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## **EDUCATIONAL SITUATIONS (ES) AS USEFUL TOOLS FOR TEACHERS TO IMPROVE ARCHITECTURAL DESIGN STUDIO COURSES (ADSC)**

*Research Article*

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# EDUCATIONAL SITUATIONS (ES) AS USEFUL TOOLS FOR TEACHERS TO IMPROVE ARCHITECTURAL DESIGN STUDIO COURSES (ADSC)

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## Abstract

In today's world, the university is undergoing profound changes, and it needs digital technologies requiring new cognitive skills. New Information and Communication Technologies, computer and internet literacy, and teacher digital competence are increasingly becoming requirements for teaching. In architecture, teachers do not have tools to help them teaching better. This study subjects Educational Situations (ES) or tetrahedrons Cyber DiPL developed by Abbaoui et al. (2020) as suitable tools for teaching better architectural design studio courses (ADSC). The survey that served as the common thread is run with forty-nine (49) teachers from the institute of architecture, Ferhat Abbas University Setif 1 (Algeria). The results show that educational situation to do (ES to do), educational situation forged by experience (ES to practice) and educational situation to differentiate (ES to differentiate) are suitable tools. Furthermore, each ES related to know-how (Kh), knowledge practice (Kp) and theoretical knowledge, learned or scientific knowledge (Tk) brings out three other triangles (triangles of a didactic, of a pedagogy and of an apprenticeship). These triangles have corners dedicated to digital technologies to help teachers improve architectural design studio courses. The outcomes of this study could provide current and future teachers with valid and reliable tools to guide their teaching and awareness of ES development. These tools could be implemented in their teaching process and give them opportunities to make significant use of ES in architectural design studios.

**Keywords:** Architectural Design Studio Course, educational situation, practice, differentiate

## 1. Introduction

Architectural Design Studio Course (ADSC) is the central element in architectural training. «*The architectural design studio course is generally considered the backbone of any architectural curriculum and follows a particular method of problem solving, which makes it a distinctive course*» AboWardah (2020, p.82). ADSC cannot be limited to simple questions-answers. Gaulmyn & Dupre (2019) specify that it is a special type of education. It is an important process. It requires not only a continuous development of knowledge but also a set of knowledge updated by the teacher (Tokman & Yamacli, 2007; Nadihan, & Cabauatan, 2021). «*Research on the cognitive activities and on the structure and quality of knowledge flow involved in architectural design education is increasing*» Önal and Turgut (2017, p. 183).

ADSC cannot be locked in a workshop ! Using a metaphor, ADSC, like a person, must not be closed in on himself, cantankerous and unable to engage in meaningful, social activities

that not allows him to connect with others. With The propagation of coronavirus disease 2019 (COVID-19) pandemic that had resulted in the world (Abulibdeh, 2020), the university should take intensive measures to facilitate the use of digital and internet tools, and it should provide online educational continuity for students in architecture . It should also open up wifi networks and digital plateforms. The terrible Covid-19 outbreak must not be a problem for the ADSC and the introduction of digital technology in an architecture workshop. So, we agree with Ragnedda (2020, p. 92) who said : « *access to computers and the Internet, therefore, must be intended in terms of both workstations and broadband connectivity, and digital content. To be effective, it is vital that policymakers, procurement officers and designers of workstations, software and websites consider the needs and requirements of different users...*». Students in architecture need to be connected to the internet, and apologies are not tolerated!

It is important to include all students in architecture, and ensure that they have equal opportunity to use the internet and digital networks. We then admit with Abbaoui et al. (2020) that digital equity is an equitable distribution based on student needs. An institute of architecture should not be closed on digital equity! A digitally equal institute needs to promote more digital rights in order to give teachers the opportunity to enhance ADSC and not discriminate students at the time of consultations.

We also agree with Ravi (2020) for whom digital equity is a condition in which all individuals have the capacity and resources needed for full participation in 21st-century education. Building digital equity in architectural design studios require intentional strategies and planning to reduce barriers and to realize benefits from technologies. In his book, Ragnedda (2020) highlights how digital technologies present an opportunity to reduce social disparities, tackle social exclusion, enhance social and civil rights and promote equity.

