



Journal of University Studies for inclusive Research (USRIJ)  
مجلة الدراسات الجامعية للبحوث الشاملة

**Journal of University Studies for inclusive Research**

**Vol.6 , Issue 14 (2022 ), 2632 - 2665**

**USRIJ Pvt. Ltd.,**

**عنوان البحث:** تصورات المتعلمين حول استخدام الفيس بوك في التعليم: استكشاف المتغيرات الكامنة بناءً

على تحليل العامل الاستكشافي والتأكيدي.

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**Research title:** Learners' Perceptions about the Use of Facebook in Education: Exploring Latent Variables Based on Exploratory and Confirmatory Factor Analysis.

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## المخلص

على مدى العقدين الماضيين، كان المربون والباحثون يجرون بحثاً حول الفوائد المحتملة لاستخدام الفيسبوك في التعليم، ويبدو أن القليل من هذه البحوث تبنى طرق تحليل المتغيرات الكامنة، كما تم اتباعه في هذه الدراسة. ومن أجل مساعدة كافة الأطراف ذوي العلاقة بالعملية التعليمية في استخدام الفيسبوك بالتعليم بطريقة مناسبة، ولتحقيق المطلوب، سعت هذه الدراسة لنمذجة استخدام الفيسبوك في التعليم من خلال نموذج مبني على تصورات المتعلمين.

تألفت عينة الدراسة من ٣٨١ من الطلاب من كافة محافظات فلسطين واستخدمت أسلوب الاستبيان الإلكتروني في جمع البيانات، واعتمدت المنهج الوصفي كأساس لتصميم البحث مع استخدام طرق احصائية لدراسة المتغيرات الكامنة وتحليل العناصر المكونة لها من أجل الوصول للنتائج.

تمكنت الدراسة من تحديد أربعة عوامل لاستخدام الفيسبوك في التعليم التي تدعو الطلبة والمعلمين إلى استخدام الفيسبوك في التعليم، وقدمت نموذجاً يمكن اعتماده لهذه الغاية.

**الكلمات المفتاحية:** استخدام الفيسبوك في التعليم، المتغيرات الكامنة، تحليل العامل، تحليل العامل الاستكشافي، تحليل العامل التأكيدي.

## **Abstract**

Over the past two decades, educators and researchers have been conducting research on the potential benefits of using Facebook in education, and little of this research appears to adopt methods of analyzing latent variables, as was followed in this study. In order to help all parties related to the educational process to use Facebook in education, this study sought to model the use of Facebook in education through a model based on learners' perceptions.

The study sample consisted of 381 students from all governorates of Palestine and used the electronic questionnaire method in collecting data and adopted the descriptive approach with the use of statistical methods to discover the factors of using Facebook in education.

The study was able to identify four factors of the use of Facebook in education, that invites students and teachers to use Facebook in education and provided a model that can be adopted for this purpose.

**Keywords:** Use of Facebook in Education, Latent Variables, Factor Analysis, Exploratory Factor Analysis, Confirmatory Factor Analysis.

## **Learners' Perceptions about the Use of Facebook in Education: Exploring Latent Variables Based on Exploratory and Confirmatory Factor Analysis**

## **INTRODUCTION**

At the threshold of today's technological age, the human community has reached an advanced point in its use of social networking tools, particularly Facebook. There's

no doubt that these tools have enabled people in the whole world to share their thoughts, information, joys and sorrows, and have created a virtual world known to everyone, which has become an important source and means for the exchange of knowledge among people in all fields. According to *Statista (2021a)*, a research expert covering internet and e-commerce, the number of active Facebook users in 2020 has reached more than 2.7 billion. Moreover, *Statista (2021b)*, also reported the number of Facebook users in the Middle East region, which includes 93.1 million. According to World Population Review the population in Palestine in 2020, is 5,101,414 (*WPR, 2021a*), and the number of Facebook users are 2,677,000 (*WPR, 2021b*).

It is known that Facebook is a social networking tool that was created in the beginning for student communities in different colleges and became later used by people like other social networking tools to communicate in various social matters (*Donath & Boyd, 2004; Stutzman, 2006; Walther et al., 2008*). Facebook today is considered the most popular social networking medium in the world (*Fithriani et al., 2019; Lutzke et al., 2019*). Numerous research indicate its important uses in communication between students and teachers (*Fithriani et al., 2019; Hershkovitz & Forkosh-Baruch, 2019; Toker & Baturay, 2019*). Soon in this research, a lot of literature will be reviewed, which outlines the possibilities of using Facebook in education.

Before reviewing the global literature on the use of Facebook in education, it is worth noting a group of exciting research on the use and benefit of Facebook conducted in the countries near to Palestine, from which the study sample will be taken. In Egypt, *Zoghaib (2016)* referred to students' communication and collaboration in

completing graduation assignments and students' inquiries about learning events. *Kayri and Cakir (2010)* from Turkey, suggested that the availability of social networks such as Facebook in virtual environments encourages the continuity of lifelong learning. In Iran, *Akbari et al. (2015)* indicated that Facebook was able to increase the degree of competence of a group of doctoral students. In addition, a study of students from Iraq, has emphasized that the use of Facebook may effectively support communication, information exchange and cooperation for students in higher education contexts (*Dabner, 2012*).

