



Teachers' Acceptance of Using Interactive Digital Analogies in Teaching Computer Science

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تقبل المعلمين لاستخدام المتشابهات الرقمية التفاعلية في تدريس علم الحاسوب

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مستخلص البحث:

تواترت الأدلة على أن استخدام المتشابهات كأداة فاعلة في التدريس لتقريب المفاهيم غير المألوفة بمفاهيم مألوفة، وفهم أوسع عبر التشابه بينها، إلا أن الأدب التربوي لم يتناول بشكل واسع المتشابهات بصورة رقمية تفاعلية، وتقبل معلمي الحاسوب على وجه الخصوص لاستخدامها، وبالتالي هدف البحث قياس تقبل المعلمين لاستخدام المتشابهات الرقمية التفاعلية، والتنبؤ بنية استخدامها من خلال نموذج النظرية الموحدة لقبول واستخدام التكنولوجيا (UTAUT) طبقت الدراسة على (١٤٣) معلما/معلمة لمادة الحاسوب في تربية عمان الأولى وقصبة مادبا/الأردن. أظهرت نتائج تحليل الانحدار إمكانية التنبؤ بنية استخدام المتشابهات الرقمية التفاعلية من خلال العوامل الأربعة وفق النموذج المعدل لقبول واستخدام التكنولوجيا، وقد تضمن البحث تفصيلا للنتائج، ومجموعة توصيات؛ أبرزها تدريب المعلمين على استخدام المتشابهات الرقمية وزيادة التركيز على استخدامها في بيئات التعلم.

الكلمات المفتاحية: المتشابهات الرقمية التفاعلية، النظرية الموحدة لقبول واستخدام التكنولوجيا، معلمو الحاسوب، الدول النامية.

المساهمة/الأصالة: يضيف البحث إلى الأدبيات تعريفاً للمتشابهات في شكل رقمي تفاعلي، ونموذجاً معدلاً للنظرية الموحدة لقبول واستخدام التكنولوجيا لمساعدة القائمين على العمل التربوي من صانعي قرار، ومعلمين صورة أوضح بالعوامل المؤثرة في رفع سوية البيئات التعليمية باستخدام المتشابهات الرقمية التفاعلية.



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ABSTRACT:

Growing evidence show that analogies can be used as a powerful tool for reducing the gap between unknown and familiar concepts for transferring knowledge, understanding the relation between elements through similarities, and promoting thinking to higher level. There is lack of literature reforming analogies in digital and interactive form. Teachers, on the other hand, are the main active members of the learning and teaching process, where their understanding and readiness to use new strategies and technologies are essential for practicing those technologies. This paper explored teachers' acceptance of using digital analogies in teaching computer science and predicting their intention of using it . To achieve the research purposes, the researcher used descriptive and analytical methodology. A questionnaire was used for collecting data out of teachers who teach computer science in Jordanian schools as a developing country. The sample of the research consisted of (143) teachers drawn out of Amman and Madaba governorates schools. The modified questionnaire that used in this research depended on the Unified Theory of Acceptance and Use of Technology (UTAUT). The acceptance degrees among in-service computer science teachers in Amman and Madaba Directorates for using Interactive Digital Analogies (IDA) in teaching according to UTAUT model and its factors were high except Facilitating Condition in a medium degree according to one sample test. UNIANCOVA test showed no significant statistical differences according to Directorates, Gender, years of experience and Academic level. Regression test showed that Behavioral intention can be predicted by UTAUT four factors. The study recommended the focus on IDA within learning environments.

Keywords: Interactive Digital Analogies, UTAUT, Computer science Teachers, Developing Countries.

1. Introduction

Technological rapid changes have opened new ways of impacting education which is not out of that. Analogies is one of many types of media integrated learning application Which offers a way of bridging the gaps between unfamiliar concepts through familiar ones into the learning process, this can give learners opportunity to understand new concepts in a new and innovative way where it can enhance both teachers and learners' motivation to provide a rich learning and teaching environment especially if Analog designed in an interactive digital form.

This development in integrating those discoveries in teaching. The obstacles, barriers, and challenges are facing teachers in understanding the way of using those technologies effectively according to their fields of study in educational settings which can be affected by teachers' acceptance involvement in in-service teacher training to evoke their competencies into a proper level (Jwaifell, M., Abu-Omar, A., & Al-Tarawneh, M. 2018). Teachers need to know more about new technologies which they can use to ensure a high quality of learning and teaching environments, besides justifying similes and metaphors in scientific thinking. Analogies used even among students with learning disabilities (Al-Dhaimat, Al-Mohtady, Jwaifell, and Abutayeh, (2020). Using Unified Theory of Acceptance and Use of Technology can give a high overview to predict teachers' behavioral intention to use those technologies in teaching including analogy in a digital form.

1.2 Analogies

Analogy concept refers to the similarities of two systems, as Hajian (2018) Mentioned that Genter (2003) defined analogical comparison with two domains have similar structure, with or without surface features. Glynn (1991) Consider the familiar concept as a source while the unfamiliar as the target. Computer science example as computer system (input, output, and process devices) considered as a target while the human system (senses and brain) is the source, as both constructed in similar structural-common relational roles.

