

The answers to Sub-question 17.1 justify this choice.

17.1 - To justify their choices on the need for a hybrid teaching, the students gave several points of view, which are summarized by the answers to the question (17-1) as follows

Hybrid teaching integrating several teaching aids (board, handout, ICT), is more beneficial to diversify teaching strategies and tools, apply differentiated pedagogy, reach more the objective, help to develop concentration, and awaken motivation by touching the different learning styles of students and taking into consideration their differences, and also touching the perceptual channels preferred by the learners, to allow diversifying the teaching tools and didactics and reaching a large number of them, and at the same time keeping paper support in case of need. It is professional training that requires the use of both traditional and new media. Each means used is in its place because it is necessary to adapt the tool according to the need.

We cannot do without the old methods and keep only the new ones because they are complementary. We must take into consideration all generations (web 2.0, web 3.0, and web 4.0).

This hybrid teaching can suit all types of learners because each student differs by their channels of perception. It satisfies everyone because it allows better assimilation of the courses and helps a better appropriation of the knowledge, which are generally of different natures, by an iterative process between the presential and online.

The diversification of the supports enriches the active pedagogy and moves away from monotony. Also, the existence of several learning styles requires diversification of teaching styles and didactic aids.

The change of tools and the variety of methods are beneficial to reach all profiles and integrate all learning

styles.

The physical and psychological presence of the teacher is necessary and mandatory to follow the development of the learners because diversity leads to complimentary.

Hybrid teaching allows for better understanding, especially of abstract concepts, and also for good and rapid memorization. It complements the shortcomings of all teaching and learning tools and methods. It allows for balance between the two teaching methods (face-to-face and distance), promoting better teaching and filling in the gaps when using only one way.

Hybridization can minimize the possible negative effects of ICTs because it requires diversification of teaching methods and strategies depending on the content, the environment, and the audience.

18 - In response to a question (18) on the need for teachers to be trained in the use and integration of ICT in a teaching session, 100% of the students answered Yes.

Analysis of responses to Question 18

Statistically, the study reveals that 100% of the students agree with the need for teachers to be trained in using and integrating ICT in a teaching session.

The qualitative study that justifies this choice is reflected in the answers to sub-question 18.1.

18-1- For the answers to question (18-1) that justify the need for teachers to be trained in the use and integration of ICT in a teaching session.

The students gave their points of view which are summarized as follows:

This training is mandatory for teachers to integrate ICT in their teaching sessions because it is very important to diversify teaching techniques.

Now we are talking about online or distance learning courses. To use ICTs well, it is necessary to have the basic knowledge. It has become necessary to be trained and acquire computer skills and know-how to use them well because ICTs without training can be lacking. We must follow the novelties in this field, considering the importance of these techniques now and in the future.

To facilitate the use of ICTs and to use them well in one's course, it is necessary to have a certain mastery so as not to disrupt the teaching process, follow the course's evolution, and be able to speak the same language as the students. This is of great benefit to both parties. Teachers who do not master ICTs cannot keep up with the technological evolution of the current generation, which is dominated.

Innovation requires the use of ICTs that provide the most appropriate scientific learning opportunities for students.

Digital technology has become a necessity to update knowledge so that teachers can use it in a correct, effective, and adapted way. Knowing how to use them has become a primordial need to keep up with the

times.

For a good continuing education, it is necessary to accompany the new context requiring the integration of ICT in the delivery of courses, which facilitates the attraction of students to deepen their knowledge and better adhere to the courses.

Teachers must be able to include ICTs and apply them in their teaching and adhere to this revolutionary movement so that they can better take advantage of them and know how to use them well since they have become a necessity for the new generation. But unfortunately, many teachers at ISPITS are still working with transmissive pedagogy using traditional methods without changing their archaic methods and following the wave of innovation that ICT brings.

19 - In response to question (19) concerning the importance given to the use of ICT for the creation of good integration of the knowledge of two or more disciplines to the realization of a joint project it is that: 15.7% of the students answered that there is medium importance; 51% vital importance; and 33.3% extreme importance.

Analysis of the answers to Question 19

Most of the students affirmed that there is vital importance (51%) and extreme importance (33.3%) given to the use of ICTs to create a good integration of two or more disciplines in the realization of a common project. This integration is a key concept in the best approach of interdisciplinary training.

20 - In response to a question (20) concerning the importance given to the use of ICT to create interactions between students to achieve a good understanding of the courses: 3.9% of the students answered that there is low importance; 13.7% medium importance; 52.9% high importance; 29.4% extreme importance.

Analysis of the answers to Question 20

Most of the students affirmed that there is high importance (52.9%) and extreme importance (29.4%) given to the use of ICT to create interactions between students to achieve a good understanding of the course. The interaction between students is a basic concept of the best approach to interdisciplinary training.