An investigation of Facebook usage by university students in Saudi Arabia, showed that Facebook aided intercultural and gender communication and enabled discussion and analysis of educational matters (*Aljasir, 2015*). In Yemen, *Alotumi (2015)* stated that, besides positive students attitudes on using Facebook, it effectively helps them in identifying learning topics, forming better thinking, brainstorming and mind mapping as well as acquiring and practicing what they learn. In Syria, *Alshiekhly et al. (2015)* said that Facebook allowed Syrian dentistry students to discuss topics more openly in a flexible environment and also that it might be a useful platform for teaching aspects of a theoretical instruction in dentistry. *Bsharah et al. (2014)* from Jordan, indicated that Facebook could benefit students' social skills and intelligence.

One study of students from a university in United Arab Emirates UAE, *Mouakket (2015)* has indicated that there are perceived usefulness, satisfaction and enjoyment by students who used Facebook in their learning. In a study that included learners from Lebanon, the results indicate valuable and beneficial effects for universities and educators on the effective use of Facebook in learning (*Moorthy et al., 2019*). Another study in Oman, results showed that Facebook helped learners think

critically, engage in a collaborative community, and encouraged them to monitor their progress, and teachers had positive attitudes toward social networks (*Alkhoudary, 2018*).

One study in Palestine, suggests that social networks, including Facebook, may provide a virtual space for informal learning, student interaction, and scientific knowledge sharing (*Battrawi & Muhtaseb, 2012*). In Kuwait, results of a case study of effectiveness of Facebook in English language learning indicated that Facebook actually helped students improve their efficiency by providing an interactive and a multimedia environment (*Faryadi, 2017*). In addition, a study in Qatar, indicated that the use of Facebook contributed to knowledge sharing, ease of use, and a positive impact on student learning. Another study in Bahrain, showed that Facebook has some technological affordances for education (*Wang et al., 2012*). In Cyprus, one study showed that Facebook can bring positive change in teachers' opinions and can improve students' learning skills (*Bicen & Uzunboylu, 2013*).

Initially, and before mentioning more of the possibilities about using Facebook in education, it is necessary to mention significant research in this area. The researcher considers it an essential reference for his research. It goes back to *Mazman and Usluel (2010)* those who drill their first research that aimed to design a structural model that shows how Facebook can be used in education, and explained aspects of its use as an educational tool.

Some educational research has indicated that Facebook can be used in educational contexts and in various ways (*Bosch, 2009; Lee & Teh, 2016; Ventura & Quero, 2013; Willems & Bateman, 2013*). Many researchers indicated that the use of

Facebook increases cooperation between teachers and students and increases confidence between them (*Çoklar, 2012; Cunha Jr et al., 2016; Hosny & Fatima, 2012; Mazer et al., 2009*), while others concentrated on its ability to provide students with a varied educational experiences, which is why teachers are encouraged to integrate social networks into their (*Bartlett-Bragg, 2021; Nazir & Brouwer, 2019; Petrović, 2014*).

A large group of researchers indicated that Facebook promotes cooperation and collaborative learning among college students in diverse educational settings (*Al-Tamimi et al., 2018; Bahati & Practice, 2015; Cedeño et al., 2020; Chen & learning, 2015; Cheung et al., 2011; Cunha Jr et al., 2016; Davidovitch & Belichenko, 2018; Latorre & Santana, 2020; Menzies et al., 2017; Zincir, 2017*). Others focused on the important role of Facebook for students' communication with each other or with their teachers (*Aamir, 2015; Al-Tamimi et al., 2018; Allen, 2012; Bosch, 2009; Cunha Jr et al., 2016; Petrović et al., 2012; Susilo, 2014*). Furthermore, there is considerable research indicating that Facebook is a tool that can enhance students' learning or students' experiences in different contexts and settings (*Awidi et al., 2019; Chaka & Govender, 2020; Jumaat et al., 2019; Kumar & Syed, 2020; Petrović, 2014; Sirivedin et al., 2018; Zarzour et al., 2020*).

Below is a presentation of the findings of the most important literature that was relied upon to derive the questionnaire questions in this study.

One study showed that Facebook improves communication between teachers and students and helps potentially develop a sustainable relationship between them, it also contributes to the student engagement for joint collaboration with teachers and



students have adopted Facebook groups are to organize the learning process among themselves (*Cunha Jr et al., 2016*). Furthermore, Facebook is easy to use and popular technology, it can improve teacher-student interaction, it is working positively in the information dissemination process, it also raises the interest of learners and offers an opportunity for students interaction (*Çoklar, 2012*). In addition, Facebook groups have an educational potential to be used by students for peer-to-peer learning without a teacher (*Dalsgaard, 2016*).

