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A Community of Practice around Online Labs in Iraq: Towards Effective Support for Academics and Educational Systems in the MENA Region

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Abstract: Currently, the interest for Science, Technology, Engineering, and Mathematics disciplines in higher education has been growing through a quality improvement in curriculae, examining its impact on the educational outcomes, and ascertaining its effect on the continuous quality improvement to staff and students. Hands-on experiments with innovative instructional technologies, such as online labs, built confidence and skills of academics and students by helping them to better understand, especially in engineering and science fields. A community of practice is a group of people informally bound together by shared expertise, a set of problems, or interest in a topic and fulfils goals. In general, a community of practice focuses on sharing best practices and creating a new knowledge to advance a domain of professional practice. It informs about the appropriate activities and instructional technologies that support the education systems by making the universities a better place for developing the skills of teachers and students. The study purpose is to examine how staff and students are interested in using new instructional technologies, namely online labs, to support hands-on labs for completing their tasks. In addition, it

illustrates the potential benefit of a community of practice around online labs. However, in order to facilitate the formation of a new community of practice around instructional technologies in Middle East and North Africa several presentations about online labs have been made in different universities in Iraq. Research instrument consisted of a series of questions for collecting data from the respondents by using three techniques: questionnaire, online meeting, and interview.

Keywords: Community of Practice, Educational systems, Middle East and North Africa Region, Online Labs, Engineering and Science disciplines

1. Introduction

Simply put, educational systems are widely comprised to schools and universities. They provide power to the human being to develop the civilization and culture. Typically, this term is frequently used in news media and public discourse [1].

Currently, several challenges entailed to reform and improve educational systems are complex and multifaceted. They may need to change the state-policy, union-contract negotiations, and/or school-schedule modifications, etc [2].

Today, active learning has received the attention of numerous institutions in the world. It has been presented as a radical change from traditional to modern instruction. In general, active learning can be defined as any instructional method that engages students in the learning process and it encourages the students to do meaningful learning activities and think about what they are doing. Furthermore, it allows teachers and students to collaborate and cooperate by working together in small groups toward a common goal [3, 4]. In reference [5] pointed out:

> *"However, suggests that students must do more than just listen: They must read, write, discuss, or be engaged in solving problems. Most important, to be actively involved, students must engage in such higher-order thinking tasks as analysis, synthesis, and evaluation. Within this context, it is proposed that strategies promoting active learning be defined as instructional activities involving students in doing things and thinking about what they are doing." (pp.5)*

Numerous countries have started to reform and reshape their education system sectors, for instance Germany [6] and Portugal [7]. Germany, in particular, has adapted the higher educational system, which is based on a new graduation system of Bachelor and Master Degrees. Since 1998, it has achieved clear progress over past years such as increasing the

number of students. In result, the students' numbers, who studied abroad, has raised from 2003 to 2008 [8].

The Latin America region has also reformed its educational systems as well. This reform appeared in some countries such as Brazil, Chile, and El Salvador. In 2012, the first Bi-regional University Association Conference in Brazil discussed the innovative strategies for higher education among Latin American and European universities. In this conference, they agreed to enhance the higher education system through collaborative research. Furthermore, they determined the research partnerships to include two-way exchanges among universities [6].

Reference [9] has highlighted that one of solutions to enhance educational productivity is using resources more effectively to ensure better results. Another solution is introducing more technology and offering courses with student demand.

Nowadays, groups of countries in the Middle East and North Africa (MENA) region face a number of common challenges in their higher education sectors. Despite the many attempts to improve the higher educational systems in the MENA region, for example Tunisia and Jordan [10], try to mobilize their considerable wealth to effect change in their higher education, the fact is they were not enough to face challenges for advancing the higher education [10,11].

Additionally, reference [12] has found that the higher educational systems in the MENA region are in the low-level scale, when compared to other world regions. They stated:

> *"Higher education systems in the MENA region have not developed more, so far, because they have failed to focus on 21st century skills. In other terms, the education systems need to change the way they operate, moving from their traditional approach to a more modern one." (pp. 241).*

Reference [10] has also provided information about education system in the MENA region, for example:

> *"Since education is the main source of knowledge creation, the task is clear: the education systems must be changed to deliver the new skills and expertise necessary to excel in a more competitive environment." (pp.84)*

Initial impression of collaboration and cooperation work among researchers has appeared in one of resent research study [13]. This study showed there are few connections among the MENA researchers, when considering a specific instructional technology, known as online labs. Therefore, it should raise the collaborative work in this region, from individual to strong group, and grow the interest of researchers in online labs by building a CoP around this instructional technology.

Noticeably, several instructional methods and technologies can enhance the educational

systems in the MENA region, for instance online labs [12, 15]. These instructional technologies have the possibility to share resources, materials, and experiments among universities in the MENA region. In addition, it is possible to create a CoP around these instructional technologies for serving students and teachers in this region and increasing the collaborative and cooperative work among researchers, especially in engineering and science disciplines [13].

Therefore, the research questions motivating this study are:

- Are academics interested in using online labs?
- Do academics believe that a CoP around online labs can: 1) serve teachers, students, and universities, and 2) increase the collaborative work among researchers?

This paper addresses the development of a CoP around online labs in the MENA region and its value. It is also discusses the possibility of building a regional and national community network in this region [16].

Structure work is divided into seven sections, as follow:

- Section two: It starts by clarifying the meaning of a CoP, as indicated.
- Section three: It presents the methodology and techniques used to collect data that can help to build a CoP around online labs in the MENA region.
- Section four: It analyses data that collected from the techniques and then analyses it.
- Section Five: It details the result of work.
- Section Six: It remarks the work.
- Section Seven: It concludes the paper and presents future work.