In an institute of architecture, students should not be penalized both in terms of accessing-using but also in understanding-treatment of new digital technologies. The book of Howard, Schaffer & Thomas (2018) inform us on teacher education programs and future researches, providing positive examples and recommendations for educational technology leaders and educators on moving toward digital equity. Many researchers provide targeted overviews of relevant digital equity gap literature during the current crisis brought on by the COVID-19 pandemic. We may name a few : Palvia et al. (2018) ; Reich (2019) ; Willems, Farley & Campbell (2019) ; Adedoyin & Soykan, (2020) ; Aguilar (2020) ; Carrillo & Flores (2020) ; Hall et al. (2020), König, Jäger-Biela & Glutsch (2020); Lane at al., 2020 ; Scull et al. (2020) ; Williamson, Eynon & Potter (2020). In their papers, the authors argue that technology-rich learning experiences must serve all students. They also focus on the increasing significance of digital equity in higher education, the interactive multimedia and digital technologies to teach better, the distance education during the coronavirus emergency (or online teaching) and the coaching with video-analysis.

However, the question is whether students are ready to learn online. According to Stosic (2015) and Abbaoui et al. (2020), the answer is obvious, and students are able to identify potential barriers to their achievement managing of their preparedness through online learning. In order to facilitate students readiness for online learning, Hung et al. (2010), Ünal, Alır & Soydal (2014), Martin, Stamper & Flowers (2020) and Yeşilyurt (2021) suggest a digital technology-oriented instruction with its focuses on forming learning materials designed properly to engage students and promote learning by teachers.

Although it sounds obvious to say that these authors are right, we argue our position suggesting a way to better teaching ADSC. We refer to ES as teaching-learning situations or tetrahedrons Cyber DiPL developed by Abbaoui et al. (2020). Indeed, as specified by Abbaoui et al. (2020, p.30), a tetrahedron Cyber DiPL with Di for Didactic, P for Pedagogy, L for Learning, with its new pole (a device cyber) is an opportunity to use Information and Communication Technologies (ICTs). According to knowledge types : know-how (Kh), knowledge practice (Kp) and theoretical knowledge, learned or scientific knowledge (Tk), tetrahedron Cyber DiPL includes Cyber DiPL to do, Cyber DiPL to practice and Cyber DiPL to differentiate. Tetrahedron Cyber DiPL has become a useful tool to improve teaching, learning, and digital equity in the institute of architecture (Abbaoui et al., 2020). In their Tetrahedron Cyber DiPL, the authors discerned educational situation to do (ES to do), educational situation forged by experience (ES to practice) and educational situation to differentiate (ES to differentiate) (Abbaoui et al., 2020). The Educational Situation (ES) is in fact an educational teaching management and learning situation enhanced by digital technology developed by teachers to improve their courses (Abbaoui et al., 2020).

As mentioned above, in this time of Coronavirus Disease 2019, online teaching and learning in higher education is now part of the educational situation (ES). Mishra, Gupta & Shree (2020) held that if the circumstances enduringly persist over the time, online teaching and learning would gradually replace the formal education system. They also pointed out that the shift from traditional method to modern method of teaching learning through zoom, virtual and webinar has become a necessary shift. Online education, including online teaching and learning, has been studied by several researchers (Bawa, 2020 ; Coman et al. 2020 ;Kiernan, 2020 ; Mishra, Gupta & Shree, 2020 ; Murphy, 2020 ; Oyedotun, 2020 ; Rashid & Yadav, 2020). All these authors agreed that the sudden transition to online education as a result of Covid-19 has now become a new reality in higher education. They also admitted that the crisis is imposing challenges on teachers they must overcome. Already before COVID-19 pandemic crisis struck, many authors emphasized the importance of online education. Esani (2010) pointed out that moving from face-to-face to online teaching is an opportunity to seize. Barr & Miller (2013) and Nash (2015) argued that online education with its wide range of digital learning platforms is growing rapidly, and it is beneficial for students.

Therefore, the current study aims to enhance teaching architectural design studio courses (ADSC). Educational Situations (ES) or tetrahedrons Cyber DiPL developed by Abbaoui et al. (2020), and the survey conducted among forty-nine (49) architecture teachers are means to achieve this goal.