According to a study that investigated the possible educational use of Facebook in higher environmental education, it turns out that Facebook is a potential educational tool, it increases student productivity and is a good medium to engage students more broadly in education processes (*Petrović et al., 2012*). Moreover, a Facebook group has the potential to be used as an online tutorial complements where the Facebook enables students to easily communicate and interact with peers (*Susilo, 2014*). Another recent study stated that Facebook can enhance student engagement and it is a great blessing for making the learners creative (*Afroz et al., 2020*).

In terms of collaboration and achievements, one study had emphasized that Facebook enables collaborative learning, it can improve course quality and it can improve students' achievements (*Davidovitch & Belichenko, 2018*). In addition, another study by *Cedeño et al. (2020)* also confirmed the potential of Facebook to promote the collaborative learning. Another study that was interested in the role of Facebook networks as information sources, it discovered that it plays a role as a source of information for college students (*Jeon et al., 2016*). Moreover, *Moorthy et al. (2019)* stated that Facebook can be used as an educational tool if its perceived



usefulness is improved among students. Additionally, *Chugh and Ruhi (2018)* stated that Facebook provides convenience of learning and higher engagement.

*Allen (2012)*, in his article titled “An Education in Facebook”, he claimed that the use of Facebook in education is natural, challenges traditional notions of university education and also it challenges traditional communication methods and relationships between students and teachers. In another study by *Nazir and Brouwer (2019)*, on the community of inquiry on Facebook in Higher Education settings, they concluded that incorporating educational activities with Facebook has positive impacts on student learning and that Facebook has more positive influences on students with teacher presence.

A study by *Saikaew et al. (2011)*, it discovered that Facebook may be used among learners for discussion, may be used among learners to share documents and that it has an excellent potential to serve as a lifelong learning channel for teachers and students. Once again, *Çoklar (2012)* study, that evaluated students using Facebook as an educational environment in Turkey, stated that Facebook has attractive features that stimulate teaching, it has features that gain students time to learn, it also has features that facilitate quick access to information and even it has features that make learning fun for students.

A study on the potentials and pitfalls of social networking tools such as Facebook in Higher Education settings had stated that Facebook offers students and teachers in formal education an opportunity to share ideas that provides instant feedback for learners (*Willems & Bateman, 2011*). In addition, a study on students’ attitude toward the formal integration of Facebook in their education, at Al Hussain Bin Talal

University in Jordan, the researchers stated that students have high positive attitudes toward the formal integration of Facebook in their education and that the possibility of Facebook integration with formal education is due to its characteristics such as ease of use the ability to experiment and observability by students.

Many old and new studies examined the use of Facebook in education with students studying English as a second language (*Adi Kasuma & Ai Lin Tan, 2019; Mirani et al., 2020; Shukor & Noordin, 2014; Yunus et al., 2011*), confirmed the capabilities of Facebook, including one study by *Kumar and Syed (2020)*, who stated that Facebook is a suitable environment for language learning as it works to enhance language skills, including reading, writing, vocabulary and grammar. According to the researchers, students in general demonstrate positive perceptions of this environment. Therefore, they recommended the teachers who teach English as a second language in Pakistan, the country of study, to organize their lessons in a way that includes the use of Facebook.

A study of the use of Facebook in distance learning in Islamabad stated that teachers can employ Facebook for course projects to enhance communication and engage students in a procedure that might not be fully possible in traditional classroom settings and furthermore that Facebook is an unbelievable learning tool (*Aamir, 2015*). Results of another study explained that Facebook is a resource with great educational potential in which it encourages more active participation of students in their learning. Moreover, a master's thesis by *Petrović (2014)*, from Serbia showed that Facebook enhances students' overall satisfaction with the course, enriches students with learning experiences that wouldn't be possible within the confines of a traditional classroom and can improve students' motivation to study the course.

In answering why students used Facebook, one study that was conducted of sophomore students from the University of Jordan cleared that inquiries about course details, examination dates and assignments are among the reasons why students use Facebook (*Al-Tamimi et al., 2018*). Not far away from Jordan, another study in Palestine conducted by *Shraim (2014)*, showed some technological affordances of Facebook and that students demonstrated positive attitudes to learning through it and their engagement were easy and they worked in an environment that enables cooperative learning, easy communication and learning through social communication. In addition, they indicated the importance of initiating institutional change to facilitate the spread of educational culture related to the use of Facebook.

An interesting study of the use of Facebook in education by two researchers from Saudi Arabia showed that students can benefit from each other's experience, increase their knowledge of educational material, and share resources with the cooperation on Facebook and teachers can get to know their students more and receive valuable feedback that will improve the course through Facebook (*Hosny & Fatima, 2012*). At the same period of time, but far away from Saudi Arabia a researcher from Taiwan showed basically that one of the motives for using Facebook was to display and share photos, as it showed the strongest indication of content creation behavior among students and thus educators should pay attention to and encourage motives more related to the educational process (*Alhabash et al., 2012*). Another study suggested that Facebook's social presence features can encourage students to collaborate and work together. For example, users can see who is there and have a conversation with them individually or in a group via the chat service, in real time (*Cheung et al., 2011*).