2. A Community Of Practice

The term CoP has been widely described in several studies. It has become immensely popular in the world [17, 18]. In a nutshell, when a group interacts and discuss around a topic, it is called a community [19, 20]. In general, according to Etienne Wenger in references [19], the definition of communities of practices is:

> *"Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly"*

Other definition of communities of practices includes:

"Groups of people who come together to share and learn from one another – either face-to-face or virtually are held together by a common interest in a body of knowledge and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices." http://www.csuchico.edu/swrk/mh/communityofpractice.shtml.

Reference [21] has mentioned the term CoP, which is provided by John Sharp in 1997, and cited:

"A Community of Practice (CoP) is a special type of informal network that emerges from a desire to work more effectively or to understand work more deeply among members of a particular specialty or work group."(pp.140)

Furthermore, the CoP concept is focused on enhancing people's skills through interaction around problems, solutions, and insights, and building a common store of knowledge [22, 23]. The concept has a number of practical applications in business, organizational design, education, and civic life [22]. Additionally, in reference [24] Wenger has claimed another CoP concept and wrote:

"In our communities of practice, we come together not only to engage in pursuing some enterprise but also to figure out how our engagement fits in the broader scheme of things" (p. 162).

A CoP can also be a simple social system to people, as stated in reference [22]:

"A community of practice itself can be viewed as a simple social system."(p. 179)

In general, a CoP is described along three important dimensions [25]: Domain, Community, and Practice (Exhibit 1).

Exhibit 1: Dimensions of a Community of Practice

- *Domain*: Definition of the area of enquiry. Amis to organize the members to share the knowledge that gives them a sense of joint enterprise, brings them together, and share common interest.

- *Community*: A group of people who interact and learn together for building relationships. The relationships among members are a sense of belonging, interact regularly, and engage in joint activities.
- *Practice*: Share the common resources (i.e. documents, cases, and tools) that can build the capability of the community.

Currently, and specifically in education, a CoP brings the experience of schooling in three dimensions: internally, externally, and over the lifetime of students. Focus on the external part; it revolves around how to connect the experience of students to actual practice through peripheral forms of participation in broader communities beyond the walls of the school [26].

Based on an extensive literature review [27, 28], identified a topology of 21 structuring characteristics on which a CoP may differ and be compared. The geographic dispersion was one of them, which refers to the physical location of the participants.

The major factor to the success of a CoP is based on the use of information and communication technologies (ICT). ICT enable to create online communities that are characterized by strong social relationships among participants and foster strong commitment to the community goals [29]. Several conversational technologies, such as Discussion Forums, Weblogs, and Wikis, can support communities as well [30]. Therefore, it seems instructional technologies can facilitate to create the boundaries of a CoP.

In sum, it is useful to use technological platforms for facilitating and supporting to create a CoP around the improvement of educational system. In addition, it can be a good place to start exploring a social discipline of learning by deciding the kinds of activities that can be important for such a community [22, 29].

2.1. Building a CoP around online labs

Building a CoP can contribute significantly to the success of any education system and emphasize social and economic aspects as well. Some software in the Internet can become the first step for supporting a CoP (i.e. chatting). Nowadays, several new instructional technologies have been at the inception of several CoPs, like those around online labs [29].

Creating a network can bring benefits, especially in higher education sectors; this is what has been proved in the past and today. Furthermore, Internet technology has been expanding the range of networks widely, as mentioned in reference [16]:

> *"Taking the Higher Education level into consideration, it is easy to find many successful and fruitful examples of networks both in the long and short past. More recently, the advent and wide use of the Internet has brought an all new range of opportunities to sustain and expand existing networks and also to create new ones. " (pp. 15)*

To create a CoP around online labs in the MENA region, at least, a regional and national community network must be built for providing the resources to teachers and students. Moreover, this community network can support increasing the collaborative work among researchers.

3. Methodology

This section identifies the factors that can help building a CoP around online labs in the MENA region by using the 4 W's ideas "Where, Why, Which, and What" [31], as shown in Exhibit 2:

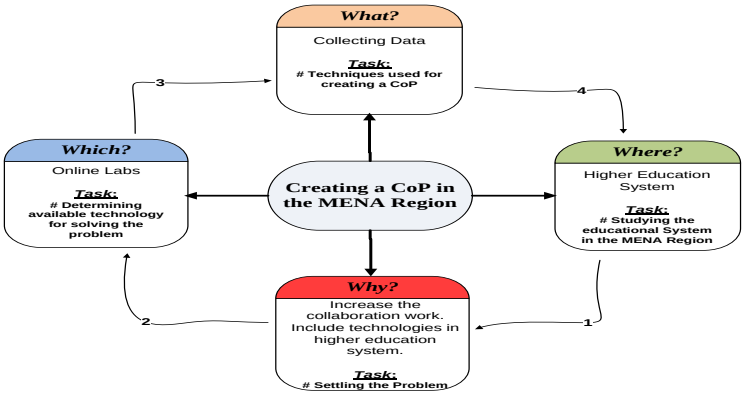


Exhibit 2: Methodology for creating a CoP

3.1. Where do we want to create a CoP?

- Higher Educational System Sector in the MENA region.

Despite the great steps achieved in the MENA education field such as: almost complete gender parity in education, quadrupled the average level of schooling halved illiteracy since 1980 by improving literacy dramatically, and funding education, etc., the fact is that the MENA coutries still has several challenges ahead in their educational system and collaboration work among researchers [32]. In general, these countries needs to enhance their educational system from low quality that is existed now to highest quality, as showed in World Bank Group report.

> *"Evidence demonstrates that school systems in MENA are generally of low quality. Basic skills are not being learnt, a fact most clearly captured by international standardized tests, whose results reveal that the Region is still below the level expected given MENA countries' per capita income".*

3.2. Why is important to create a CoP?

- To increase the collaboration and cooperation work among MENA region researchers.
- To improve the education sector by including instructional technologies.