Interactive Digital Analogies (IDA) refers to presenting the source and the target digitally with interactive features as a physical simulation. Though, the researcher defined IDA as "Digitized two similarities (source and target) systems that allow the user to observe similarities by one system to the other by choosing one of one of the systems' elements. Figer 1 showing a screenshot of IDA for learning computer system hardware as a target and human senses as a source.

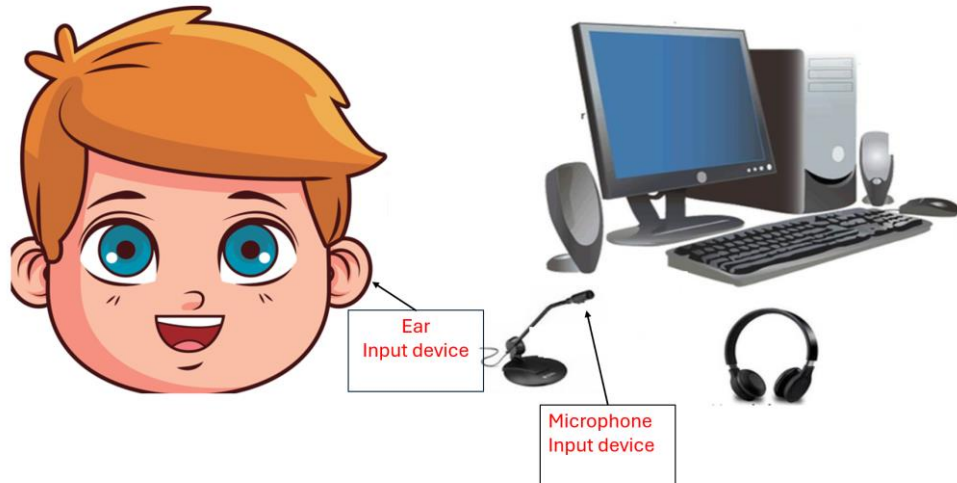


Figure 1: Screen shot for IDA (some elements removed for simplifying)

When the learner moves over or clicks the mouse pointer on one of the elements of the source the Concurrently the element will appear in the other system (Target).

1.2. 1 IDA and its role in Learning

This interactive and dynamic complex environment give the opportunity for students to consider and think more about using technologies (Leinhard & Greeno, 1986; Spiro, Fletovich, Jacobson & Coulson, 1991) this goal can be achieved if teachers have good attitudes and establish their acceptance of new technologies though acquiring more competencies to practice and design rich learning\teaching environments based on those technologies.

The analogies can be not only in a concrete (physical) form of systems for the source or the target, but it may also take similarity between two concepts. For example, Parham-Mocello, Erwig, and Nieves (2024) used analogies for computer science abstract cognitive concepts by considering a story game as source and the content of introduction of computer science as a target. Alizadeh et al (2015) used an analogy in computer science tutorial dialogues. Saxena, Singh, and Gupta (2023) used analogies as a similarity of procedural objective in teaching process control block in computer system as a target, versus managing patient file to examine the patient at the emergency section. Scholars used physical analogies in teaching computer science concepts such as

Giacaman (2012) investigates using analogies and live coding to teach parallel computing system as a target versus physical analogy (house building) as a source. Galloway (1992) stated that teaching with analogies can have a positive impact on students for understanding and ability to explain computing. In learning and teaching, analogies can give critical benefits :

- 1) Schema induction: acquired through comparison where the comparison needs abstractions and deep knowledge which need preserving and storing in the memory (Murphy & Panchanadam, 1999; Brown & Clement, 1989; Gick & Holyoak, 1980; Gick & Holyoak, 1983). After schemas analogy can work as facilitator for transferring structural similar cases (Hajian, 2018)
- 2) Developing higher order cognition and expert-like thinking (Hajian, 2018): Analogies need the students to compare and relate and store information in memory (Lewis & Smith, 1993; Richland & Simms, 2015) which can be happened through reasoning.
- 3) Modifying alternative concepts: Through more understanding and clearing the target in analogies, Hajian (2018) mentioned that Schollum et al (1981) revealed that analogies reduce misconception between Force and Momentum by using analogies.

in addition, IDA can add more benefits with respect to Interactivity: it can give self-control in when they interact with source/target back and forward, experience and practice any time, and repetition till the objectives achieved. IDA still needs more research about its' impact on different strategies and different disciplines as a new framework of using analogies digitally in interactive ways. Using new technologies starts with people who are going to use and benefit from it. Exploring teachers' acceptance of using and integrating IDA in learning/teaching situations are essential for their intention to use it.

1.2. 2 Model of Unified Theory of Acceptance and Use of Technology (UTAUT)

Based on Venkatesh et al's (2003) model of UTAUY for ICT acceptance, which is a triad construct representing integrating and use of ICT, scholars investigated (UTAUT) model and analyzed teachers' performance expectancy, effort expectancy, and social influence to predict behavioral intention, in addition facilitating condition to predict use of behavior, where Blut et al (2021) analyzed UTAUT to explore challenging its validity. Researchers used the UTAUT model



to investigate the use of different types of ICT for different disciplines in education.