A study on the Facebook use at the University of Cape Town in South Africa, the study showed that Facebook is one of many Web 2.0 tools that has potential applications for teaching and learning by providing a more interactive environment than traditional environments, with the ability to search for and retrieve information, which led to a shift in learning methods and acceptance of Facebook, especially among young people and that Facebook enables students to communicate academically on campus with colleagues in off-campus areas (Bosch, 2009).

Searching for ways to use Facebook in education as one of the most popular and widespread social networks as mentioned above is a topic that is not new, and research is still ongoing. This study is considered one of the serious studies that covers a wide geographical area and using distinct statistical methods. Here are details about the various elements and circumstances of the study.

The problem of the study lies in the lack of educational research that sought to explore the uses of Facebook in education by exploring and analyzing the underlying factors and the associated observed variables, and through this study the following main question will be answered:

*What are the perceived values of the possibilities, incentives and aspects of using Facebook in education, according to the students' opinion?*

This question has a set of sub questions, including:

*Do students tend to use Facebook in education?*

*What are the benefits of using Facebook in education?*

*What are the features of Facebook that causes students using it?*

In order to study the different aspects of this problem, a group of sub-questions were asked, specifically 43 questions that were formed based on the results of previous

research, and which included several aspects presented by the study tool represented by the questionnaire. Furthermore, taking into account the four latent variables, which will be referred to from now on as factors, and the indicators, that are observed variables, of each of them, that were found in this study using exploratory factor analysis, as shown in the Table (2), and that will be discussed later, the following six hypotheses were determined to address the main question and the sub-questions of this study, namely:

***H1:*** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the observed variables of the potentialities factor in the use of Facebook in education.*

***H2:*** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the observed variables of the enhancements factor in the use of Facebook in education.*

***H3:*** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the observed variables of the communication factor in the use of Facebook in education.*

***H4:*** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the observed variables of the informative factor in the use of Facebook in education.*

***H5:*** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the*

*observed variables of all the four discovered factors, taken together, in the use of Facebook in education.*

**H6:** *There is statistical indication in the means of the respondents' responses at the significant level ( $\alpha \leq 0.05$ ) regarding the perceived value of the seventeen observed variables of PEGI model, taken together, in the use of Facebook in education.*

This research seeks to uncover the underlying factors and the elements related to them that can be measured and that explain them; hence, describe the use of Facebook in education from the students' point of view, taking into account as a primary input most of the results of previous research in this field, and analyze the responses to the questions posed related to them to draw conclusions.

The importance of this study stems from the fact that it is a serious and in-depth study that covered all regions of Palestine, and used classy statistical methods to draw conclusions, in addition to its inclusion as an entry point most research results in this field over two decades. Likewise, the importance of this study lies in providing educational solutions that undoubtedly contribute to standing in front of the challenges at this particular time, as the whole world in all its segments, especially the educational segment, suffers from the impact of the pandemic COVID-19.

The study consisted of five key terms that must be defined as follows:

- **Use of Facebook in Education:** according to the researcher's opinion, what is meant by the use of Facebook in education in this study, includes all matters related to the capabilities and characteristics that Facebook provides learners

with, so that it helps them in their learning and in communicating with each other and with teachers.

- **Latent Variables:** they are variables that are not directly observed but that are extrapolated from other variables that are observed and measured directly.
- **Factor Analysis:** “it is a technique that is used to reduce a large number of variables into fewer numbers of factors” (StatisticsSolutions, 2021a).
- **Exploratory Factor Analysis:** “(EFA) is a classical formal measurement model that is used when both observed and latent variables are assumed to be measured at the interval level” and “in EFA, a latent variable is called a factor and the associations between latent and observed variables are called factor loadings. Factor loadings are standardized regression weights” (ScienceDirect, 2021).
- **Confirmatory Factor Analysis:** “(CFA) is a multivariate statistical procedure that is used to test how well the measured variables represent the number of constructs”. In addition, “in confirmatory factor analysis (CFA), researchers can specify the number of factors required in the data and which measured variable is related to which latent variable. Confirmatory factor analysis (CFA) is a tool that is used to confirm or reject the measurement theory” (StatisticsSolutions, 2021b).

This study is based on exploring learners' perceptions and how, according to their viewpoints, Facebook can be used in education, and determines what influencing factors invite them to use it, and it did not focus on researching the causes for this



use. Therefore, the descriptive methodology was adopted in the design of this study for its ability to answer these types of questions, and their common use in educational research of this kind. (Loeb et al., 2017; McCombes, 2020).

It is also worth noting that the study had some limitations:

- This study was limited to exploring the perceptions of learners in Palestine.
- Due to the current worldwide epidemiological situation associated with the COVID-19 pandemic, the data collection tool was limited to the electronic questionnaire.
- The study was limited to identifying the perceived value of using Facebook in education without other social media or other means that could be used in distance learning.
- Due to the descriptive nature of the methodology used, this study does not address “why” questions (McCombes, 2020).
- Due to the method of collecting data using the electronic questionnaire, it was difficult to control the number of respondents in terms of gender, age, or academic level, noting that the respondents were controlled not to send more than one response according to their e-mails.