After studying the higher educational systems in the MENA region, it ssems to be that instrucational technologies (i.e. online labs) can help to buliding a CoP this region for supporting and assiting teachers and students, and create a strong collaborative and collaboratve work among MENA researchers [14]:

3.3. Which available instructional technology can be used to facilitate a CoP?

- Online labs technology.

Based on the existing typologies for online communities, a CoP can be based on different Internet platforms.

To bulide a new CoP, one should consider the paradigm related to the emergence of new instructional technologies. Online labs are characterized by a strong social relationship between participants. It supports the participants by continuity of communication and a common online meeting space. In addition, it enables long-lasting relationships between researchers. In result, one can build a CoP around online labs.

Reference [29] has talked about online learning communities and stated:

> *"On-line learning communities are dedicated to collaborative on-line learning. Their basic aim is the establishment of a learning space for a certain subject, where participants can receive both defined degrees or knowledge and support for continuous lifelong learning. "(p.87).*

Moreover, in the same reference it is said as well:

> *"The basic communication and coordination services for community support accompany the basic services enabling on-line learning and teaching." (p.88) and "On-line learning communities emerge between teachers and students, as well as among students of on-line education platforms. Learning communities usually emerge around on-line learning platforms offered by universities and other schools. An interesting example of an independent on-line learning community is the German Learnetix community (www.Learnetix.com)." (p.80)*

In reference [33], the authors have considered this definition in their study about the importance of technologies for creating a CoP, as said:

"Facilitating community is not a static, one-time event related to "turning on" a software platform or technology. While technology - the technical architecture - can assist greatly in providing a platform for communication and collaboration, even more important is the social architecture of the community" (p.2)

3.4. What are the techniques used to facilitate building a CoP?

- Questionnaire, Interview, and Online meeting discussion.

For collecting quantitative and qualitative data we used three techniques [34, 35]: Questionnaire, Interview, and Online meeting (Exhibit 3). The questionnaire technique relied on presenting seminars in different institutions: University of Duhok (UoD), University of Zakho (UoZ), and Duhok Polytechnic University (DPU). The second approach used to build a CoP was meeting and interviewing a number of the academics from these three institutions. The third approach was focus on group via online meeting discussion technique, which included a video conference during an opening session between an outside expert in online labs and the academics of institutions.

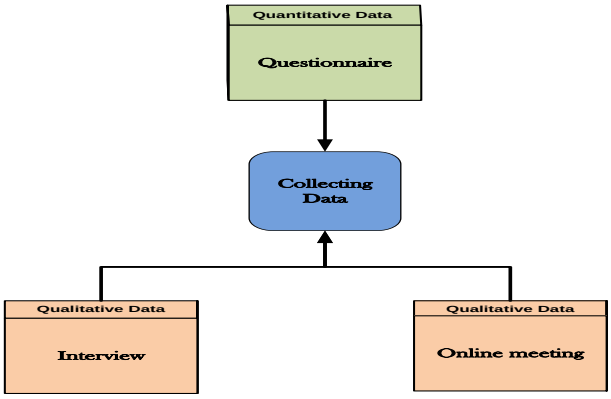


Exhibit 3: Techniques used for collecting quantitative and qualitative data

3.4.1. Quantitative Data

For collecting quantitative data the questionnaire technique was used. A series of presentations was made in three universities in the Kurdistan region, Iraq, especially in engineering and science disciplines. The presentations schedule was:

- On 14th December 2015, UoZ, Faculty of Engineering and Science.
- On 23th December 2015, UoD, Faculty of Engineering.
- On 6th January 2016, UoD, Faculty of Science
- On 12th January 2016, DPU, Faculty of Engineering and Science.

After presentation, the questionnaire's forms were handed out to respondents and the forms were collected back, after respondents answered.

3.4.2. Qualitative Data

For collecting qualitative data the interview and online meeting techniques were used. Interview technique can include a type of basic questions - called open-ended questions- [35] to gain a new insight and discover new ideas [36]. Therefore, it was used to meet academics, face to face, from those universities, who are interested to use instructional technologies in their courses and who have more than fifteen years of work experience at university.

Second technique, online meeting, used the Skype conference tool, which is used for giving more details about online labs and showing how online labs can support a CoP work. Prof.Gustavo R. Alves from the Polytechnic of Porto, School of Engineering (IPP-ISEP), Portugal, was involved in this online meeting[1]. Currently, he has vast working experience in online labs and has considered one of the most active researchers in this area[2] [37].

4. Data Analysis

This section analyzes the quantitative and qualitative data collected from the questionnaire, interview, and online meeting. Quantitative data provides a great value to study by providing meaningful results from a large data [38]. Qualitative data focus on meanings rather than on quantifiable phenomena. It includes rich descriptions of the data rather than measurements of specific variables [39]. Furthermore, it involves the identification, examination, and interpretation of patterns and themes in textual data and determines how these patterns and themes help to answer the research questions [38].

4.1. Questionnaire

The questionnaire aims to evaluate how online labs can assist teachers and students, and highlights to how a CoP around online labs can increase collaborative and cooperative work among researchers (see appendix), especially in engineering and science disciplines. In general, the data is classified into kinds: Nominal data and Interval data [38].

- ***Analyze Nominal Data***: To classify the demographical background of participants, (i.e. Occupation, Gender, Language, Age, Program Taken, Internet Use experience, and Internet Use Frequency) (Exhibit 4).