Researchers used UTAUT to examine teachers' acceptance of ICT in teaching, for instance in Jordan Al-zboon, Gasaymeh & Al-Resa'i (2021) and Birch & Irvine (2009) investigated teachers' attitudes toward integrating ICT in their educational practice by UTAUT model, Abbad (2021) analyzed students' intentions to use their actual usage of Moodle by using UTAUT model. In Ghana for instance Kolog (2015) used UTAUT to predict students' their behavioral intention to adopt and use e-counseling. It is obvious that researchers have confidence in the UTAUT model in developing countries.

The researcher examined computer science teachers' acceptance of using IDA in teaching, which is as the researcher knowledge there is a paucity in the literature that examined integrating IDA in teaching computer science and understanding teachers' acceptance for using IDA in teaching in the Arab countries.

1.2. 3 Rationale of the Study and Research Questions

In this study according to researcher's experience: Computer science teachers are very close and familiar in using digital technologies with respect to their field of study. They are teaching how to design and programming by using computer languages, authoring systems and using application systems. In the other hand, they have lack of lack competencies to use technologies in their teaching process practice. For that ministry of education in Jordan enroll them in training programs about teaching strategies and using audio visual aids in teaching. There still is a shortage of research of computer science teachers acceptance of using new technologies such as Interactive Digital Analogies (IDA), therefore this study was conducted under the claim that in-service science teachers in Amman and Madaba Directorates have no prior knowledge about IDA and hot to use it in teaching, thus their acceptance in the use of this technology may very limited, especially that IDA was limited as similarity without interactivity. Therefore, this study is aimed at determining Amman and Madaba Directorates computer science teachers' acceptance for integrating and intention to use IDA, by answering the following questions:

- 1) What are the acceptance degrees of in-service computer science teachers in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance

Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions?

- 2) Is it possible to predict the degree of computer science teachers' Behavioral Intentions for using IDA in teaching through the degree of Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions?
- 3) Are there statistically significant differences at ($\alpha \leq 0.05$) among the means of in-service computer science teachers' responses in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions according to the study variables (directorate, Gender, years of experience, Academic Level)?

1.2. 4 The Study Significance

- 1) The study explores Teachers' accepting of a new technologies IDA as a new technology that has an impact in teaching computer sciences for better leaning unfamiliar concepts through other familiar ones.
- 2) The study tool is applied in a governmental school, namely, Amman and Madaba governorates. It is hoped that its results will contribute to enhancing the process of teaching and learning Computer sciences and teaching strategies in those schools.
- 3) Hopefully, the study results and recommendations will have an impact on decision-makers in the Ministry of Education to take decisions and procedures that will enhance teaching and learning process in schools.
- 4) The study examines the relationship between teachers' acceptance of IDA behavioral intention to use it in teaching. Besides predicting, which are of great importance in managing educational institutions.
- 5) In the light of its results, the study presents a set of recommendations that contribute to enhancing the teachers' competencies and career development in schools.

1.2. 5 The Study Objectives:

The study aimed at:

- 1) Determine the degree of computer science teachers' acceptance of using IDA in teaching computer sciences.

- 2) Recognize if there are statistically significant differences at ($\alpha \leq 5.05$) between the means of in-service computer science teachers' responses in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions according to the study variables: directorate, Gender, stage, years of experience, and age.
- 3) Identify the possibility to predict the degree of teachers' IDA usage in teaching through the degree of their Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions according to the study variables: directorate, Gender, years of experience, Academic Level.

1.2. 6 The Study Limitations:

- 1) Geography: schools of Amman first directorate and Madaba governorates - Jordan.
- 2) Time: The academic year 2023/2024.
- 3) Human: computer science teachers at Amman and Madaba directorate formal schools.
- 4) Study limitations: The study results are determined by the method of sample selection, the validity and reliability of the study tool that is based on the modified model of UTAUT, and the statistical procedures used to answer its questions.

1.2. 7 Procedural Definitions

Interactive Digital Analogies (IDA): Digitized representations of two Systems (source and target) that enable Learners to explore structural similarities through interactive features.

Teachers' Acceptance: It is the computer science teachers' sense of satisfaction that motivates them to use IDA in teaching according to the modified model of UTAUT, measured by the degree of the study participants' response to the study tool domains: Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions.

2. Method

The descriptive and analytical methodology research design was used in this study. The researcher conducted a survey using an online questionnaire for collecting data out of teachers who teach computer science in Jordanian schools according to UTAUT Model.

2. 1 The Study Population and Sample

The population of the study consisted of (175) in-service computer science teachers (122) from Amman and (53) from Madaba governorates in Jordan, while the participants who responded resample the sample of this study which consisted of (143) teachers; (99) from Amman first directorate of education (Qasabet Amman) and (44) from Madaba directorate of education (Qasabet Madaba). The total percentage was (82%) of the population; (81%) from Amman and (83%) from Madaba Governorate. The participants were enrolled voluntarily in this study, reading the brochure of IDA and responding to the online survey.