## **Method and procedures**

The data collection process continued for two months, which may sound lengthy to some, especially since the data collection process was electronic. In fact, one might

say the biggest challenge the researcher faced in this study was the collection of data. However, it was the investigator's organized plan that resulted in the desired number of responses. After designing the questionnaire using Google Forms, the researcher published it in various electronic forums and Facebook pages and groups with reasonable numbers of members.

The researcher deliberately moved away from sites that have enormous numbers of members with a tactical aim to facilitate the process of following up the posts he sends so that they do not disappear at high speed due to the large number of posts sent by members. Despite that, he had to enter these sites every week and push his posts to the top to remain visible to the members. In numerous forums, he was forced to wait days and sent letters to officials explaining his purpose for the publication of the questionnaire for their approval. Moreover, he had to write to the most active members and ask them in a courteous manner to support him by inviting the members to respond to his questionnaire.

The researcher recruited his friends who are in constant contact with them, and there are around a 300 people on WhatsApp. They helped him deliver the questionnaire to the largest possible number of people within the spatial boundaries of the study, and the researcher thinks that this matter helped him very much.

This study included two samples, one was survey sample, which included 100 responses, with the aim of identifying the validity and reliability of the study tool, and the second was the main study sample after modifying the questionnaire, as shown later, and it consisted of 381 valid responses. Besides identify the nature of

the respondents, the tool included five demographic questions aimed at forming a clear idea of the way the that respondents use Facebook as shown in Table (1).

**Table (1) The Profile of Student Respondents**

Table (1) The Profile of Student Respondents						
Code	Variable	Category	*Survey sample		**Study Sample	
			Freq.	Pct.	Freq.	Pct.
D1	Gender	Male	31	31%	95	25%
		Female	69	69%	286	75%
D2	Age	Less than 25 years	29	29%	96	25%
		From 25 and less than 35	32	32%	109	29%
		From 35 and less than 45	24	24%	104	27%
		From 45 and more	15	15%	72	19%
D3	Academic level	Secondary school student	6	6%	18	5%
		Community college student	5	5%	14	4%
		Undergraduate student	75	75%	223	59%
		Graduate student	14	14%	126	33%
D4	Facebook usage rate	Several times a day	83	83%	335	88%
		Several times a week	12	12%	33	9%
		Several times a month	4	4%	9	2%
		Several times a year	1	1%	4	1%
D5	Average Time Spent	Less than 1 hour	10	10%	28	7%
		Less than 2 hours	29	29%	117	31%
		Less than 3 hours	53	53%	218	57%
		More than 3 hours	8	8%	18	5%
* n = 100						
** n=381						

It is noted from Table (1) that the percentage of females Almost double the percentage of males, which may be attributed to the economic conditions in these countries, where most males are forced to work. In addition, it is also noticed that more than half the sample is from the young students and that the rate of Facebook usage is relatively high.

Forming the questionnaire began by converting the findings of the previous studies that were reviewed above into questions. This process resulted in 57 questions, and the questionnaire was formed based on these questions. In order to identify the validity of these questions and their ability to answer the study questions, the questionnaire was evaluated by three researchers with experience in the subject matter of the study. After taking into account their suggestions and making the required amendments, the questionnaire resulted in its final approved form consisting of 50 questions.

After a survey sample of 100 responses was received, then to ensure the validity of the tool, but this time statistically. Pearson correlation coefficient ( $r$ ), was used to ensure the internal consistency of the study tool, by comparing the correlation coefficients between the individual responses for each question and the total of those responses.

As it was found that the calculated ( $r$ ), ranged in (.402 - .745), is greater than the tabular ( $r_c=0.197$ ) for all values, noting that the corresponding critical correlation value  $r_c$  for a significance level  $\alpha=.05$ , for a two-tailed test, and size sample  $n=100$ , so then, the degrees of freedom  $df = 98$ , is  $r_c=0.197$  (SocSciStatistics, 2021). The result was that the correlation is significant at the 0.05 level, hence the tool is valid.

Then, reliability coefficient was calculated using Cronbach's alpha coefficient for this survey sample and the overall reliability factor found to be (0.979), which is excellent (George & Mallery, 2003), for social science research purposes.

As the researcher's intention was from the outset to use exploratory factor analysis, to identify latent variables and observed variables that define them. It was necessary to examine whether it is possible to dispense with some extra variables, which may be measured by other variables and for this purpose a principal component analysis (PCA) was used.

Actually, PCA can be defined as “a dimensionality-reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information in the large set” (Jaadi, 2021).

From the test it was found that seven variables can be deleted, and the value of Kaiser-Meyer-Olkin KMO test improved after removing these variables from .892 to become .914 which is considered as an excellent value (IBM, 2021).

After obtaining the study sample from the studied students, an Exploratory Factor Analysis (EFA) test was performed to identify what were the latent variables (Factors) and what observed variables were measuring them, the result was that there were four factors named potentialities, enhancements, communication, and informative, with KMO test value of .969 that is excellent (IBM, 2021). Figure (1) summarizes the diminishing process of variables.