[1] http://uoz.edu.krd/news.php?NID=86#prettyPhoto
[2] https://scholar.google.com/citations?user=vAonlVMAAAAJ&hl=en

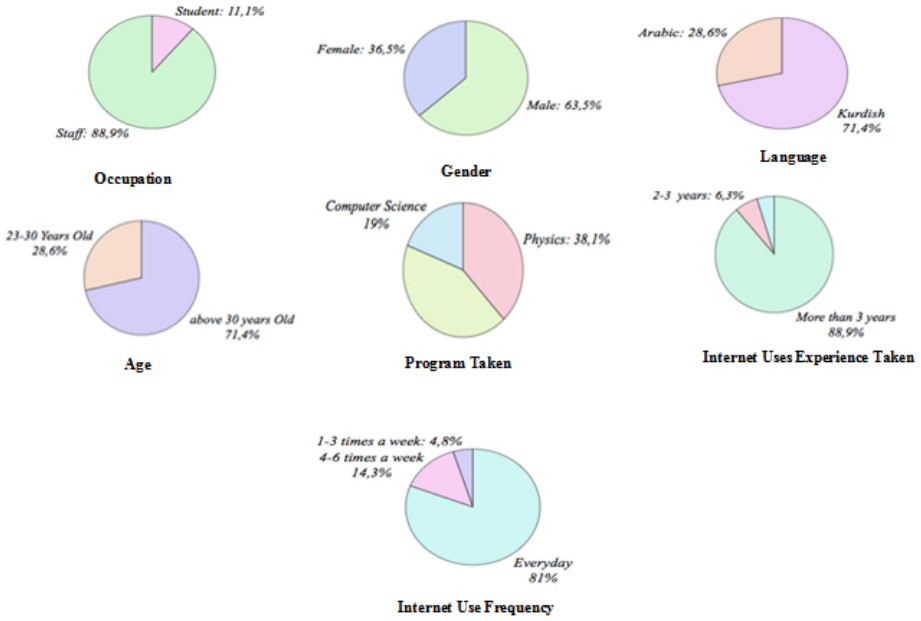


Exhibit 4: Analyze the Nominal Data

- ***Analyze Interval Data:*** To classify the continuous data of questionnaire. It is standardized differences between values. We transferred the questionnaires into a spreadsheet by putting each question number as a column heading, and one row for each person's answers [TABLE1]. The scale was: Strongly Agree (4), Agree (3), Disagree (2), and Strong Disagree (1) [40, 41]. This four-point scale (i.e. an even scale) forces people to choose a side, without a middle point [40, 42]. It gives a certain tendency of answer, hence increasing the reliability and validity [43]. In addition, within using four points, the result can reasonable and perceive the tendency [44].

TABLE I. Analyze the Interval data

Question Number	Scaling				Total Questionnaires	Percentage			
	(4)	(3)	(2)	(1)		(4)	(3)	(2)	(1)
Q1	6	40	12	5	63	10%	63%	19%	8%
Q2	14	42	6	1	63	22%	67%	10%	2%
Q3	14	37	10	2	63	22%	59%	16%	3%
Q4	20	32	11	0	63	32%	51%	17%	0%
Q5	11	46	6	0	63	17%	73%	10%	0%
Q6	19	37	6	1	63	30%	59%	10%	2%
Q7	19	38	6	0	63	30%	60%	10%	0%
Q8	17	37	6	3	63	27%	59%	10%	5%
Q9	15	39	7	2	63	24%	62%	11%	3%

Q10	20	33	10	0	63	32%	52%	16%	0%
Q11	27	28	8	0	63	43%	44%	13%	0%
Q12	13	39	11	0	63	21%	62%	17%	0%
Q13	6	34	22	1	63	10%	54%	35%	2%
Q14	3	18	28	14	63	5%	29%	44%	22%
Q15	10	45	6	2	63	16%	71%	10%	3%

4.2. Interview

Regarding the academics questions, these had already been discussed and replied in their office about online labs. Interestingly; academics agree that online labs can be useful to STEM fields for supporting hands-on labs. In their comments, they indicated online labs technology can be very interesting to use in higher education and curricula. In addition, they pointed out online labs should become available resources for engineering and science disciplines. The academics answers are shown in the results section.

4.3. Online meeting discussion

During the presentation, the participants wrote questions related to online labs technology and a CoP to the respondent. Several questions were passed and answered by Prof. Alves. These questions were related on online labs, collaboration and cooperation works among researchers, a CoP, cost of online labs use, and so on. These questions and answers are also shown in the results section.

5. Results

In this section, we describe the results collected from both quantitative and qualitative data analysis. Afterward, we highlight some important points.

5.1. Quantitative Data Results

To examine the questionnaire data we used the terms of a P-value, under a null hypothesis, for quantifying the strength of the evidence against in favor the null hypothesis and measuring the size of an effect or the importance of a result [45]. Therefore, for moderating the evidence against a P-value is ≤ 0.05 [46] and, as statistically significant, it is commonly used in researches [45, 47, 48]. It is used as a confidence for analyzing the data to find if there are independencies and correlations in the nominal and interval data.

5.1.1. Correlations among Nominal and Interval Data

Regarding the quantitative data, several correlations were detected inside nominal and interval data, and between nominal and interval data (Exhibit 5). These correlations are

described below.

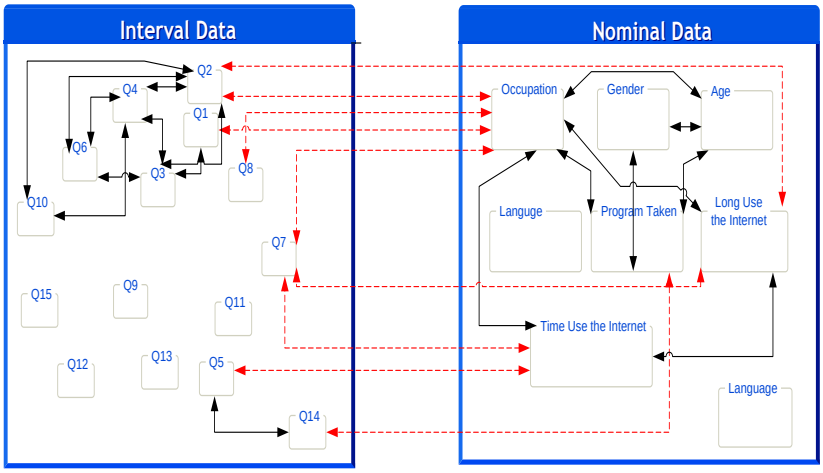
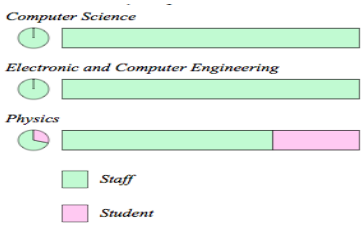