Table 1. Demographic variables of the Sample

Directorate	Gender		Total	Years of Experience			Total	Academic Level		Total
	Male	Female		1-5	6-10	≥11		First Degree	Higher Studies	
Amman	46	53	99	18	17	64	99	60	39	99
Madaba	21	23	44	10	5	29	44	27	17	44
Totals	67	76	143	28	22	93	143	87	56	143

The researcher' main concern was to measure the acceptance degree of Amman and Madaba Governorate in-service computer science teachers for integrating IDA in teaching according to UTAUT model and its domains in order to understand the whole picture of their aptitudes predicting their behavioral intention to use it, and give recommendations to the administration of Ministry of Education in Jordan, and universities for better understanding when planning for teachers' training and pre-service training.

2. 2 Ethics

The study was approved by the Directorates of Education for the Governorates of Amman and Madaba, in addition it was approved by Al-Hussein Bin Talal University Research Ethics Committee at the Faculty of Education. Names of the participants unrevealed.

2. 3 The Measurement Tool

The study used the modified UTAUT model (Kreishan & Jwaifell, 2022; Jarrar, 2023; Al-zboon, Gasaymeh & Al-rsa'i, 2021) as a measurement tool for measuring the acceptance degree of the teachers. When analyzing the items' content, it appeared to the researcher and

the four referees that those items are suitable for investigating computer science teachers' acceptance of using IDA in teaching and have no cultural biases. The Arabic version of the questionnaire tool and the brochure which gives a preview of IDA concept, use, and example of it, were validated by four referees of Al-Hussein Bin Talal university's instructors. The reliability of the questionnaire was calculated within applying the study using Cronbach's Alpha Coefficient beside the correlation between the factors its factors and the total, as shown in Table 2:

Table 2. Reliability of the Modified UTAUT

Factor	Item	Cronbach's Alpha	Pearson correlation
(PE)	I believe that the use of IDA in teaching would be helpful. I believe that the use of IDA will make it easy to me to Explain computer concept. I believe that the use of IDA will increase my teaching productivity. I think that the use of IDA will motivate my students for learning.	0.932	0.928**
(EE)	I believe it will be easy for me to learn how to use IDA in teaching. I believe the IDA is clear and understandable in teaching computer science. I believe IDA does not need high skills to use. It is easy for me to use IDA in teaching	0.776	0.876**
(SI)	I think my students will want me to continue using IDA in teaching them. I think school administration will support me in using IDA for educational purposes. I believe that my fellow teachers and students' parents will encourage me to use IDA for educational purposes. I think the school administration wants me to use IDA for educational purposes.	0.871	0.869**
(FC)	There are enough resources in the school to use IDA. I have the knowledge necessary to use IDA in my teaching. There is enough software in my school	0.839	0.882**

Factor	Item	Cronbach's Alpha	Pearson correlation
	compatible with IDA for editing. I can enlist the help of someone who can help me navigate my difficulties when using IDA in my teaching		
(BI)	I intend to use IDA in the future for teaching. I plan to develop learning/teaching situations based on IDA in the future. I will continue using IDA in Teaching in the future. I will recommend my colleges to use IDA	0.938	0.959**
Acceptance		0.974	

** Correlation is significant at the 0.01 level (2-tailed)

Measurement scale of the tool was reformed into three levels of acceptance as shown in table 3:

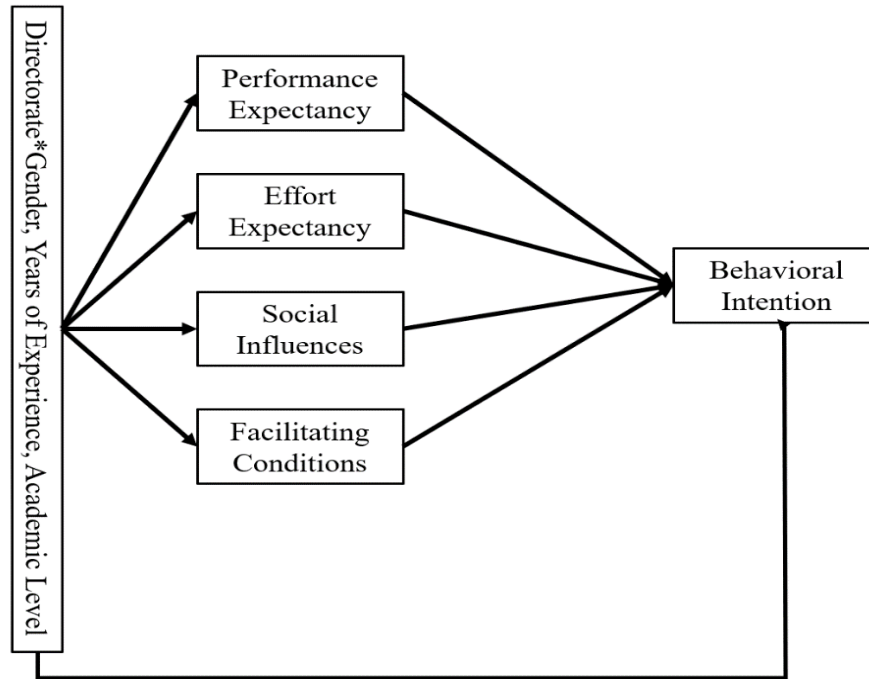
Table 3. Scaling acceptance levels

Strongly diss agree	diss agree	Neutral	Agree	Strongly agree
1	2	3	4	5
1-2.33	2.34-3.67			3.68-5
Weak Acceptance	Medium Acceptance			high Acceptance