Figure (1) Diminishing of variables from start to the Model

To ensure the rationality of the variables in determining the factors that were previously explored by the exploratory factor analysis, confirmatory factor analysis was used and it turned out that among the 43 observed variables only 17 formed a good fit mode as shown in Table (2) bellow, and later on in Figure (1). For clarity and ease of follow-up to the reader, these variables were named.

**Table (2)**  
**Factors and Observed Variables**

Variable Code	Question	*Coffs	Observed Variables
<b>Factor1 - Potentialities (other possible names: Capabilities, Possibilities or Feasibilities)</b>			
MOTIVE	Q45	.643	Students' motivation
ATTITUDE	Q38	.673	Raising students' positive attitudes
EASEUSE	Q44	.599	Ease of use
ENRICHE	Q40	.605	Enriches students learning
<b>Factor2 – Enhancements (other possible names: Improvements or Developments)</b>			
EXPERINCE	Q4	.572	Learning experiences
INSPERE	Q27	.622	Students' inspiration
ENGAGE	Q16	.651	Students' engagements
ACHEIVE	Q23	.688	Students' achievements
COLLABOR	Q14	.563	Collaborative learning
<b>Factor3 - Communication (other possible names: Interaction)</b>			
ACCESS	Q34	.697	Fast accessibility
SHARE	Q22	.633	Sharing learning experiences
FEEDBACK	Q32	.683	Receive feedback from teacher and colleagues
IDEAS	Q41	.605	Opportunity to share ideas
<b>Factor4 – Informative (other possible names: Instructive or Educative)</b>			

SOURCE	Q47	.700	Source of information for students
ACCESS	Q37	.685	Features that facilitate quick access to information
INFORME	Q48	.649	Gaining information about the course
RESOURCE	Q49	.634	Resource with great educational potential
* Extraction Method: Principal Component Analysis suppressing small coefficients with absolute values below 0.4, since values above 0.4 are stable (Guadagnoli & Velicer, 1988).			

The 35 questionnaire paragraphs included predefined answers, according to the five-point Likert scale since it is common in educational contexts (Norman, 2010), to measure the opinions of the respondents, where strongly agree coded as (5 grades), agree (4 grads), neither agree nor disagree (3 grads), disagree (2 grads), and strongly disagree was coded as (1 grade). The respondents were asked to determine the degree of their agreement with each of the paragraphs. Where less than (2.34) approval in average was considered low, between (2.34-3.66) approval was considered medium, and more than (3.66) approval was considered high.

To test the hypotheses of the study, the SPSS program was used and the following statistical treatments were calculated:

- Calculation of means of agreements in the respondents' responses on questionnaire paragraphs to identify the degree of agreement with each paragraph that represent an observed variable.
- Independent samples T test, and One-way ANOVA to test the hypotheses as shown below.

In the next section, the researcher will present these statistical procedures and discuss the findings that have been reached through these procedures. In addition to presenting the outcomes resulting from the direct observation of the researcher.



## FINDINGS AND DISCUSSION

In addition to the exploratory factor analysis, which was used in exploring the study factors and showed their related observed variables along with their correlation coefficients indicating the possibility of using them in determining these factor, and in order to know the perceived value of each of these 35 variables and test the reasonableness of the study hypotheses, the means of the degree of respondents' agreement on each of the study paragraphs of the questionnaire, that represents one of these variables, were calculated, and the result is as shown in Table (3).

<b>Table (3)</b>					
<b>Means of the rate of agreement on the observed variable</b>					
<b>Factor</b>	<b>*Observed Variables</b>	<b>Level of agreement</b>			<b>Means Range</b>
		<b>Low</b>	<b>Medium</b>	<b>High</b>	
		<b>&lt;2.34</b>	<b>[2.34-3.66]</b>	<b>&gt;3.66</b>	
<b>Potentialities</b>	16	0	11	5	(3.03 – 3.84)
**Questions (18, 20, 13, 9, 14, 4, 27, 16, 19, 26, 23, 28, 38, 22, 29, 25)					
<b>Enhancements</b>	17	0	17	0	(3.03 – 3.59)
**Questions (19, 26, 28, 43, 45, 42, 38, 44, 40, 39, 36, 32, 35, 41, 33, 48, 49)					
<b>Communication</b>	11	0	8	3	(3.26 – 3.75)
**Questions (23, 38, 21, 34, 36, 22, 32, 35, 41, 33, 37)					
<b>Informative</b>	9	0	4	5	(3.54 – 4.06)
**Questions (40, 39, 46, 47, 50, 37, 48, 29, 49)					
<b>*Totals</b>	<b>53</b>	<b>0</b>	<b>40</b>	<b>13</b>	
<b>Percent</b>		<b>0%</b>	<b>75%</b>	<b>25%</b>	
* Notice that there are only 35 distinct questions (observed variables).					

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**\*\* Questions were classified within these factors based on the exploratory factor analysis.**

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These results indicated three important things as follows:

- The absence of any low agreement rate indicates that the community of learners represented by the respondents is aware of the perceived value of using Facebook in education.
- As it appears, the average agreement rate constituted 75% of the total agreement rate, and this supports the six hypotheses H1 through H6 to a reasonable extent.
- It is also noted that the high agreement rate, which constituted 25%, was related more to communication, and informative factors, that is largely consistent with most previous studies and which confirms that the perceived value of Facebook being as means of communication that encourages interaction and is considered a source of information for the students at a high-rate agreement, which supports hypotheses H1 through H6, to a large extent.