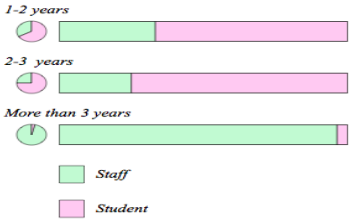
Exhibit 5: Correlations inside Nominal and Interval Data, and between Nominal and Interval Data

Occupation: *The number of respondents was 63. 88.9% were teachers and 11.1% were (master) students. Regarding occupation we found a correlation (P ≤ 0.05) with nominal (i.e. Age, Program Taken, Internet Use experience, and Internet Use Frequency) and interval (i.e. Q2, Q7, and Q8) data (Exhibit 6).*

a) *Occupation and Program Taken* (P-Value = 0,002)

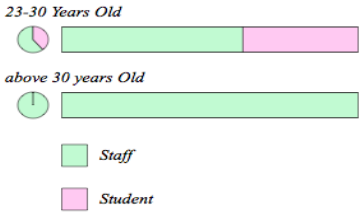


b) *Occupation and Internet Use Experience* (P-Value < 0,001)



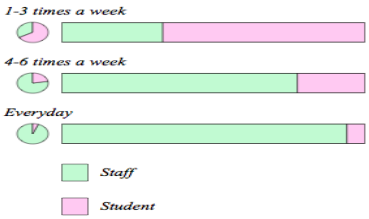
c) *Occupation and Age*

(P-Value < 0,001)



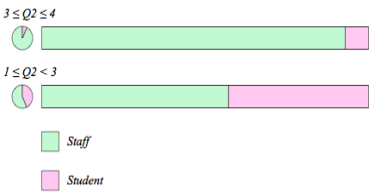
d) *Occupation and Internet Use Frequency*

(P-Value = 0,003)



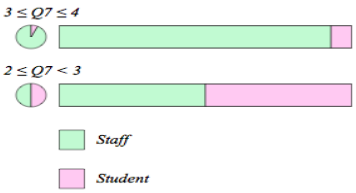
e) *Occupation and Q2*

(P-Value = 0,005)



f) *Occupation and Q7*

(P-Value = 0,001)



g) *Occupation and Q8*

(P-Value < 0,001)

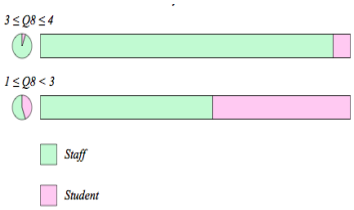
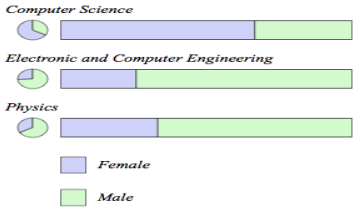


Exhibit 6: Occupation Correlation with Age, Program Taken, Internet Use Experience, Internet Use Frequency of Use of the Internet, Q2, Q7, and Q8

Gender: Regarding gender there was 63.5% male and 36.5% female. During the analysis we found a correlation of gender with two nominal data Age and Scientific Area Program Taken (Exhibit 7).

a) *Gender and Program Taken*
(P-Value = 0,047)



b) Gender and Age
(P-Value = 0,047)

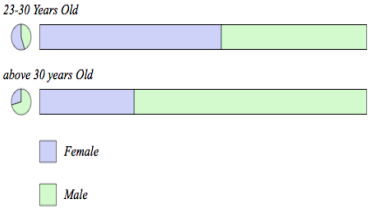


Exhibit 7: Gender Correlation with Age and Program Taken

Age: In age, the percentage was 28.7 % in the 23-30 years old and 71.3% were above 30 years old. We found age has a correlation with Internet Use Experience nominal data (Exhibit 8).

Age and Internet Use Experience

(P-Value = 0,028)

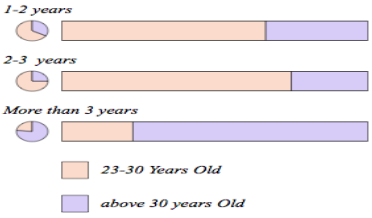


Exhibit 8: Age Correlation with Internet Use Experience

Program Taken: Program taken is correlated with Q14 interval data (Exhibit 9).

Program Taken and Q14
(P-Value = 0,043)

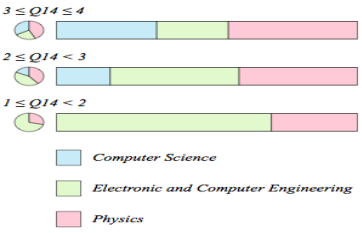
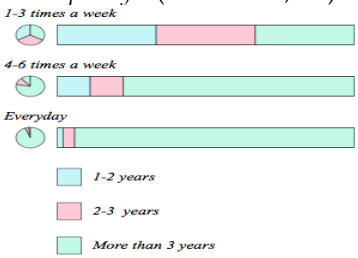


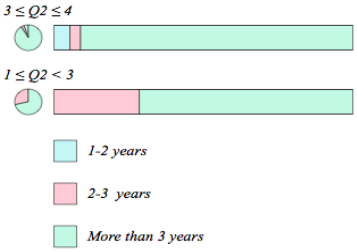
Exhibit 9: Program Taken Correlation with Q14