2. 4 The research Design

To answer the study questions, teachers participated in a brief zoom meeting and read a brochure illustrating IDA concept, design and usage in teaching and learning situations regarding computer science. The brochure and the measurement tool were uploaded to google forms to be answered online for all teachers who attend or did not attend the zoom meetings. The developed model of UTAUT in this research is designed as the following:

Figure1. The design of the study



The study context can be mapped as the following:

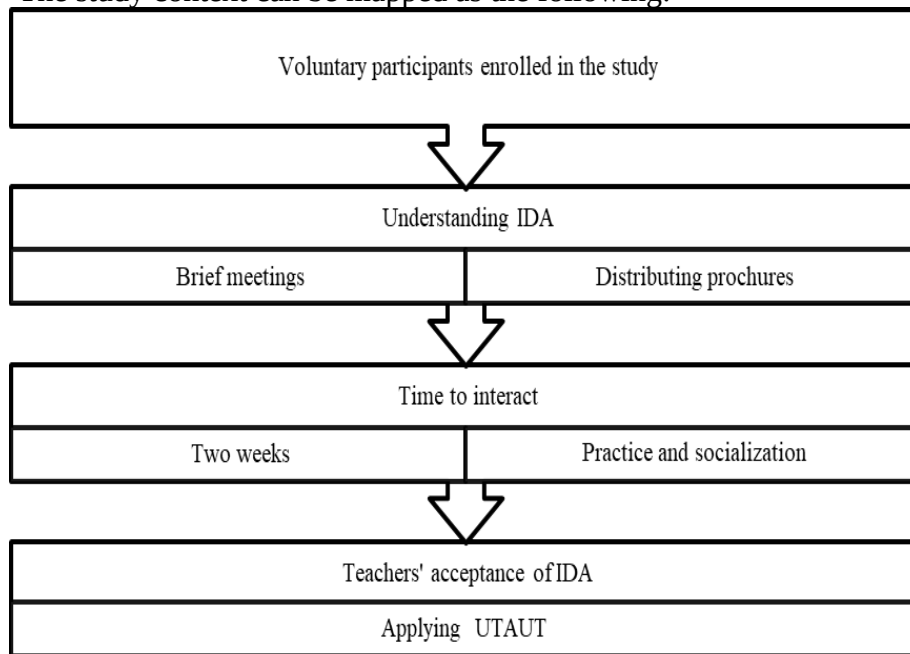


Figure1. The context of the study

2. 5 Variables

The measured variable: Level of Acceptance of IDA Measured by the degree of teachers' responses according to the modified UTAUT model.

The predictor (Dependent) variables: the factors of the modified UATUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions).

The predicted (Independent) variable: Computer science teachers' behavioral intention to use IDA in teaching.

The classified variables are: (Directorate (Amman, Madaba), Gender (Male, Female), Years of experience (1-5, 6-10, 11 years or more), Academic level (First Degree, Higher Studies).

2. 6 Data Analysis

The gathered ratio data classified and analyzed to answer the study question. Hence the classified variables have one, two or three levels; different types of statistical procedures were used: One sample t-test was used to answer the first question, while regression analyses were used to answer the second question, and ANOVA and paired sample t-test were used for answering the third question.

3. Finding and Discussion

The Analyses of the resulting ratio data were performed using descriptive statistics. Descriptive measures including means and standard deviations for UTAUT factors were calculated to answer the questions of the study. These descriptive statistical measures were also tabulated and reported for classified variables (directorate, gender, years of experience, and academic level) to determine the teachers' acceptance for using IDA according to the modified UTAUT model as shown in tables each question of the study as follows:

Results of Q1: What are the acceptance degrees of in-service computer science teachers in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions)?

Means and standard deviations were calculated of teachers' responses according to the modified UTAUT model and its factors, while the analyses of One sample t-test for means differences with (df=142) where used to determine the teacher's acceptance in using IDA in teaching:



Table 4. Results of one sample t-test

Factors	Acceptance		Crucial Score	T value	Sig	Level
	Mean	SD				
Performance Expectancy (PE)	4.11	.66	3.67	7.933	.000(a)	High
Effort Expectancy (EE)	3.90	.58	2.33	4.734	.000(a)	High
Social Influences (SI)	3.83	.67	3.67	2.875	.005	High
Facilitating Conditions (FC)	3.17	.74	2.33	13.551	.000(a)	Medium
Behavioral Intentions (BI)	3.89	.74	3.67	3.554	.000(a)	High
Acceptance	3.78	.61	3.67	2.143	.034	High

As shown in Table (4), the means of IDA Acceptance ranged between (3.17 - 4.11) with a medium level of acceptance for effort expectancy and facilitating conditions, and high level for effort expectancy, performance expectancy, social influences, and behavioral intentions besides the overall acceptance level. The highest mean was for performance expectancy (M=4.11, SD=0.66), followed behavioral intentions (M=3.90, SD=0.57) and effort expectancy (M=3.90, SD=0.58) .