## 2. Theoretical Foundation

Abbaoui et al (2020) quoted in their review literature several authors who worked on Educational Situations designed as tetrahedron models. They made reference to the following authors' models : Altet's (1997) systemic model, tetrahedron's Alava (2000), Rezeau's (2001) pedagogical square, tetrahedron's Lombard (2003), Ailincăi's (2010) KITLoK model, Poisson's (2010) tetrahedral model (Abbaoui et al., 2020, p. 31). These models showed the use of knowledge and the instrument (as computer) used during exchanges between learner and teacher in instrumented learning situations. In fact, each model is not a "three-part model", and it includes Teacher, Learner, Knowledge and Instrument. Although each model seems interesting, the model developed by Abbaoui et al. (2020) is more complete as it integrates a whole pole named device cyber including digital interactive multimedia and

digital technologies. « *Interactive multimedia and digital technologies enable computer-based multimedia, the World Wide Web, CD-ROMs, video games, interactive television, virtual reality, touchscreen kiosks, 3D architecture design programs, computer graphics and other interactive media innovations* » (Aikat, 2009, p.1). Furthermore, according to knowledge types : know-how (Kh), knowledge practice (Kp), and theoretical knowledge, learned or scientific knowledge (Tk), Abbaoui et al. (2020) developed several pedagogical situations or tetrahedrons.

The tetrahedron Cyber DiPL developed by Abbaoui et al. (2020) has the following geometrical shape :

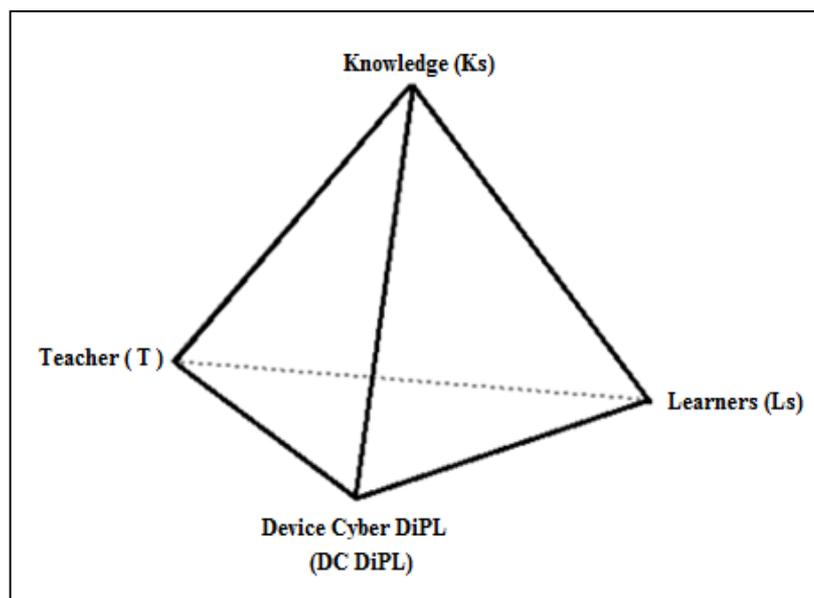


Figure 1: Tetrahedron Cyber DiPL (Abbaoui et al., 2020, p. 38)

The model developed by Abbaoui et al. (2020) showed the use of interactions between learners (Ls) and teacher (T) in instrumented learning situations. The model also determined the role of knowledge (Ks) and the instrument (as Device Cyber DiPL or DC Cyber DiPL with Di for Didactic, P for Pedagogy, L for Learning) used during exchanges. According to the same authors, cyber is a prefix relating to computer and internet. « *It is added to an existing word to transpose reality into cyberspace or to associate with it. Associated with DiPL, it concerns education sciences. It includes general digital resources, and digital teaching and learning resources. In these conditions, the device Cyber DiPL is defined as a lever for many educational activities in disciplines and learning for all ages, and whose interactions can continue through time and space. It brings together digital resources that are favored by Information and Communication Technologies (ICTs). The device Cyber DiPL can be favored by these resources which depend on educational networks set up by institutes, and training institutions* » (Abbaoui et al., 2020, p. 33).

With knowledge types : know-how (Kh), knowledge practice (Kp) and theoretical knowledge, learned or scientific knowledge (Tk), Abbaoui et al. (2020) discerned educational situation to do (ES to do), educational situation forged by experience (ES to practice) and educational situation to differentiate (ES to differentiate). The three educational situations are mentioned on Table 1:

Table 1. Educational situations according to types of knowledge (Abbaoui et al., 2020, p. 38)