Internet Use Experience: Long use time of the internet is correlated with Internet Use Frequency nominal data and Q2, and Q7 interval data (Exhibit 10).

a) *Internet Use Experience and Internet Use Frequency* (P-Value = 0,015)



b) Internet Use Experience and Q2 (P-Value = 0,034)



c) *Internet Use Experience and Q7* (P-Value = 0,001)

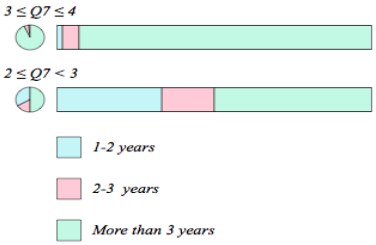
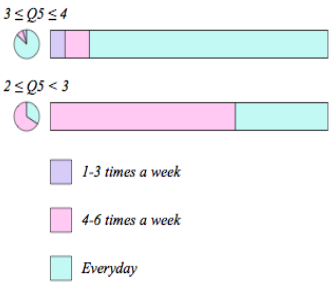


Exhibit 10: Internet Use Experience Correlation with Internet Use Frequency , Q2, and Q7

Internet Use Frequency: Finally, Internet Use Frequency is correlated with Q5 and Q7 (Exhibit 11).

a) *Internet Use Frequency and Q5* (P-Value < 0,001)



b) Internet Use Frequency and Q7 (P-Value = 0,002)

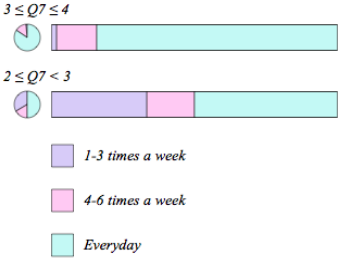


Exhibit 11: Internet Use Frequency Correlation with Q5 and Q7

5.1.2. Correlation among Interval Data (Q1 – Q15)

During analyzing the interval data of questionnaire several variable relations have been detected among questions. In general, these variable relations, namely Coloration and Two-way ANOVA, show a mutual relation of two or more pairs of variables and how strongly they are related [49, 50]. As shown in [TABLE2], these categories are used to form groupings of observations (Exhibit 12).

TABLE II. Correlation among Interval Data

Group	Questions	Detected	Variable Relation	P-Value
Usefulness	2, 4, and 6	Interaction	Two-way ANOVA	P = 0.033
Sustainability	5 and 14	Positive	Correlation	P = 0.013
Learnability	1 and 3	Positive	Correlation	P < 0.001
	2 and 3	Positive	Correlation	P = 0.008
	2 and 4	Positive	Correlation	P = 0.002
	2 and 10	Positive	Correlation	P = 0.012
	3, 4, and 6	Interaction	Two-way ANOVA	P = 0.012
	4 and 10	Positive	Correlation	P < 0.001

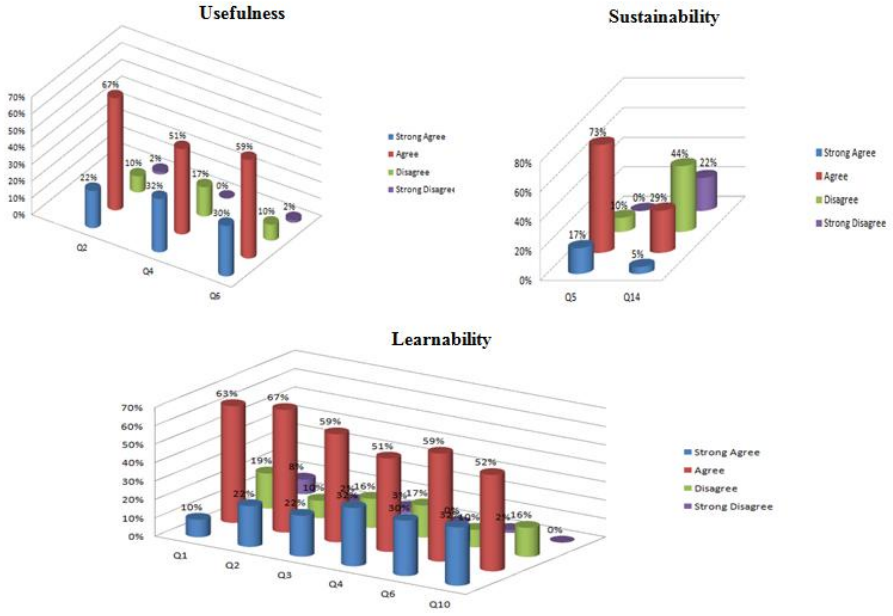


Exhibit 12: Interval Data Results (Usefulness, Sustainability, and Learnability)

5.2. Qualitative Data Results

Qualitative data results were collected from using interview and online meeting techniques, as shown below.

5.2.1. Interview Results

TABLE3 shows some of the researchers' answers collected from the interviews, which included six questions:

TABLE III. Interview Result

Q1	**Can online labs technology provide useful information for teachers and students of higher education?**
Answers	*It is very useful because it would provide experiments that cannot be available at the university using modern techniques".* ***(Dr. Yaseen Taha, UoZ)***
	It could if we consider that teachers can have an overview into the already existed and ready experiments in its subject at the online lab system. For students, sure it would provide experiment information and can work on it from anytime and from anywhere. ***(Dr. Shavan Asker, UoD)***
	Yes both of them can get benefit from it. The teacher by using the new methods to develop his teaching and the students by connecting what is he going to study with the technology. ***(Dr. Raghad Yousif, UOD)***
Q2	**Do you think online labs technology can assist and support work of the teachers in the hands-on lab and at the same time, offer students an easier way to complete their tasks?**
Answers	*I can feel the sense to which level the teachers and students can improve their skills and knowledge.* ***(Dr. Yaseen Taha, UoZ)***
	Yes of course because some time you need more perceptible tools to understand the difficulties in the lectures. ***(Dr. Raghad Yousif, UOD)***
	Yes, if the relevant teachers and/or instructors received some basic training on the use of the system. The system will need good documentation (with regular updates) for users and some model experiments to encourage potential users enrolling it within their courses. ***(Dr. Ezideen Haso, DPU)***
Q3	**Do you think students can benefit from online labs technology applications, especially in STEM fields?**
Answers	*It can be benefitted, especially for physics department. Because, in same case, Our Hands-on labs cannot include all components for students, which are required to complete the experiments.* ***(Dr. Mohammed Ibrahim, UoD)***
	Yes, especially now where our province is in a financial crises. ***(Dr. Bayaz Al-Sulaifanie, UoD)***
	Yes. It can do so by sharing experiments from worldwide universities and this would undoubtedly improve the quality and improve the curriculum in some cases. ***(Dr. Shavan Asker, UoD)***
Q4	**Do you think online labs technology can improve the curriculum in higher educational system?**

Answers	*Sure, because higher education system required several equipment and tools that might not be available. Therefore, such a technology will compensate such lack of availability".* ***(Dr. Yaseen Taha, UoZ)***
	It depends what facilities are available? Can we use this technology to conduct our laboratories keeping in mind that number of students is high?. ***(Dr. Bayaz Al-Sulaifanie, UoD)***
	Yes I believe so if the service provider of the On-Line laboratories support a large domain of theories and implementations. ***(Dr. Ezideen Haso, DPU)***
Q5	**Do you think online labs technology can increase collaboration and cooperation works among researchers?**
Answers	*Yes sure. The systems would let researchers and people from the academia share their knowledge and experience so this would be a great opportunity to collaborate and share information and work together.* ***(Dr. Shavan Asker, UoD)***
	It will help to increase the collaboration and cooperation work by using online labs. This technology can help to create a bridge for researchers to share information and knowledge". ***(Dr. Mohammed Ibrahim, UoD)***
	I don't think that On-Line labs will have big impact on the research side, because research usually needs specialized equipment that may not necessarily be shared with other researchers. Moreover, if there isn't wide domain of users for certain experiments set of equipment then it won't be economically viable for the service provider of On-Line Labs people (or company) themselves. The economical issue here will prevail in this case. ***(Dr. Ezideen Haso, DPU)***
Q6	Finally, do you have a special advice about use online labs technology in STEM fields?
Answers	*On-line labs can provide good alternative for some educational establishments (probably in third world countries). From my own experience the issue of labs is quite complicated. In most cases labs and their equipment needs logistic support. By this I mean a range of things, starts with fund for the initial cost, right personnel to run and maintain the equipment, suitable premises and last but not least (the legitimate use of these lab equipment (in some cases). These could be burdensome responsibilities for some educational establishments. In the On-Line labs case most of these issues are resolved. As a computer laboratory can play a dual functionality in these cases, besides being a computer lab it could be used as Electrical Technology (for instance) using On-Line labs via internet connection.* ***(Dr. Ezideen Haso, DPU)***
	It needs encouragement and motivation to get knows this technology and gets closed to this technology. ***(Dr. Yaseen Taha, UoZ)***
	I suggest the following to use the online lab. First step is to encourage the staff members and postgraduate students to use this technology. It is very essential to introduce them to the facilities and devices available. Second step is to use this technology to implement final year projects. Third step is to encourage all undergraduate students to use this technology. ***(Dr. Bayaz Al-Sulaifanie, UoD)***

5.2.2. Online meeting Results

Q1: Why are most online labs free?

Answer: The purpose of online labs is educational. They are used for assisting and supporting hands-on labs, not for replacing them.

Q2: How can online labs increase the collaboration and cooperation work among researchers?

Answer: Online labs have the ability to increase collaboration and cooperation works by sharing the resources, experiments, and so on, among universities and researchers.

Q3: Do online labs have facilities to serve a CoP?

Answer: Yes, today, there are communities around online labs, for example Virtual Instrument Systems In Reality (VISIR). This community is called a Special Interesting Group (SIG)[3] and includes many researchers from different countries.

Q4: Is it possible to consider that online labs can be one useful option, in higher education government, in case of unavailability of equipments, or high-cost of Instruments?

Answer: In general, it can be said that online labs save time and money. Therefore, yes, online labs can be used, in case of unavailability of equipments or costly equipment, for assisting hands-on labs. Additionally, it can help to develop the students' technical skills and contribute to the quality of higher education, and so on.

6. Remarks

In general, it is important to remark the results collected from the quantitative and qualitative data analysis. These remarks are:

1. **Providing resources:** Quantitative and qualitative data results show that online labs can assist the education systems by sharing materials and online experiments among teachers and students. As shown in table I, Q2, Q7, and Q11 have the highest scale of "agree" and "strong agree". Likewise, the academics' answers, during interview, indicated that online labs can provide a new method of teaching, i.e. online experiments, for both teachers and students.

2. **Assisting and Supporting Work:** The results of quantitative data, presented by Q3, Q5, Q7, Q9, and Q11, show online labs can help teachers and students to complete their task 24/7. As shown in table I, Q14 has the highest scale of "disagree" and "strong disagree" and that means most respondents are also agreed online labs is aimed to support hands-on labs, not replaced them, by offering online experiments

[3] http://www.online-engineering.org/SIG_visir.php

to students and teachers. Likewise, most academics' answers collected from the interview mentioned that online labs can provide more tools and encourage them to improve their students' skills.