There were observed differences between the degree of teachers' acceptance of using IDA in teaching for the factor FC and the crucial score (2.33) which represents the upper limit of the weak degree, and the factors: PE, EE, SI, BI, and the total acceptance degree, and the crucial score (3.67) which represent the upper limit of the medium degree. To examine the significance of the observed differences, the results of One-sample t-test showed that there is a statistical significance at ($\alpha \leq 0.05$). Therefore, the degree of computer science teachers' acceptance factors FC at the Medium level, and PE, EE, SI, BI, and Acceptance are at the High level.

In general, the results were consistent with other studies conducted for investigating teachers' acceptance of using ICT in teaching, particularly in computer science and analogies, but in this study the main objective is IDA which the researcher didn't find any study about it.

This result can be explained by the fact that computer science teachers are very close to IDA concept with respect to interactivity with digital programs, while the degrees of acceptance concern Analogy itself is a new thing for most of them. This . The teachers seek to improve their competencies for having more career improvement, which depends on their productivity as ministry of education in Jordan committed promotions to teachers' productivity in teaching.

Results of Q2: Is it possible to predict the degree of computer science teachers' Behavioral Intentions for using IDA in teaching through the

degree of Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions?

To answer the second question by measuring the relationship between the degrees of PE (M=4.11, SD=0.66), EE (M=3.16, SD=0.76), SI (M=3.83, SD=0.67), and FC (M=3.17, SD=0.74), and its relation to the degree of Teachers' BI to use IDA, the multiple linear regression analysis was used by 'Enter' method through entering all the independent variables in the linear regression equation. Table 5 showing the correlation matrix:

Table 5. Pearson Correlation Test between factors of acceptance and behavioral intention (N=143)

Factor	BI	PE	EE	SI
PE	.905**			
EE	.810**	.765**		
SI	.804**	.762**	.690**	
FC	.804**	.755**	.727**	.670**

**: ≤ 0.01

Out of 5 table 5 the correlation coefficients between factors of acceptance (PE, EE, SI, & FC) and BI are correlated positively. The correlation ranged between (0.67-0.905), indicating a direct proportion between factors and behavioral intention to use IDA. Table 6 summarizes the results of the regression analysis:

Table 6. Summary of Multi Regression Results (Constance= -0.598)

Dependent Variable	R	R ²	F	df	Sig	Independent Variable	β	T	Sig
	.939	.882	258.462	3, 138	.000(a)			-3.784	.000(a)
BI						PE	.553	8.893	
						EE	.218	3.449	.001
						SI	.208	3.986	.000(a)
						FC	.178	3.711	.000(a)

It was noted from the table that the values of the correlation coefficient were ($R = 0.939$), while ($R^2 = 0.882$) and the Adjusted R^2 was (0.879), meaning that the independent explanatory variables (PE, EE, SI, & FC) of IDA could explain almost (88%) of the variables in (the degree behavioral intention to use IDA) and the rest (12%) was attributed to other factors. of, Effort Expectancy, Social Influences, Facilitating Conditions

As observed from the analysis of ANOVA, the value ($F=258.642$) calculated from the sample is statistically significant at ($\alpha \leq 0.05$), which confirms the high explanatory power of the multiple linear regression model. It is also concluded that the independent variables (PE, EE, SI, & FC) were statistically significant according to t-test at ($\alpha \leq 0.05$).



Based on the results of the regression analysis, the degree of computer science teachers' behavioral intention of using IDA in teaching can be predicted through the degree of (PE, EE, SI, & FC). Linear regression equation was concluded using the Unstandardized Coefficient Beta of the factors acceptance:

Computer science teachers' behavioral intention to use IDA in teaching=

$$(0.553 * \text{Performance Expectancy}) + (0.551 * \text{Effort Expectancy}) + (0.553 * \text{Social Influences}) + (0.551 * \text{Facilitating Conditions}) - 0.598$$

It can be noted from this result that it is possible to predict the degree of computer science teachers' behavioral intention of using IDA in teaching through the degree of Performance Expectancy, Effort Expectancy, Social Influences, and Facilitating Conditions at Amman and Madaba directorates.

Results of Q3: Are there statistically significant differences at ($\alpha \leq 0.05$) among the means of in-service computer science teachers' responses in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions according to the study variables (directorate, Gender, years of experience, Academic Level)?