21- In response to a question (21) concerning the importance given to the use of ICT to create interactions between students and teachers for the good progress of the courses and to reach a good understanding of the courses: 4% of the students answered that there is weak importance; 12% medium importance; 50% vital importance; 34% extreme importance.

Analysis of the answers to Question 21

Most of the students affirmed that there is high importance (50%) and extreme importance (34%) given to the use of ICTs to create interactions between students and teachers to achieve a good understanding of the courses. The interaction between students and

teachers is a basic concept of a good training process through the interdisciplinary approach.

22- In response to a question (22) concerning the importance given to the use of ICT to create a good collaboration between teachers of two or more disciplines for the realization of a common project: of the students answered that there is low importance; 13.7%: medium importance; 47.1% vital importance; 36.3% extreme importance.

Analysis of the answers to Question 22

Most of the students affirmed that there is high importance (77.1%) and extreme importance (36.3%) given to the use of ICT to create a good collaboration between teachers of two or more disciplines to realize a joint project. The collaboration between teachers is a basic concept for a good approach to interdisciplinary training.

The qualitative study concerning other useful remarks or information about the integration of ICT in teaching is reflected in the students' views in the form of answers to question 23.

23 - In response to question (23), regarding other useful comments or information for us, regarding the integration of ICT in teaching, the students brought their views as follows It is necessary to insist on the training of teachers regarding ICT. These are very important tools, which are part of the present. It is a new interdisciplinary approach to par excellence because it promotes imagination and transfers knowledge from one discipline to another. It is necessary to train teachers and learners in computer and information and communication technology, but it is a technology to be used moderately and not to be abused. The integration of ICTs is considered useful, but it should not, in any case, substitute other traditional methods and tools, i.e., it is necessary to consider the complementary traditional and modern methods (ICT).

One should not be too tied to technology and neglect the physical presence because this teaching profession requires the emotional and psychological side through the learner's contact with the teacher. Before integrating ICTs, it is necessary to think about training teachers or any person involved in their use to preserve the human side as this person reaches an important degree of mastery of the skills of these new tools. The use of ICT is very desirable, but neither teachers nor students are sufficiently trained in the proper use of computer tools. It is necessary to ensure the judicious use of these ICTs, invest in this rich and innovative field, and encourage teachers to use these tools through continuing education by promoting them through agreements with universities. ICTs should not replace the teacher. We must insist on preserving the personality and presence of the teacher in the transmission of skills. ICTs are a need and a necessity; they must be integrated into all areas, but this requires

conditions that are sometimes non-existent because we must not neglect psychosocial skills and forget the human side, which is the basis for mastering communication and learning languages and human behavior.

It is necessary to increase the awareness of all actors to the importance of the integration of ICTs in education and to offer them the necessary means for this, such as integrating the technique of auto-copy in the undergraduate cycle. The effectiveness of the use of ICTs depends on the way they are used. It is necessary to train teachers to master these tools and students by providing them with courses in computer science and the use of these technologies, which they will need during their training and in the course of their profession. To do this, ISPITS must be equipped with computer rooms with Internet access and make them available to students and teachers to excel together and gradually acquire the skills necessary for the best use of these tools.

5. Conclusions

We started by defining the training by the interdisciplinary approach and the ICT. We have announced the programs adopted by the Moroccan state for better integration of ICTs in the fields of teaching and training. We tried to show the mode of use, the interest as well as the utility of these ICTs, in the good progress of the learning sessions, in the field of the training of the students of this master of pedagogy, and the nursing sciences and techniques of health, to answer the problems that the ICTs is necessary to the training by the interdisciplinary approach. We adopted both quantitative and qualitative methods to study the problem. And we arrived at the following results: their analyses which interest us in validating the hypothesis: that ICTs are necessary for the collaboration, between the speakers of two or more disciplines, for the integration between them of their mutual knowledge, and to create interactions between them and between the learners.

We conclude that, after the analysis of the answers to question 9, on communication between colleagues and collaboration between students through the use of ICT, these two criteria do not represent a large percentage (21.6% for communication and 27.5% for collaboration), while the answers on their use in the preparation of presentations represent (80%). And for the improvement of the intellectual level, general culture and the broadening of the field of knowledge in science is (60%) of the answers, represent the most important part of the answer.

To question 10, it was found that 92% of the students attended courses that included ICT during the training.

To a question 14, and sub-questions 14.1 and 14.2; that statistically: 96.1% of the students are in favor of

the use of ICT in science courses; 25% consider that they accelerate learning only; 9.8% of them see that they generate a better understanding; 19.6% confirm that they positively influence learning; and 17. Of the quality of the study, some students think that ICTs are part of the current trend and are becoming a necessity to accompany the pedagogical trend, that they affect several learning profiles and save time and space.

