

E-LEARNING AND PROBLEM-SOLVING SKILLS: VIEWS OF MOROCCAN TEACHERS

El Mustapha El Anouar ¹
Mohamed Jallal El Adnani

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ABSTRACT

Studying e-learning through the eyes of teachers sheds light on how the development of problem-solving skills in digital environments is influenced. This paper aimed to explore teachers' views of enhancing their problem-solving competencies via online learning in Morocco's Béni Mellal-Khénifra region. Primary data were gathered from a sample of 520 teachers using a structured questionnaire survey. The constructs in the conceptual model were evaluated with a customized five-point Likert scale. Data analysis was conducted using CFA and SEM with AMOS software. The findings indicated that self-efficacy predicts both actual use and teacher satisfaction. This means that the more a teacher believes in his abilities, the more likely he is to voluntarily use digital platforms and be satisfied with them. The results also revealed that teacher satisfaction has an impact on improving problem-solving skills, with no direct impact of actual use on this skill. This suggests that satisfaction mediates the effect of actual use on problem-solving skills among teachers. Ministry of National Education, Preschool and Sports should focus on strengthening teachers' self-efficacy, which should become a priority through continuing education programs. It also should regularly assess teachers' level of satisfaction with the actual use of e-learning platforms and adapt their systems based on trainees' feedback.

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1. INTRODUCTION

Teachers face several problems that hinder their work and, consequently, hinder the learning process and prevent them from achieving their planned goals. This requires urgent solutions that give the learning process a positive dimension and achieve the desired goals (Al Hassan & Abdel Aziz, 2016). In this context, there has been growing interest in problem-solving as a transversal skill requiring continuous training in thinking and higher mental skills. In turn, this requires the search for new approaches that enable learners to acquire these skills to adapt to the change, development, and dynamism that characterize digital societies.

As part of this dynamic, e-learning has emerged as a strategic approach that has enabled adult learners to take a new path by offering varied and open resources based on new modes of collaboration and sharing. These new modes help to create a flexible learning environment by allowing individuals to study according to their needs, pace and interest (Al Hassan & Abdel Aziz, 2016). The existing literature offers several definitions of the concept of "e-learning". Therefore, finding a universally accepted definition for the term proves difficult (Rodrigues et al., 2019). It can be defined as a method of presenting content, explanations and training followed by interactions (synchronous or asynchronous, remote or partial) via advanced computer programs or the global network (Al Hassan & Abdel Aziz, 2016). E-learning can

¹ Corresponding author: El Mustapha El Anouar
Email: elmustapha.elanouar@usms.ma / elanouare@gmail.com

also be defined as a system for presenting programs courses via the global network, compact discs or other networks, facilitating interactions for learners (Al Hassan & Abdel Aziz, 2016). Rodrigues et al., (2019) propose a more recent definition of e-learning presenting it as an innovative online system based on digital technologies and various educational media. Its main objective is to offer learners a personalized learning environment that is centered on their needs, open, enjoyable, interactive, and that promotes learning processes. In summary, e-learning can be defined as a planned and intentional learning system that strategically uses information technology, the internet, and its many communication tools to disseminate educational content and provide an active and interactive learning environment.

E-learning has been linked to problem-solving skills in numerous previous studies (Al Hassan & Abdel Aziz, 2016; Dimitrov et al., 2002; Songkram, 2015). Most of the results of these studies reflect the existence of statistically significant differences attributable to the use of the e-learning environment and its applications in the development of various skills, particularly problem-solving skills. The objective of this article is therefore to identify teachers' perceptions about the link that connects e-learning to problem-solving skills among teachers in the Béni Mellal Khénifra (BMK) region in Morocco. To this end, the study seeks to solve this issue: How do teachers' views of e-learning self-efficacy, use, and satisfaction enhance their problem-solving skills?

This study provides original field data on the link that may exist between e-learning and improved problem-solving skills among teachers. Exclusively, this article enriches the theory of educational technologies in Morocco and shows how e-learning can go beyond the simple dissemination of content to become a real lever for professional development and pedagogical innovation. The results therefore aim to inform stakeholders about the benefits of strengthening e-learning not only for students, but also for the continuing education of teachers, and to justify investment in online professional development programs.

This study is based on a questionnaire survey to gather responses from 520 teachers. Measurement of the study variables was carried out using a five-point Likert scale. The data were analyzed using confirmatory factor analysis (CFA) and structural equation modeling (SEM) with AMOS.