Although these results supported the six alternative hypotheses, the researcher wanted to verify whether there was statistical indication of differences in the respondents' perceptions due to the demographic variables, which are gender, age, academic level, Facebook usage rate, and average time spent using Facebook, and the results came as shown in the Table (4) that follows.

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**Table (4) Testing Hypotheses**

**Frequencies of Null Hypothesis Acceptance Due to D1, D2, D3, D4, or D5**

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Alternative Hypothesis	Factor	OVS <sup>1</sup>	Cronbach's Alpha <sup>2</sup>	(D1) <sup>3</sup>	(D2) <sup>4</sup>	(D3) <sup>5</sup>	(D4) <sup>6</sup>	(D5) <sup>7</sup>
H1	Potentialities	16	.944	5	1	2	0	5
H2	Enhancements	17	.954	1	0	2	0	9
H3	Communication	11	.933	1	1	0	0	8
H4	Informative	9	.911	1	0	4	0	6
H5	All Factors	35	.971	7	1	7	0	13
H6	PECI Model	17	.946	2	1	4	0	5

<sup>1</sup> Number of Observed Variables in the test, and notice that there are 35 distinct observed variables overall.

<sup>2</sup> The general rule of thumb is that a Cronbach's alpha of .70 and above is good, .80 and above is better, and .90 and above is best (StatisticsSolutions, 2021c).

<sup>3</sup> D1: Gender, using Two-Sample Independent t-Test

<sup>4</sup> D2: Age, using one-way ANOVA.

<sup>5</sup> D3: Academic level, using one-way ANOVA.

<sup>6</sup> D4: Facebook usage rate, using one-way ANOVA.

<sup>7</sup> D5: Spent time using Facebook, using one-way ANOVA.

According to the result shown in Table (4), one can say that the perceived value of the use of Facebook in education may differ according to the nature of the use and the characteristics of the user. As shown, the perceived value changes to a relatively large degree according to the time that a user spends on Facebook, and it changes in an average percentage according to academic level and gender and are more stable when the age changes. These results may be useful if studied in more depth in dealing with the different categories of users and the nature of use. It should be noted that the gender-related results correspond to Mazman and Usluel (2011) who found

that Facebook is used by more males, while females resort to using other means of communication.

Table (5) shows the results of the confirmatory factor analysis (CFA), using the SPSS-AMOS software, through which the four factors and the observed variables associated with each of them were identified, and it formed then the innovative model for using Facebook as shown in Figure (2), that was named PECI only in purpose of making it easier to remember. The analysis also appears that the examined values of the model led to “Good Fit”.

It should be noted again here that according to testing the hypotheses in Table (4) above, and especially with regard to the sixth hypothesis (H6), the perceived value of Facebook use in education, and therefore this proposed model may differ from one user to another depending on the nature of use and the characteristics of the user, as explained previously. It is also worth to realize what a study of Schermelleh-Engel et al. (2003) specified, that A “good model fit” only indicates that the model is plausible

Table (٥) Model Fit Indices Summary				
Fit Measure	*Good Fit	*Acceptable Fit	Model Value	Result
<b>CMIN</b>				
$\chi^2$	$0 \leq \chi^2 \leq 2df$	$2df < \chi^2 \leq 3df$	151.381	Good
df = 105	$0 \leq \chi^2 \leq 210$	$2df < \chi^2 \leq 315$		

p value	$.05 < p \leq 1.00$	$.01 \leq p \leq .05$	.002	Close
$\chi^2 / df$	$0 \leq \chi^2 / df \leq 2$	$2 < \chi^2 / df \leq 3$	1.442	Good
<b>RMSEA</b>				
RMSEA	$0 \leq RMSEA \leq .05$	$.05 < RMSEA \leq .08$	.034	Good
p value	$.10 < p \leq 1.00$	$.05 \leq p \leq .10$	.990	Acceptable
<b>RMR, GFI</b>				
SRMR	$0 \leq SRMR \leq .05$	$.05 < SRMR \leq .10$	.028	Good
GFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI < .95$	.955	Good
AGFI	$90 \leq AGFI \leq 1.00$	$.85 \leq AGFI < .90$	.935	Good
<b>Baseline Comparisons</b>				
NFI	$.95 \leq NFI \leq 1.00$	$.90 \leq NFI < .95$	.961	Good
CFI	$.97 \leq CFI \leq 1.00$	$.95 \leq CFI < .97$	.988	Good
RFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI < .95$	.949	Good
IFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI < .95$	.988	Good
TLI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI < .95$	.984	Good
<b>ECVI</b>				
ECVI	$ECVI \leq 1.00$ , Fits better when it is close to 0.		.651	Good

\* These judgments are based on research from previous studies (Kline, 2015; Newsom, 2012; Parry, 2020; Schermelleh-Engel et al., 2003).