To question 17, 100% of the students statistically prefer a hybrid teaching integrating several supports (Tables, Handouts, ICT).

To question 18, the study reveals that statistically, 100% of the students favor the necessity of teacher training in the use and integration of ICT in a teaching session.

To question 19, we can see that most of the students affirm that there is vital importance (51%) and an important intensity (33.3%), given to the use of ICT for the creation of good integration of two or more disciplines in the realization of a common project. This integration is a key concept in the best approach of interdisciplinary training.

To question 20, most of the students affirmed that using ICT for creating interactions between students to achieve a good understanding of the course is very important (52.9%) and very important (29.4%). The interaction between students is a basic concept for a good approach to interdisciplinary training.

Toa question 21, most of the students affirmed that the use of ICT for creating interactions between students and teachers to achieve a good understanding of the courses is very important (50%) and very important (34%), and that the interaction between students and teachers is a basic concept for a good approach to interdisciplinary training.

Toa question 22, most of the students affirm that there is high importance (77.1%) and an important intensity (36.3%), given to the use of ICT to create a good collaboration between teachers of two or more disciplines for the realization of a common project. Collaboration between teachers is a basic concept for a good interdisciplinary training approach.

Following the analysis of the responses of these 51 students, we concluded that ICT is:

- A need to improve teaching;
- A need to create interaction and good collaboration between stakeholders;
- And also an obligation for the integration of knowledge between disciplines.

Therefore, ICTs must be integrated among the basic tools to generate good training through the interdisciplinary approach.

To this end, we must think about motivating practitioners for more integration of knowledge and skills between their disciplines and for more collaboration between them, encouraging them to train in soft skills that would allow them to improve these

concepts, which are the basis for the interdisciplinary approach.

From another point of view, a research study studied the contribution of the "E-Assessment" on the appreciation of the personality and the system of values within professional organizations. Indeed, the platforms dedicated to evaluation cover several families: behavioral tests or personality tests, aptitude tests, and useful questionnaires [27].

On the other hand, an important factor depends on the school and university orientation. Indeed, more importance had to be given to the orientation of the participants, knowing the importance of the cooperation of teachers in the orientation process [28].

In addition, different questions are raised to identify the real factors of failure within the framework of the interdisciplinary approach, pointing the finger at the gap between saying and doing, between concepts and their uses [29].

Finally, the objective and the scientific novelty of the study presents research on the contribution of ICT to education through the interdisciplinary approach. It shows the value of integrating knowledge from multiple disciplines to assist in successful nursing education [30]. The described interdisciplinary pedagogical approach promotes a better understanding of the study of nursing. It requires the development of digital skills for the proper use of ICT by future student teachers of nursing [31]. The development of digital teaching competence continues to be a challenge for the educational system that must therefore be addressed. It will continue to be a key issue in the training of current teachers. It is indeed a fundamental pillar for promoting a new way of teaching, being the only way to develop a panorama of pedagogical innovation [32]. Digital competence and ICT improve soft skills, integration, and collaboration, which are the basic soft skills to training through the interdisciplinary approach. The study guides us towards a good understanding of the usefulness of developing these skills for better training through the interdisciplinary approach. The study is so simple that the researcher in the field of interdisciplinary training could find a guide in a questionnaire that details the different paths to follow to identify the need for practitioners to be well trained in this interdisciplinary approach [34].

5.1. Recommendations

We plan to confirm these results with a future study on a larger sample. We will use similar experiences in a larger context to broaden our perspective on the subject and derive more detail from it.

Training through the interdisciplinary approach requires good collaboration between stakeholders and good integration of knowledge. Hence the need to develop these two soft skills (collaboration and integration) by providing training in this direction.

We must think of methods of motivation to create the need among stakeholders and encourage them to join this training program to better understand the usefulness of the interdisciplinary approach, realize good plans for the future, and familiarize themselves with solving the complex problems of today's life.

4.1. Limitations

According to our study on the contribution of (ICTs) to training through the interdisciplinary approach to health science and technology education, we find it of great importance. It is very important to point out that this study has certain limitations:

- Training through the interdisciplinary approach requires strong will on the part of the participants for good collaboration between them, something which is very difficult to optimize;
- the use of ICT tools obliges trainers and trainees to improve their skills to use them, as they evolve and renovate, but unfortunately, most of them lack the motivation to do so;
- Ispits in Morocco do not provide staff with training in ICT tools; to keep pace with the evolution of these technologies;
- Difficulties in contacting all students and teachers of these seven institutes to expand our study population.

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