2. LITERATURE REVIEW

2.1 Self-efficacy (SE)

SE is perceived as a key determinant of human action that influences how individuals feel, think, motivate themselves and consequently act and behave. Indeed, when an individual believes that he is able to achieve the desired results, he is unlikely to make the necessary efforts to change the situation (Alqurashi, 2016).

Beliefs in SE encourage individuals to actively engage in pursuing their goals. Individuals who believe in their abilities have a strong sense of SE. They perceive complex tasks not as obstacles to be avoided, but as opportunities for development and improvement of their skills. These individuals set ambitious goals, persevere in achieving them, and quickly regain their sense of efficacy after a setback. Consequently, their level of stress and anxiety tend to be lower while their personal achievement is greater (Alqurashi, 2016).

Many studies have shown that SE has positive effects on user satisfaction and actual usage of information and communication technologies (Aldholay et al., 2018; Alruwaie et al., 2020; Shih, 2006; Wang, & Liao, 2008; Wu & Wang, 2006). Hence, the following hypotheses are formulated:

H1: SE affects positively actual usage.

H2: SE affects positively teacher satisfaction.

Research on SE began before the advent of e-learning, and even after its emergence, studies on SE in online learning environments have remained limited and recent (Hodges, 2008). Therefore, the objective behind the study of this variable is to enrich the existing literature and assess the impact of teachers' sense of SE on their use of technological tools and online learning platforms.

2.2 Actual use (AU)

AU is defined as the measurement of the frequency, nature and duration of a given technology (Aldholay et al., 2018; Almaki et al., 2024). Therefore, it exceeds intended use and concerns what the users actually do, not just what they plan or want to do. In addition, to measure this AU, Sulis Sandiwarno adds two metrics: completion rate and lostness which is used to calculate the effectiveness of web page navigation (Sandiwarno, 2021).

The AU of e-learning technology is a dependent variable associated with intention to use, training, and management support (Ayele & Birhanie, 2018). Here, it refers to the concrete realization of the system's use by teachers, beyond their intention.

The literature shows that AU of a system, the skills possessed by the users, and their satisfaction's level are closely linked (Abdelrady & Akram, 2022; D'Ambra et al., 2013; EL Anouar et al., 2025). This paper investigates the extent to which AU affects teachers' satisfaction and problem-solving skills, forming the basis for these two hypotheses:

H3: AU influences positively teacher satisfaction.

H4: AU influences positively teachers' problem-solving competencies.

2.3 User satisfaction (SAT)

SAT refers to the aggregate of a learner's affective or emotional reactions to its interaction with an online learning system (Ritzhaupt, 2019). Here, SAT corresponds to the emotional dimension of users based on their personal experience and their confidence in the

system. Zhao (2016) agrees with this idea and describes learner satisfaction as one of the important determinants in evaluating the success of e-learning environments. The scientific literature repeatedly highlights the marked positive correlation between user satisfaction and user skills, observed in a variety of educational and professional contexts (El Anouar et al., 2025; Owolabi et al., 2024). Consequently, this paper explores the effect of teacher satisfaction on teachers' solving problem skills. As result, the following hypothesis is formulated:
H5: SAT influences positively teachers' solving problem skills.

2.4 E-learning and Problem solving (PS)

2.5

PS is a skill that involves a series of “concrete steps in the process of dealing with challenges” (Giacomazzi et al., 2022a). This process includes identifying and exploring the problem, defining it concretely, exploring possible alternatives, planning a solution, and finally implementing the chosen solution and monitoring its effects (Giacomazzi et al., 2022b).

In contrast to this primarily cognitive interpretation, Giacomazzi and al., (2022) present another definition of PS as synonymous with “helping community members overcome a difficult situation or resolve conflicts amicably”. This conceptualization is strongly influenced by a communitarian approach where identify is linked to the community. Consequently, the contextualized process of PS, while including the identification and understanding of causes, places a unique and crucial emphasis on seeking advice and input from community members before evaluating options and adopting the best solutions.

Online learning environments offer opportunities for problem-based learning through various media and learning styles that allow learners to reflect on real world PS decision based on the theoretical principals they have acquired (Kassymova et al., 2020). In addition, PS makes successful communication based on learners and lecturers' feedback (Sandiwarno, 2021).

Previous studies have shown that e-learning develops problem-solving skills in various contexts (Al Hassan & Abdel Aziz, 2016; Diani & Syarlisjswan, 2018; Kassymova et al., 2020). These contexts include programming (Kassymova et al., 2020), mathematics teaching (Al Hassan & Abdel Aziz, 2016), and basic physics (Diani & Syarlisjswan, 2018).