To answer the third question, means and standard deviations were calculated to examine the differences of teachers' responses according to UTAUT model for the study variable based on their directorate (Amman Madaba) and overall Acceptance (A), for each variable (Gender, Years of Experience, & Academic Level):

1) Results of Directorate*Gender:

. Table 6. Means and standard deviations according to directorate and gender

Factor	Amman (N=99) Male (N=46) Female (N=53)						Madaba (N=44) Female (N=34) Male (N=21)						Total (N=143) Male (N=67) Female (N=76)					
	Male		Female		Sum		Male		Female		Sum		Male		Female		Sum	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
PE	4.07	.77	4.04	.67	4.00	.05	4.34	.45	4.15	.59	4.24	.53	4.16	.69	4.07	.64	4.11	.66
EE	3.97	.64	3.79	.64	3.87	.65	4.03	.25	3.89	.47	3.96	.38	3.99	.55	3.82	.59	3.90	.58
SI	3.88	.77	3.77	.71	3.82	.74	3.88	.51	3.83	.47	3.85	.49	3.88	.69	3.79	.64	3.83	.67
FC	3.24	.84	3.08	.75	3.16	.79	3.23	.64	3.16	.60	3.19	.61	3.24	.78	3.11	.71	3.17	.74
BI	3.84	.92	3.84	.76	3.84	.83	4.07	.38	3.92	.50	3.99	.45	3.91	.80	3.87	.69	3.89	.74
A	3.80	.73	3.70	.65	3.75	.68	3.91	.35	3.79	.46	3.85	.41	3.86	.63	3.73	.60	3.78	.61

Table 6 shows observed differences between the means of acceptance for using IDA in teaching according to directorate and gender of

teachers. Univariate Analysis of Variance ANOVA (UNIANOVA) was conducted to examine means differences as shown in Table 7: Table 7. Summary of UNIANOVA according to directorate and gender of teachers

Source of Variance		Sum Squares	df	Mean Square	F	Sig.
PE	Directorate	1.116	1	1.116	2.539	.113
	Gender	0.391	1	0.391	0.889	.347
	Directorate*Gender	0.202	1	0.202	0.460	.499
	Error	61.091	139	0.440		
EE	Directorate	0.198	1	0.198	0.597	.441
	Gender	0.801	1	0.801	2.406	.123
	Directorate*Gender	0.017	1	0.017	0.052	.820
	Error	61.091	139	0.333		
SI	Directorate	0.025	1	0.025	0.056	.813
	Gender	0.210	1	0.210	0.465	.496
	Directorate*Gender	0.024	1	0.024	0.054	.817
	Error	62.830	139	0.452		
FC	Directorate	0.027	1	0.027	0.049	.825
	Gender	0.377	1	0.377	0.678	.412
	Directorate*Gender	0.071	1	0.071	0.127	.722
	Error	77.243	139	0.556		
BI	Directorate	0.723	1	0.723	1.309	.254
	Gender	0.161	1	0.161	0.291	.590
	Directorate*Gender	0.170	1	0.170	0.307	.580
	Error	76.770	139	0.552		
Acceptance	Directorate	0.286	1	0.286	0.756	.386
	Gender	0.358	1	0.358	0.954	.333
	Directorate*Gender	0.004	1	0.004	0.010	.921
	Error	52.699	139	0.379		

Results of the UNIANOVA revealed no significant differences at $\alpha \leq 0.05$ between the means of means according to directorate and gender and interactive between directorate and gender at the factors (PE, EE, SI, FC, BI and Acceptance in total).

This result can be referred to equality of teachers' culture, where they have the same cultural background while the two cities are close to each other -distance=21km- and teachers have the same opportunities to reach resources.

2) Results of Directorate*Academic Level:

Table 8. Means and standard deviations according to directorate and academic level

Factor	Amman first-degree (N=60) Higher-Studies (N=39)				Madaba first-degree (N=27) Higher-Studies (N=17)				Total first-degree (N=87) Higher-Studies (N=56)			
	First-degree		Higher-Studies		First-Studies		Higher-Studies		First-Studies		Higher-Studies	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
PE	4.11	.72	3.96	.69	4.29	.50	4.16	.60	4.17	.66	4.07	.64
EE	3.87	.67	3.88	.62	3.99	.40	3.91	.36	3.91	.60	3.88	.55
SI	3.93	.73	3.65	.72	3.81	.55	3.91	.37	3.89	.68	3.73	.64
FC	3.24	.77	3.04	.82	3.23	.68	3.13	.51	3.24	.78	3.07	.74
BI	3.91	.86	3.74	.80	4.04	.41	3.93	.51	3.95	.75	3.80	.72
Acceptance	3.81	.69	3.66	.67	3.87	.41	3.81	.42	3.83	.61	3.70	.61

Table 8 shows observed differences between the means of acceptance for using IDA in teaching according to directorate and academic level of teachers. UNIANOVA was conducted to examine Means differences as shown in Table 9:

Table 9. UNIANOVA summary according to directorate and academic level of teachers

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.
PE	Academic Level	0.528	1	0.528	1.206	.274
	Directorate*Academic Level	1.072	2	0.536	1.224	.297
	Error	60.869	139	0.438		
EE	Academic Level	0.034	1	0.034	0.100	.752
	Directorate*Academic Level	0.262	2	0.131	0.385	.681
	Error	47.256	139	0.340		
SI	Academic Level	0.230	1	0.230	0.522	.471
	Directorate*Academic Level	1.031	2	0.516	1.169	.314
	Error	61.180	139	0.441		
FC	Academic Level	0.643	1	0.643	1.163	.283
	Directorate*Academic Level	0.105	2	0.053	0.095	.909
	Error	76.876	139	0.553		
BI	Directorate	0.549	1	0.549	1.000	.319
	Directorate*Academic Level	0.704	2	0.352	0.642	.528
	Error	76.240	139	0.548		
Acceptance	Directorate	0.344	1	0.344	0.912	.341
	Directorate*Academic Level	0.349	2	0.175	0.463	.631
	Error	52.476	139	0.378		

Results of the UNIANOVA revealed no significant differences at $\alpha \leq 0.05$ between the means of means according to directorate and gender and interactive between directorate and academic level at the factors (PE, EE, SI, FC, BI and Acceptance in total).