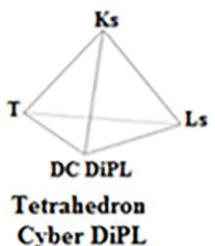
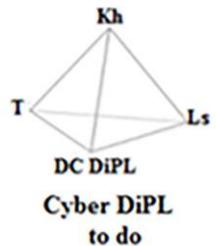
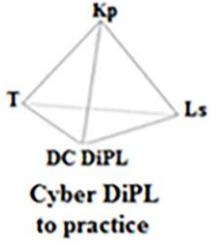
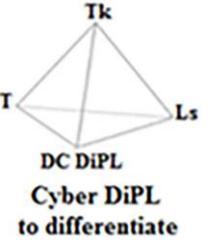
<b>Triangles</b>	<b>Knowledge</b>	<b>Know-how (Kh)</b>	<b>Knowledge practice (Kp)</b>	<b>Theoretical knowledge (Tk)</b>
<b>Triangle of a didactic</b>		Triangle of a didactic to do	Triangle of a didactic to practice	Triangle of a didactic to differentiate
<b>Triangle of Houssaye</b>	Houssaye's pedagogical triangle			
<b>Triangle of a pedagogy</b>		Triangle of a pedagogy to do	Triangle of a pedagogy to practice	Triangle of a pedagogy to differentiate
<b>Triangle of an apprenticeship</b>		Triangle of an apprenticeship to do	Triangle of an apprenticeship to practice	Triangle of an apprenticeship to differentiate
<b>Educational Situation (ES)</b>		ES to do	ES to practice	ES to differentiate

An educational situation (ES) is defined by Abbaoui et al. (2020) as a teaching-learning situation, and it is represented by a tetrahedron Cyber DiPL. According to types of knowledge Ks, Kp, Tk, the authors identify tetrahedron Cyber DiPL to do, tetrahedrons Cyber DiPL to practice and tetrahedron Cyber DiPL to differentiate (Abbaoui et al., 2020, p. 39). In fact, each ES or tetrahedron Cyber DiPL includes triangle of a didactic, triangle of a pedagogy, triangle of an apprenticeship and triangle of Houssaye.

There are only the first three triangles that are considered in this study. Houssaye's pedagogical triangle will not be taken into consideration because there is an absence of digital technology at its corners. The pedagogical situation of Houssaye (2000) is a classic and traditional pedagogical situation (Abbaoui et al., 2020). According to these authors, in Houssaye's pedagogical triangle, represented by Knowledge-Teacher-Pupil, there can only be one relationship at a time. «*In the Houssaye's pedagogical triangle, there are actors forgotten and tending to disappear, and the most important thing is that access to Information and Communication Technologies (ICTs) are missing. Therefore, the lack of digital equity is evident* » (Abbaoui et al., 2020, p. 32).

Table 2 below shows the tetrahedrons Cyber DiPL and the types of triangles according to Kh, Kp and Tk.

Table 2. *Tetrahedrons Cyber DiPL and types of triangles (Abbaoui et al., 2020, p. 40)*

Triangles & Tetrahedrons	Knowledge	Know-how (Kh)	Knowledge practice (Kp)	Theoretical knowledge (Tk)
Triangle of a didactic = T - Ks - DC DiPL	Triangle of a didactic to do = T-Kh-DC DiPL	Triangle of a didactic to practice = T-Kp-DC DiPL	Triangle of a didactic to differentiate = T-Tk-DC DiPL	
Triangle of a pedagogy = T - DC DiPL - Ls	Triangle of a pedagogy to do = T(Kh)-DC DiPL-Ls	Triangle of a pedagogy to practice = T(Kp)-DC DiPL-Ls	Triangle of a pedagogy to differentiate = T(Tk)-DC DiPL-Ls	
Triangle of an apprenticeship = Ls - Ks - DC DiPL	Triangle of an apprenticeship to do = Ls-Kh-DC DiPL	Triangle of an apprenticeship to practice = Ls-Kp-DC DiPL	Triangle of an apprenticeship to differentiate = Ls-Tk-DC DiPL	
Triangle of Houssaye = T - Ks - Ls	Houssaye's pedagogical triangle			
 Tetrahedron Cyber DiPL	 Cyber DiPL to do	 Cyber DiPL to practice	 Cyber DiPL to differentiate	

### 3. Purpose and Research Question of the Study

The main purpose of this study is to enhance teaching architectural design studio courses (ADSC). The study is based on quantitative and qualitative methods, and on Educational Situations (ES) or tetrahedrons Cyber DiPL developed by Abbaoui et al. (2020). According to Tables 1 and 2, the three educational situations are : ES to do, Es to practice and Es to differentiate. So, in our case, taking into account teachers' wishes and needs, the research question guided this study is the following:

Can the three educational situations (ES) be suitable tools to help teachers improving architectural design studio courses (ADSC) ?