3. METHODOLOGY

3.1 The research model

The research model presented in figure 1 is based on the existing literature. Analysis shows that SE influences both actual use and user satisfaction, which predicts PS as one the 21st century skills. The link between these variables stems from previous studies mentioned above. Thus, the model examines the link between SE

considered an antecedent variable, SAT and AU, which in turn explain PS as a dependent variable, among teachers in public schools at the three levels of basic education in the BMK region of Morocco. This model includes five hypotheses to be tested.

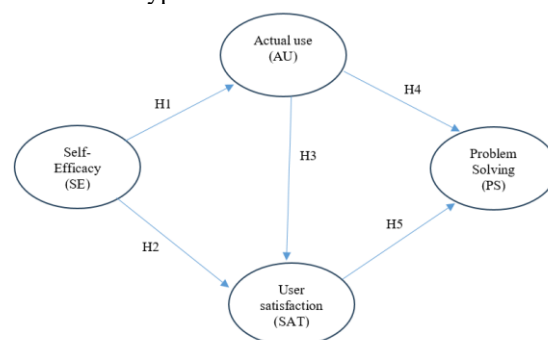


Figure 1. Proposed research model

3.2. Design of the measurement tool

A 17-items questionnaire was designed specifically for this study, as presented in Table A of the Appendix. The constructs were measured using a five-point Likert scale, ranging from 1 “Strongly disagree” to 5 “Strongly agree”, except for items AU1 and AU2, which were assessed on a six-point scale to capture greater response variability. Given that the participants were native Arabic speakers, it was essential to ensure an accurate translation of the questionnaire from english into Arabic. To guarantee linguistic and conceptual equivalence between two versions, the back-translation technique was employed - a widely recognized procedure for verifying translation accuracy and minimizing semantic discrepancies- (Aldholay et al., 2018).

3.3. Data gathering

Data was collected using a paper questionnaire, which was distributed in person over a period of 60 days. The choice of in person administration allowed researchers to verify whether each participant currently used or had previously used the FADEEP and/or e-Takwine -Tanmia platforms as part of their lifelong learning activities. In contrast, distributing the questionnaire online would not have guaranteed that respondents could be identified as teachers using e-learning. For these reasons, an in-person distribution method was deemed more appropriate for this study.

The study focused on teachers in public schools at three levels of basic education in the BMK region of Morocco who use or have used e-learning as a tool of continuing self-training, particularly via the FADEEP and e-Takwine-Tanmia platforms.

For the clarity and comprehensibility of the questionnaire, a pre-test was conducted with 20 teachers. The feedback received was used to adjust the wording of certain items before the final data collection. The questionnaires were distributed after confirmation of the teachers' experience with e-learning. Participants were asked to complete them on the spot and drop them off at a designated collection point.

Of 800 copies distributed, 552 were recovered, representing a response rate of approximately 69%. After verification, 520 valid questionnaires were selected for statistical analysis. The 32 excluded questionnaires had either a non-response rate of more than 10% or aligned responses suggesting a lack of attention when completing the questionnaire. The demographic profile of participants is shown in Table 1.

4. EMPIRICAL RESULTS

4.1 Measurement model (MM) assessment and CFA

As indicated in Table 2, all the goodness-of-fit indices (GoFI) exceed the threshold values recommended in prior studies, confirming that the MM demonstrates a satisfactory fit to the observed data. On this basis, it is appropriate to proceed with the assessment of the model's psychometric characteristics, specifically the reliability and the validity of the MM.

Table 1. Characteristics of the participants (N=520)

Demographic Item	Frequency	Percentage
Sexe		
Female	253	48.7
Male	267	51.3
Age		
< 30	17	3.3
[30-40[	123	23.6
[40-50[	175	33.6
≥ 50	48	9.2
Educational cycle		
Elementary school	284	54.6
Middle school	109	21
High school	127	24.4

Provincial directorate		
Azilal	98	18.8
Béni Mellal	105	20.2
Khénifra	92	17.7
Khouribga	116	22.3
Fqih Ben Saleh	109	21

Table 1. The GoFI of the MM.