3. **Benefiting from Online Labs:** Students can benefit from online labs, especially in fields that face the limitation of equipment and components. This point appeared in some academics' answers to Q2, Q4, Q6, Q9, Q10, and Q11 of the questionnaire.

4. **Improving the Curriculums:** In general, academics agreed the curriculum can be improved by including educational technologies, particularly online labs. These technologies can support a large domain of theories and implementations. This is shown in the Q2, Q3, Q6, and Q7 results, as well.

5. **Increasing the Collaboration and Cooperation among Researchers:** Most researchers agreed that online labs can help to increase collaboration and cooperation work among them by sharing knowledge and experience. In addition, one of the two main questions received from the respondents during the online meeting was '*how can online labs increase the collaboration works among researchers and how can online labs have the ability to create a CoP, especially around the VISIR Open Lab Platform'*. From the quantitative data result it can be noticed that Q4, Q5, Q15, which are related to collaboration and cooperation works and to a CoP, evidence a high level of agreement.

6. **Advising: Several advices have been gathered in this study**. For example:

    - Online labs can be a good alternative, for some countries, related to the increase of number of student, financial crises, and quality of education system.
    - Online labs need encouragement and motivation for people who have never used technologies in education.
    - Online labs can be implemented as final projects for students in the last year of their study.

7. **Outcomes and Impact:** Two things can be highlighted:

    - ***First work done***: After completing this series of presentations at UoD, UoZ, and DPU, it may be online labs -*remote and virtual labs*- to use in theses universities by including several online experiments, specifically in the VISIR system, for the 2016-2017 academic year.

    - ***Second work done***: Researchers from these three universities have collaborated in creating a group of researchers and afterward they submitted a proposal to the IREX organization. The project idea is to create a remote experimentation network to use online experiments, which are developed and located in united

State universities, for serving teachers and students in the Kurdistan-region of Iraq. In sum, it has been accepted for implementing by collaborating with Oklahoma State University (OSU). In general, the project aims to develop an online lab, which is based on virtual environment and called Virtual Reality (VR), for engineering and computer science students at UoD, UoZ, DPU, by introducing fundamentals of robotics to students. In addition, this online lab can include several experiment modules that allow students run experiments via the Internet.

7. Conclusion and Future Direction

This paper outlines some indicators related to the higher education systems in the MENA region, such as the support given by educational technologies to academics working in this region. Major goals of this work are:

- Providing additional materials to researchers, teachers, and students in the MENA region by using instructional technologies (i.e. online labs),
- Building a CoP around online labs in the MENA region.
- Increasing collaborative and cooperative work among the MENA researchers by sharing resources and online experiments.

In result, a CoP can be task-and-goal oriented to satisfy the need for cooperative achievements of goals and provide support for online learning [51].

This research simply provides the idea for more achievements in higher education sectors in the MENA region by providing their educational system with additional instructional technologies that facilitate the students' skills acquisition.

Finally, it is hoped that by setting the online labs indicator, this work may be used to guide the development of higher educational systems in other regions. Similarly, it may find other indicators or activities related to learning *-wider impact-* that can develop and assist the higher education sectors in the MENA region for increasing collaborative and cooperative work among researchers.

Future work is to invite other universities to become a part of this online labs community, either VISIR or VR project, for sharing resources and knowledge among them and increasing collaborative and cooperative work among their researchers.

APPENDIX (Questionnaire Form)

Thank you for kindly participating in this questionnaire. We want to continually improve, so the opinions you have provided are greatly appreciated and important.

- Demographic Background (***Please kindly tick (√) your answers to the given statements)***.

Occupation

[ ] Student
[ ] Staff

GENDER.

[ ] Male
[ ] Female

Mother language.

[ ] Kurdish
[ ] Arabic

AGE group

[ ] 18-22 Years old
[ ] 23-30 Years old
[ ] Above 30 Years old

Program taken at home university.

[ ] Physics
[ ] Electronic & computer Engineering
[ ] Computer sciences

Year of study (Just for student)

[ ] First Year
[ ] Second Year
[ ] Third Year
[ ] Final Year

Internet Use experience

[ ] Less than 1 year
[ ] 1 – 2 years
[ ] 2 – 3 years
[ ] More than 3 years

Internet Use Frequency?

[ ] Everyday
[ ] 4– 6 times a week
[ ] 1-3 times a week
[ ] Less than once a week

- Please check the appropriate column, according to your level of agreement with each sentence/question

	Questions	S. Agree	Agree	Disagree	S. Disagree
1	Do you feel online labs as hands-on labs?	☐	☐	☐	☐
2	Does online labs usage improve the quality of your studies?	☐	☐	☐	☐
3	Does an online lab provide higher level of engagement in education scope?	☐	☐	☐	☐
4	Do you agree that online labs can increase the collaboration and cooperation work among students and teachers?	☐	☐	☐	☐
5	Do you think that experiments through online labs can give scope for more innovative and creative research work?	☐	☐	☐	☐
6	Do you find using online labs to be advantageous in university, for teachers and students?	☐	☐	☐	☐
7	Do you think online labs can help sharing resources?	☐	☐	☐	☐

8	Should online labs technology be used in the next years?	☐	☐	☐	☐
9	Do you think online labs can be enjoyable?	☐	☐	☐	☐
10	Does an online lab make it easier to learn and complete tasks?	☐	☐	☐	☐
11	Do you agree that new languages of online labs interfaces, such as Kurdish and Arabic, can help students to better understand how to use it?	☐	☐	☐	☐
12	Do you think that online labs use will help you to understand and support the educational curriculum?	☐	☐	☐	☐
13	Do you believe online labs (Remote Labs) actually work with real devices through the internet?	☐	☐	☐	☐
14	Do you believe online labs will eventually replace Hands-on labs?	☐	☐	☐	☐
15	Overall, do you think that online labs can be useful to create a community of practice?	☐	☐	☐	☐

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