### 4. METHODOLOGY

#### 4.1. Participants

The selection focused on teachers of the first cycle architecture in the institute of architecture, Ferhat Abbas University Setif 1. Twenty-nine (29) architecture teachers have

been randomly chosen from the 2019-2020 academic year (September 2019-June 2020); they were 14, 10 and 5 respectively from the first, second and third years at the time of data collection. The age range of the sample was between 33 and 67 years, with an average of 45.66 years.

## 4.2. Data Collection Procedures

The data collection of the current study was executed by means of quantitative and qualitative methods. The questionnaire is composed of six (6) plus one (1) closed-ended questions and one (1) open-ended.

Six (6) questions (items 1-6) require a 5-point Likert scale with Strongly Disagree to Strongly Agree. Teachers answered these questions as : Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree in terms of their stance towards the item investigated.

One additional closed-ended question (item 7) invites the teacher to put a cross in the box of his or her choice.

One (1) open-ended question (item 8) encourages teachers to give free-form answers with arguments. This allowed us to better access the respondents' true feelings on an issue.

The six (6) questions (items 1-6) are as follows :

1. Do you agree with the courses that you are providing in the architectural design studio ?
2. Is internet important for your teaching ?
3. Are you connecting to websites for the information you need ?
4. Can interactive multimedia and digital technologies help you better organizing your architectural design studio courses and useful for your educational situations (ES)?
5. Do you agree with the development of a digital literacy in your institute ?
6. Do digital educational resources improve your teaching ?

The additional closed-ended question (item 7) is as follows:

How many years have you been teaching ?

- 0- 9 years     10-29 years     more than 30 years

The one (1) open-ended questions (item 8) which requires more thought and more than a simple one-word answer is the following :

8. How to improve your architectural design studio courses and your educational situations (ES) (as teaching and learning situations) ?

The survey was fielded from September 2020 to November 2020. Sphinx iQ 2 has been of great use for our data collection.

## 5. Findings and Discussion

The findings were based on:

- the survey carried out with 29 teachers from the institute of architecture;
- the three Educational Situations (ES) : educational situation to do (ES to do), educational situation forged by experience (ES to practice) and the educational situation to differentiate (ES to differentiate).

## 5.1. Findings Based on the Survey

### 5.1.1. Findings based on closed-ended questions (items 1-6)

They are presented in the following table 3 as follows:

Table 3. Findings for the items related teacher' views

Items	SD	D	U	A	SA
	n %	n %	n %	n %	n %
1. Do you agree with the courses that you are providing in the architectural design studio ?	16 55.17%	12 41.38%	1 3.45%	0 0%	0 0%
2. Is internet important for your teaching ?	1 3.45%	1 3.45%	1 3.45%	11 37.93%	15 51.72%
3. Are you connecting to websites for the information you need ?	1 3.45%	1 3.45%	1 3.45%	10 34.48%	16 55.17%
4. Can interactive multimedia and digital technologies help you better organizing your architectural design studio courses and useful for your educational situations (ES)?	0 0%	0 0%	0 0%	14 48.28%	15 51.72%
5. Do you agree with the development of a digital literacy in your institute ?	1 3.45%	1 3.45%	2 6.90%	13 44.82%	12 41.38%
6. Do digital educational resources improve your teaching ?	0 0%	0 0%	0 0%	16 55.17%	13 44.83%

(SD=Strongly Disagree, D=Disagree, U=Undecided, A= Agree, SA=Strongly Agree)

The first item investigated if the teachers agree with the courses they are providing in the architectural design studio. The findings showed that most of teachers disagreed with the statement (D=41.38%, SD=55.17%). Only one was undecided (U=3.45%). This shows that teachers are not at all satisfied with their architectural design studio teaching methods. This is due to the fact that their methods are classical and traditional ones.

The second item took into consideration the teachers' views on the importance of internet. The findings showed that most of teachers agreed with the statement (A=37.93%, SA=51.72%). Only two disagreed with the statement (D=3.45%, SD=3.45%), and one was undecided (U=3.45%).

The third item focused on the teachers' views whether they can find information they are looking for on websites. Most of teachers agreed with the statement (A=34.48%, SA=55.17%). Two teachers disagreed (D=3.45%, SD= 3.45%), and one was undecided (U=3.45%).

The fourth item recorded the teachers' views on the usefulness of interactive multimedia and digital technologies to help them better organizing architectural design studio courses and their educational situations (ES). Most of teachers agreed with the item (A=48.28%, SA=51.72%).

Items 2, 3 and 4 reveal the importance of internet, websites and interactive multimedia and digital technologies. In agreement with Choi, Cristol & Gimbert (2018) teachers have become digital citizens and, in most cases, they use them in a natural way. They have called for digital design methods rather than the use of classical ones.