GoFI	Acceptability	Finding	Fit (Yes/No)
χ^2	-	271.760	
DF	-	113	
p-value	<0.05	0.00	Yes
χ^2/DF	1-5	2.405	Yes
RMSEA	<0.08	0.052	Yes
SRMR	<0.08	0.047	Yes
GFI	>0.90	0.940	Yes
AGFI	>0.80	0.918	Yes
NFI	>0.80	0.960	Yes
PNFI	>0.05	0.798	Yes
IFI	>0.90	0.976	Yes
TLI	>0.90	0.971	Yes
CFI	>0.90	0.976	Yes
PGFI	>0.50	0.694	Yes

Table 3 shows the results of construct reliability, which was assessed using Cronbach's alpha (α) and composite reliability (CR). All values exceed the recommended threshold of 0.7. All factor loadings are high and significant, exceeding the level of 0.5, indicating a strong item measurement quality. Convergent validity is also supported, as the Average Variance Extracted (AVE) values range from 0.511 to 0.774, surpassing the required value of 0.5

Table 3. Construct reliability, indicator reliability and convergent validity.

Construct	Item	Loading	M	SD	α (>0.7)	CR (>0.7)	AVE (>0.5)
SE	SE1	0.862	3.663	1.047	0.848	0.854	0.661
	SE2	0.823					
	SE3	0.751					
SAT	SAT1	0.850	3.667	1.033	0.911	0.911	0.774
	SAT2	0.883					
	SAT3	0.905					
AU	AU1	0.866	2.549	1.042	0.738	0.751	0.511
	AU2	0.714					
	AU3	0.524					
PS	PS1	0.831	3.501	0.965	0.950	0.950	0.706
	PS2	0.859					
	PS3	0.893					
	PS4	0.870					
	PS5	0.851					
	PS6	0.843					
	PS7	0.820					
	PS8	0.745					

Applying the Fornell-Larcker criterion revealed the adequate discriminant validity for all constructs (Fornell & Larcker, 1981), as indicated in Table 4.

Table 4. The Fornell–Larcker criterion and discriminant validity of the MM.

Construct	SE	AU	SAT	PS
SE	0.813			
AU	0.290	0.715		
SAT	0.684	0.401	0.880	
PS	0.634	0.315	0.714	0.840

4.2 Structural model examination

The indices of the structural model's goodness of fit recorded values such as $\chi^2/df = 2.517$, GFI = 0.937, CFI = 0.974, RMSEA = 0.054, TLI = 0.969, NFI = 0.958, and AGFI = 0.915. These values indicate a good fit which will allow for the analysis of the path coefficient relating to the structural model (Aldholay et al., 2018; Byrne, 2013). As illustrated in Figure 2, SEM with AMOS results are presented in Table 5.

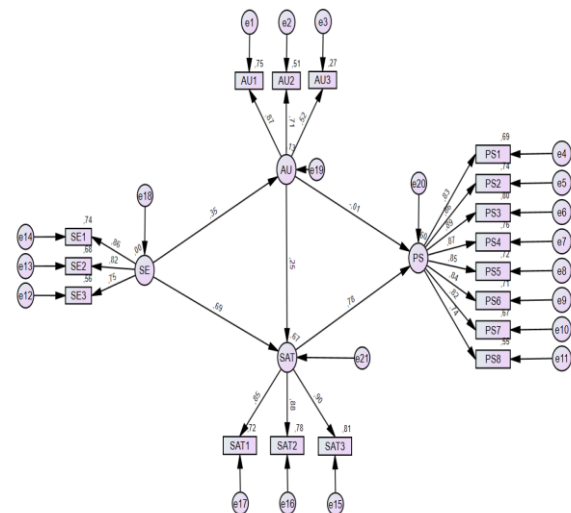


Figure 2. Research structural model outputs.

The results show that while H1, H2, H3 and H5 were confirmed, H4 was not supported ($\beta = -0.1$, $t = -3.226$, p insignificant). SE influences AU and SAT. AU also predicts user satisfaction which significantly predicts PS.

Table 5. Hypothesis tests outputs.

Hypothesis	Link	β	SE	T-value	p	Result	R ²
H1	SE→AU	0.35	0.069	5.072	***	Supported	0.125
H2	SE→SAT	0.69	0.051	13.530	***	Supported	0.668
H3	AU→SAT	0.25	0.033	7.576	***	Supported	
H4	AU→PS	-0.1	0.031	-3.226	0.882	Unsupported	0.602
H5	SAT→PS	0.78	0.044	17.727	***	Supported	

*** $p < 0.001$

Since hypothesis 4 was not confirmed, we examined the indirect effect of actual use on problem-solving skills. According to Table 6, the indirect effect is strong and reaches statistical significance. This suggests that actual

use significantly predicts problem-solving skills through satisfaction. The fact that the confidence interval does not include zero and that the p -value is significant reinforces the validity of this mediating effect.