Despite the differences according to directorate level academic and as the researcher experience it still that higher studies curriculum still rarely in universities do not point to DA or IDA enough. Thus, This result can be referred to lack of updating curriculum for new technologies.

3) Results of Directorate*Years of Experience:

Table 10. Means and standard deviations according to directorate and years of experience

Factor	Directorate	1-5 years			6-10 years			11 years and more		
		N	Mean	SD	N	Mean	SD	N	Mean	SD
PE	Amman	18	3.69	.82	17	3.92	.71	64	4.19	.64
	Madaba	10	4.12	.51	5	4.36	.43	29	4.26	.56
	Total	28	3.84	.75	22	4.02	.68	93	4.21	.61
EE	Amman	18	3.64	.70	17	3.73	.72	64	3.98	.59
	Madaba	10	3.90	.39	5	3.80	.39	29	4.00	.40
	Total	28	3.73	.62	22	3.75	.64	93	3.99	.54
SI	Amman	18	3.96	.83	17	3.72	.79	64	3.88	.70
	Madaba	10	3.68	.41	5	3.80	.33	29	3.92	.53
	Total	28	3.69	.70	22	3.74	.70	93	3.90	.65
FC	Amman	18	2.89	.90	17	3.00	.85	64	3.28	.73
	Madaba	10	3.20	.66	5	3.35	.65	29	3.16	.61
	Total	28	3.00	.82	22	3.08	.81	93	3.24	.69
BI	Amman	18	3.32	1.04	17	3.75	.82	64	4.02	.73
	Madaba	10	3.95	0.47	5	4.00	.01	29	4.01	.49
	Total	28	3.54	.92	22	3.81	.72	93	4.01	.65
Acceptance	Amman	18	3.45	0.79	17	3.62	.72	64	3.87	.92
	Madaba	10	3.77	0.38	5	3.86	.20	29	3.87	.45
	Total	28	3.56	.68	22	3.68	.65	93	3.87	.56

Table 10 shows observed differences between the means of acceptance for using IDA in teaching according to directorate and academic level of teachers. UNIANOVA was conducted to examine Means differences as shown in Table 9:

means differences as shown in Table 11:

Table 11. UNIANOVA summery, according to directorate and years of experience of teachers

Factor	Source of Variance	Sum of Squares	df	Mean Square	F	Sig.
PE	Years of Experience	2.016	2	1.008	2.407	.094
	Directorate* Years of Experience	2.053	3	0.684	1.633	.185
	Error	57.393	137	0.419		
EE	Years of Experience	1.343	2	0.672	2.041	.134
	Directorate* Years of Experience	0.472	3	0.157	0.478	.698
	Error	45.081	137	0.329		
SI	Years of Experience	1.031	2	0.515	1.139	.323
	Directorate* Years of Experience	0.058	3	0.019	0.043	.988
	Error	61.995	137	0.453		
FC	Years of Experience	0.603	2	0.302	0.550	.578
	Directorate* Years of Experience	1.353	3	0.451	0.822	.578
	Error	75.127	137	0.548		
BI	Years of Experience	2.798	2	1.399	2.738	.068
	Directorate* Years of Experience	2.798	3	0.933	1.826	.145
	Error	69.995	137	0.511		
Acceptance	Years of Experience	1.398	2	0.699	1.909	.152
	Directorate* Years of Experience	0.889	3	0.296	0.809	.491
	Error	50.178	137	0.366		

Results of the UNIANOVA revealed no significant differences at $\alpha \leq 0.05$ between the means of means according to directorate and gender and interactive between directorate and years of experience at the factors (PE, EE, SI, FC, BI and Acceptance in total). Which means that years of teachers' experience didn't affect the change of their Acceptance.

It can be concluded that there are statistically significant differences at ($\alpha \leq 0.05$) among the means of in-service computer science teachers' responses in Amman and Madaba Directorates for integrating IDA in teaching according to UTAUT model (Performance Expectancy, Effort Expectancy, Social Influences, Facilitating Conditions and Behavioral Intentions according to the study variables (directorate, Gender, years of experience, Academic Level)

3. Conclusion

This study revealed the changes in computer science teachers' acceptance for using integrating Interactive Digital Analogies in teaching when they can experience new technologies such as IDA. These findings have implications for efforts to use IDA in teaching as an effective tool. The results of this descriptive research help to clarify the aptitude of computer science teachers to use new technologies such as IDA. For example, policy makers can take advantages of technology and integrating them into learning/teaching situations and give more attention in considering a budget for using IDA in schools and training teachers. The study recommends more experimental studies if IDA has more impact in achievement rather than other technologies.

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