The fifth item pointed out the teachers' views on the development of a digital literacy in their institute. Most of teachers agreed with the item (A=44.82%, SA=41.38%). Only two disagreed (D=3.45%, SD=3.45%), and two were undecided (U=6.90%).

In teaching practice, it seems clear that teachers incorporate digital technologies into their daily activities. This coincides with Soliman, Taha & El Sayad (2019) who conclude that digital technologies have a strong impact on architectural teaching and architectural design.

The sixth item allowed the teachers' views on whether they can improve their teaching using digital resources. Most of teachers agreed with the item (A=55.17%, SA=44.83%). So, they emphasized that digital resources should be actively incorporated in the educational curriculum to prepare them to teach better.

### **5.1.2. Findings based on one additional closed-ended question (item 7)**

Teachers have several years of university-level teaching experience in the field of architectural education. Table 4 shows the number and the percentage of teachers who have between 0 and 9 years' experience, those who have between 10 and 29 years' experience and those with more than 30 years' experience.

Teachers who have between 0 and 9 years of experience have been called novice teachers (NT). Teachers who have between 10 and 29 years of experience have been called practitioner teachers (PT). Teachers with more than 30 years have been called experienced teachers (ET).

Table 4. *Type of teachers*

Year of experience		$0 \leq YE \leq 9$ years	$10 \leq YE \leq 29$ years	$YE \geq 30$ years
Number of teachers and %	Female	6 (20.68%)	6 (20.68%)	0%
	Male	4 (13.79%)	8 (27.58%)	5 (17.27%)
	Total	10 (34.47%)	14 (48.26%)	5 (17.27%)

### 5.1.3. Findings based on the open-ended question (item 8)

Findings are presented in Tables 5a, 5b et 5c. We have selected the most interesting meaningful answers of novice teachers (NT), practitioner teachers (PT) and experienced teachers (ET).

Table 5a. *Main novice teachers' (NT) meaningful answers*

Item	Main Novice Teachers' meaningful answers
8. How to improve your teaching architectural design studio course ?	<ul style="list-style-type: none"> <li>- Through video streaming on the Internet.</li> <li>- Extending pedagogical and didactic training courses.</li> <li>- Proposing teaching sessions with experienced teachers to build confidence and relieve stage fright and stress in front of an audience of students.</li> </ul>

*Novice Teachers (NT): Number et %: 10 (34.47%) = Female: (6) 20.68% and Male: (4) 13.79%*

For novice teachers (NT), the use of video streaming in online is a pedagogical tool to help them teach better and to improve their ES. It shows them instructional broadcasts or recorded instructional activities to do in the form of tutorials. Video streaming « *can be used for live instructional broadcasts or recorded instructional activities and can grab learners' attention and present information that is easy to absorb* » (Hartsell & Yuen 2006, p.33). NT need pedagogical and didactic training courses. They also suggest teaching sessions with experienced teachers (ET) to build confidence and relieve stage fright and stress in front of an audience of students. However, in this category, female teachers face more or less information technologies than male teachers. In short, novice teachers (NT) use video streaming to " how to do ", and they wish to work with ET to acquire know-how (Kh).

Table 5b. *Main practitioner teachers' (PT) meaningful answers*

Item	Main Practitioner Teachers' meaningful answers
8. How to improve your teaching architectural design studio course ?	<ul style="list-style-type: none"> <li>- Increasing internet speed at the institute and providing internet in the architectural design studio.</li> <li>-Making the architectural design studio course more lively by incorporating digital technologies.</li> <li>- Orienting the architectural design studio towards the digital age by reinforcing it with technological and digital devices.</li> <li>-Making available to teachers building design and building information modeling (BIM) software including computer-aided design (CAD software) products used commonly within the architecture and construction as : All Plan Architecture, Auto CAD Architecture, Auto CAD MEP, Archi CAD, Navisworks, Revit, Sketch UP, Vectorworks Architect...</li> <li>- Using virtual reality in architectural projects as : immersive virtual reality, non-immersive, virtual reality and augmented reality.</li> </ul>

*Practitioner Teachers (PT) : Number et % : 14 (48.26%) = Female : (6) 20.68% and male : (8) 27.58%*