Table 6. Mediating effect of SAT.

								95% Confidence Interval	
								L	Up
AU	→	SAT	→	PS				0.227	0.345
Note. The mediating effect of SAT was estimated using standardized estimates, maximum likelihood, and the bootstrap method.									

In order to examine the degree to which teachers adhere to the main dimensions of the model studied, a one sample t-test was conducted. The statistical analysis thus aims to verify whether teachers demonstrate significant levels of engagement and competence in the use of e-

learning. The results presented in Table 7 below highlight highly significant differences, confirming the importance of these dimensions in the professional growth of the teachers in the digital age.

Table 7. One sample T-test results

	t	df	p	Cohen's d	SE Cohen's d	Lower	Upper
SE	79.628	517	< .001	3.499	0.117	3.267	3.727
AU	55.672	517	< .001	2.446	0.088	2.273	2.617
SAT	77.827	517	< .001	3.420	0.115	3.192	3.643
PS	82.583	517	< .001	3.628	0.121	3.389	3.864

5. DISCUSSION

This study aims to know how teachers' views of e-learning self-efficacy, use, and satisfaction enhance their problem-solving skills in Morocco. The research examined self-efficacy using 3 indicators, and the outcomes revealed that teachers' self-efficacy in using technology affects both their satisfaction and their actual use of e-learning, which aligns with previous studies (El Anouar et al., 2025). This indicates that the higher teachers' self-efficacy is in terms of mastery of internet research and access to online learning resources, the higher their actual use and their satisfaction, as they are more confident and comfortable engaging with electronic online activities. It also aligns with Bandura's social cognitive theory, which states that self-efficacy influences task engagement and perseverance in the face of technical issues that arise from the use of e-learning. The self-efficacy of teachers in the BMK region with regard to e-learning should motivate the governmental authority responsible for education to invest more in integrating online learning into the curricula for three cycles of basic education, thereby establishing high-quality hybrid teaching. Furthermore, this ability to be comfortable with educational technologies should be exploited in the continuing training of educational and administrative staff to (re)qualify them.

The results indicate that self-efficacy positively impacts actual use. This means that as the teachers believe in their own ability to learn from online learning, the frequency and duration of teachers' use of e-learning increases. This is in line with previous works (Aldholay et al., 2018).

The results further indicate that AU exerts a significant influence on SAT, corroborating the conclusions of prior studies (Aldholay et al., 2018; El Anouar et al., 2025; Stefanovic et al., 2016). This relationship may be explained by the notion that increased engagement with e-learning platforms among teachers in the BMK region enhances their knowledge, skill development, and capacity for innovative problem-solving (Aldholay et al., 2018; El Anouar et al., 2026). However, contrasting evidence from other scholars suggests that this association may not always be significant (Cho et al., 2015).

The study also demonstrates a significant effect of teacher satisfaction on problem-solving skills. Based on the participants' responses, this result shows that e-learning appears to be an essential lever for developing problem-solving among teachers. It not only enables them to quickly identify appropriate solutions to the difficulties they encounter, but also to persevere in the face of complex problems until they find a clear solution. By offering a variety of resources and strategies, e-learning encourages teachers to explore multiple solutions, assess their chances for success, and maintain confidence in their own effectiveness. Even when initial attempts fail, it supports the continued search for solutions and provides specific guidelines for overcoming obstacles independently and effectively. These findings are consistent with earlier studies (Hou,

2012; Khazaal, 2015; Rezaee et al., 2022; Stary & Weichhart, 2012; Son et al., 2012).

However, AU showed no effect on problem-solving skills among teachers in the BMK region, which is consistent with earlier research (El Anouar et al., 2025). One explanation of this result is that AU may only lead to the development of problem-solving skills if teachers are satisfied with their use of e-learning platforms.

In this sense, the result showed that satisfaction has a mediating effect between AU and problem-solving skills. This means that it is not the use of e-learning itself that develops problem-solving skills, but the satisfaction that this use provides. In other words, satisfaction is the psychological mechanism that transforms the use of e-learning into improved skills. It therefore acts as a cognitive and effective facilitator for teachers in the problem-solving process. This result is in line with the constructivist learning theory, which states that learners develop skills when they are actively and emotionally engaged in their learning. This engagement is itself influenced by the pleasure derived from using e-learning. Satisfaction therefore plays an energizing role that fuels the problem-solving process in teachers who are satisfied with their use of e-learning systems.