\* A “good model fit” only indicates that the model is plausible (Schermelleh-Engel et al., 2003).

Figure (2) the following shows the model that was reached and is the outcome of this study.

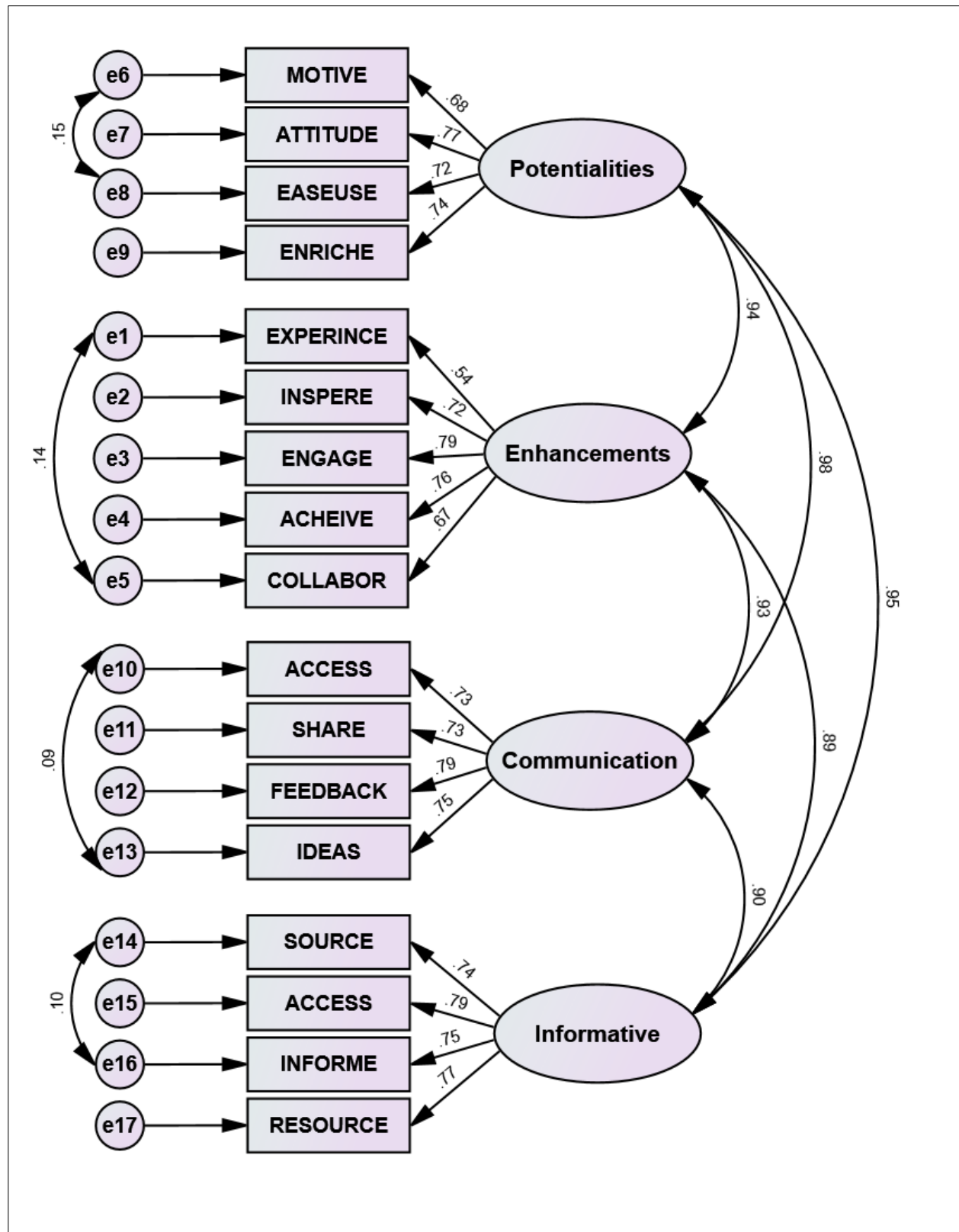


Figure (2): CFA model for use of Facebook in education model (PECI)

## CONCLUSION

This study has found four factors of using Facebook in education, which are potentialities, enhancements, communication and informative, and it showed the seventeen observed variables that determine these factors. The study presented a new model, named PECI, that could be used in planning the design of teaching and learning that includes the use of Facebook. The study also showed that the perceived value according to students' opinions of using Facebook in education may differ according to their personal characteristics such as gender, age, academic level, or the rate of use.

## RECOMMENDATIONS

At the conclusion of this study, the researcher would like to provide some recommendations that may help people touched on with this study, including the researchers' in-depth research into the differences in the use of Facebook in education according to the characteristics of learners such as gender and academic level as discovered in this study, that is most probably due to the nature of the population being investigated. In addition, the researcher advises teachers who have not yet tried using Facebook in their education to try to think at least about this topic. Moreover, educational institutions are advised to adopt some aspects in which they exploit the factors of using Facebook in education, which were revealed in this study.



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