The highest number and percentage of teachers, amounting to 14 (48.26%), is in the category of practitioner teachers (PT) with 6 female teachers (20.68%) and 8 male teachers (27.58%). In order to improve their ADSC and ES, PT expected increasing internet speed at the institute and providing internet in the architectural design studio. They wanted to make their ADSC more lively by incorporating digital technologies. However, taking on this responsibility, they suggested the orientation towards the digital age by using virtual reality in architectural projects as : immersive virtual reality, non-immersive virtual reality and augmented reality. The promotion of this idea inevitably involves available building design and building information modeling (BIM) software including computer-aided design (CAD software) products used commonly within the architecture and construction as : All Plan Architecture, Auto CAD Architecture, Auto CAD MEP, Archi CAD, Navisworks, Revit, Sketch UP, Vectorworks Architect... In agreement with Mannila, Nordén & Pears (2018), the results show that practitioner teachers (PT) develop confidence to explore what is new, what is relevant and how to include digital competence in their teaching. So, accumulation of practices, digital competence and self-efficacy are their assets to face any educational situation in better conditions (Mannila, Nordén & Pears, 2018). PT have between 10 and 29 years of experience. They have gained practical knowledge (Kp).

Table 5c. Main experienced teachers' (ET) meaningful answers

Item	Main Experienced Teachers' meaningful answers
8. How to improve your architectural design studio courses and your educational situations (ES) (as teaching and learning situations) ?	<ul style="list-style-type: none"> <li>- Adopting active and collaborative digital pedagogical practices.</li> <li>- Replacing blackboards in the workshops by interactive whiteboard (IWB), interactive digital board (IDB) and interactive educational board (IEB).</li> <li>- Enhancing the architectural design studios with videoconferencing, interactive formats, podcasts on architecture and slide shows.</li> <li>- Developing a modern teaching (modern education) oriented towards digital technologies.</li> <li>- Creating a positive culture of digitally-based teaching and learning.</li> <li>- Replacing formal education system by online teaching and learning one.</li> <li>- Making online teaching-learning a priority.</li> <li>- Developing teaching - learning situations by creating online training platforms.</li> </ul>

*Experienced Teachers (ET): Number et % : 5 (17.27%) = Female : (0) and Male : (5) 17.27%*

Although not numerous with only five (5) male teachers and a percentage of 17.27%, experienced teachers (ET) still have a real say about their high experience. In order to enhance their ADSC and ES (as teaching and learning situations), they need active and collaborative digital pedagogical practices. In their opinions, fulfilling this accurate goals in the new current crisis brought on by the COVID-19 pandemic present challenges and opportunities and, it will be done through :

- The university's adaptation to digital age and changing environments and new demands.
- The switch of blackboards in workshops by interactive whiteboard (IWB), interactive digital board (IDB) and interactive educational board (IEB).
- The enhancement of the architectural design studios with videoconferencing, interactive formats, podcasts on architecture and slide shows.
- The creation of a positive culture of digitally-based teaching and learning.
- The development of teaching - learning situations by creating online training platforms with high-speed connections.
- The replacing gradually face-to-face with teaching online.

ET have more than 30 years of experience. They have gathered theoretical knowledge, learned or scientific knowledge (Tk) that allows them to differentiate their teaching.

## **5.2. Findings based on the three Educational Situations (ES) : educational situation to do (ES to do), educational situation forged by experience (ES to practice) and the educational situation to differentiate (ES to differentiate)**

We shall now go on to discuss what is mentioned in tables 1, 2 and 5a, 5b, 5c. For novice teachers (NT) acquiring know-how (Kh), they use somehow an existing technological device (e.g. video streaming) as a device cyber DiPL to improve their ADSC for students (Learners) (Table 5a). In this case, it is an educational situation to do (ES to do). In agreement with Abbaoui et al. (2020), ES to do is represented by a tetrahedron Cyber DiPL to do (Table 1). It focuses on interactions between Teacher (T), Know-how (Kh), Learners (Ls) and device cyber DiPL (DC DiPL) (Table 2).