As implications of the paper, the results may provide guidance to the Ministry of National Education, Preschool and Sports (MNEPS) to regularly assess teacher satisfaction with the actual use of e-learning platforms for the continuing education of its educational and administrative staff and to adapt their systems based on trainees' feedback. This study also shows that SE in the use of technology predicts both SAT and AU of e-learning, which in turn explains 60.2 % of the variance in problem-solving. It is therefore essential that the MNEPS focus on these factors to establish a high-quality e-learning system and develop continuing education programs that strengthen teachers' skills and bridge the digital divide in the web 4.0 era.

This study has several limitations. First, the data was collected at a specific point in time, so the relationships observed between the variables may change over time. A longitudinal study would therefore be necessary to confirm the direction of the effects identified. Second, the study is based on teachers' self-perceptions to test the variables instead of a real assessment of their effective problem-solving skills in specific educational settings.

To overcome this limitation, it would be useful to implement a pre-test and post-test to accurately assess changes in skills. This would make it possible to measure participants' problem-solving skills using specifically designed platforms, providing a controlled and appropriate environment for observing the actual progress made during the intervention. In addition, the study relied solely on a quantitative approach assessing teachers' perceptions of e-learning and problem-solving. While these measures provide valuable insights, the additional qualitative approach, through interviews or observations, would enrich the analysis and strengthen the validity of the conclusions.

6. CONCLUSION

To assess the impact of e-learning on increasing the problem-solving skills, this research collected quantitative data from teachers in the BMK region of Morocco. The findings indicated that self-efficacy predicts both actual use and teacher satisfaction. This means that the more a teacher believes in his abilities, the more likely he is to voluntarily use digital platforms and be satisfied with them. Therefore, the MNEPS should focus on strengthening teachers' self-efficacy, which should become a priority through continuing education programs that should include hands-on workshops,

mentoring, guided demonstrations, and personalized technical support, thereby promoting sustainable and positive use of e-learning. The results also revealed that teacher satisfaction has an impact on improving problem-solving skills, with no direct impact of actual use on this skill. This suggests that satisfaction mediates the effect of actual use on problem-solving skills among teachers. Hence, MNEPS should regularly assess teachers' level of satisfaction with the actual use of e-learning platforms for the continuing education of its staff and adapt their systems based on trainees' feedback.

APPENDIX

Table A. Items of variables

Construct	Measures	Source
Self-efficacy (SE)	SE1: I know how to conduct an internet search using multiple keywords.	(Y. Sun & Rogers, 2021)
	SE2: I feel comfortable engaging in e-learning.	
	SE3: I feel confident accessing links to online resources.	
Actual use (AU)	UR1: On average, how frequently do you engage in e-learning activities?	(Aldholay et al., 2018; EL Anouar et al., 2025)
	UR2: Approximately how many hours per week do you devote to e-learning?	
	UR3: Which e-learning modalities do you habitually use?	
User satisfaction (SAT)	SAT1: I believe that choosing to use e-learning was a good and beneficial decision.	Aldholay et al., (2018)
	SAT2: The e-learning experience generally meets or exceeds my expectations.	
	SAT3: Overall, I feel satisfied with the e-learning environment I use.	
Problem Solving (PS)	PS1: Through e-learning, I am generally able to find solutions to the problems I encounter.	(Heppner & Petersen, 1982)
	PS2: When I face a difficult problem at first, e-learning helps me persist until a clear solution emerges.	
	PS3: In general, e-learning helps me solve new or complex problems.	
	PS4: When I am confronted with a problem, e-learning enables me to remain confident in my ability to solve it.	
	PS5: When trying to solve a problem, e-learning helps me identify multiple possible solutions.	
	PS6: When selecting an idea or solution among several alternatives, e-learning helps me assess the likelihood of success for each option.	
	PS7: When my initial attempts to solve a problem fail, e-learning enables me to continue searching for other solutions effectively.	
	PS8: When I encounter difficulties in solving a problem, e-learning gives me the sense of knowing exactly what to do to overcome them.	

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El Mustapha El Anouar

Sultan Moulay Slimane University,
Faculty of Economics and
Management, M'ghila Campus, BP:
502, Beni Mellal, BM-KH 23000,
Morocco.

elmustapha.elanouar@usms.ma

ORCID: 0009-0009-9515-151720

Mohamed Jallal El Adnani

Sultan Moulay Slimane University,
Faculty of Economics and
Management, M'ghila Campus, BP:
502, Beni Mellal, BM-KH 23000,
Morocco.

eladnani2000@yahoo.fr