It consists of :

- Triangle of a didactic to do : T-Kh-DC DiPL
- Triangle of a pedagogy to do : T(Kh)-DC DiPL-Ls
- Triangle of an apprenticeship to do : Ls-Kh-DC DiPL

For practitioner teachers (PT) acquiring practical knowledge (Kp), they have already developed practices from previous situations to strengthen their knowledge and know "where" and "what" digital technologies to use and "how" better teaching students (learners). To improve their ADSC, PT wish to use a device cyber DiPL such as digital technologies, devices, BIM software or virtual reality in architectural projects) (Table 5b). In this case, it is an educational situation forged by experience (ES to practice). In agreement with Abbaoui et al. (2020), ES to practice is represented by a tetrahedron Cyber DiPL to practice (Tables 1et 2). It focuses on interactions between teacher (T), Knowledge practice (Kp), Learners (Ls) and device cyber DiPL (DC DiPL) (Table 2). It consists of :

- Triangle of a didactic to practice : T-Kp-DC DiPL
- Triangle of a pedagogy to practice : T(Kp)-DC DiPL-Ls
- Triangle of an apprenticeship to practice : Ls-Kp-DC DiPL

For experienced teachers (ET), they gather theoretical knowledge, learned or scientific knowledge (Tk) that allows them to face the new current crisis brought on by the COVID-19 pandemic. They are able to differentiate their teaching to improve their ADSC. ET need a device cyber DiPL as active and collaborative digital pedagogical practices. They are convinced that it will happen through the university's adaptation to digital age, changing environments and new demands [such as : use of interactive whiteboard (IWB), interactive digital board (IDB) and interactive educational board (IEB) in architectural design studios, enhancement of envideoconferencing, ..., a culture of digitally-based teaching - learning and a teaching online (Table 5c)]. In this case, it is an educational situation to differentiate (ES to differentiate). In agreement with Abbaoui et al. (2020), ES to differentiate is represented by a tetrahedron Cyber DiPL to differentiate (Table 1).

Tetrahedron Cyber DiPL to differentiate (as ES to differentiate) focuses on interactions between teacher (T), theoretical, learned or scientific knowledge (Tk), learners (Ls), and device cyber DiPL (DC DiPL) (Table 2). It consists of :

- Triangle of a didactic to differentiate : T-Tk-DC DiPL.
- Triangle of a pedagogy to differentiate : T(Tk)-DC DiPL-Ls.
- Triangle of an apprenticeship to differentiate : Ls-Tk-DC DiPL.

The results show that the three educational situations (ES): ES to do, ES to practice and ES to differentiate use the instrument cyber DiPL (DC DiPL). DC DiPL including internet, websites, interactive multimedia and digital technologies has become a requirement and a priority. Furthermore, it is worth recalling that Abbaoui et al. (2020) defined ES as a teaching-learning situation, and it is represented by a Cyber DiPL tetrahedron. Therefore, novice teachers (NT), practitioner teachers (PT) and experienced teachers (ET) with their respective knowledge such as know-how (Kh), practical knowledge (Kp) and theoretical knowledge, learned or scientific knowledge (Tk) manage their own ES or Cyber DiPL tetrahedron. They know what steps could be taken, what practices could be implemented and how teaching could be differentiated.

## **6. Conclusion**

Finally, it is worth mentioning as pointed out González-Geraldo, Monroy and Igea (2021) that the theoretical discussion of the impact on teaching-learning situation (ES) gives us the opportunity to (re)think the relationship between Teacher-Knowledge-Learners (students). This is not a three-pronged approach. Each teacher, whether novice, practitioner or experienced, using his or her knowledge (Kh, Kp, Tk) and incorporating the instrument Device Cyber DiPL, translates this approach into a tetrahedron. Each ES will then be an useful tool to improve architectural design studio courses (ADSC). In addition, implementing ES in their requirements for teaching, NT, PT and ET have the opportunity to think deeply about their teaching intentions and actions, and they can help their students to become more aware about their learning. In agreement with Rodríguez, Cantabrana and Cervera (2021), the components of digital technology organization and management can be found as content in all their teaching activities.

However, there are some limitations in this study that should be taken into account, such as the low sample size and questionnaire, which focused exclusively on the architectural department of a single region. This does not allow the generalizability of the results. The sample has only collected data from architecture department of Setif. We think that, in order to obtain more conclusive results on this subject area, it would be necessary to expand the set of issues and extend the number of teachers from different architecture departments or schools. It will certainly going to generate intense debate, even disagreement.

The sample and the questionnaire will certainly grow, and their internal validities will be further explored. In addition, as teaching-learning situations (ES) are not the same, the generalizability of the results requires internal validities as well as more judgments on whether the findings of the study are applicable to several departments or school of architecture. Deeper ES may help teachers to identify which teaching changes in order to improve the quality of their teaching skills and courses. This would enable ES as useful tools to be applied to curricula of teachers.

As mentioned above, the process of using these ES as tools is not complex. It is sufficient for current and future architecture teachers to incorporate the instrument cyber DiPL (DC DiPL) into their educational situations (ES) to improve architectural design studio courses (ADSC).

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