E-Learning Integration and Teaching Strategies to Enhance Knowledge Retention in Higher Education

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Abstract

This research investigates the impact of e-learning integration (ELI), teaching methods (TM), and active learning strategies (ALS) on knowledge retention (KR) in higher education institutions, focusing on Omani institutions as representatives of the Gulf region. Mediating factors include Cognitive Load Management (CLM) and Personalized Learning (PL), while moderating variables encompass Student Engagement (SE), Cultural Factors (CF), and Innovative Educational Technologies (IET). The study uses Structural Equation Modeling (SEM) to look at 839 responses and find both direct and indirect links between these variables. It then makes suggestions for how technology can be used in schools to help students learn better. The findings aim to improve local educational practices, which may also benefit diverse global contexts, particularly in developing countries where English is not the primary language. Results indicate that ELI positively affects KR (B = 0.39, p = 0.000), followed by TM (B = 0.297, p = 0.000) and ALS (B = 0.091, p = 0.001). Additionally, CLM and PL partially mediate the relationships between ELI, TM, and ALS on KR, showing significant indirect effects (std. c = -0.043, t = 3.164; std. c = -0.013, t = 4.108). Cultural Factors (CF) significantly interact with ALS, enhancing its contribution to KR (B = 0.054, p = 0.037). This study underscores the significance of integrating ELI, TM, and ALS to enhance KR among Gulf students, emphasizing the significance of cultural influences in contrast to Western contexts that tend to minimize them.

1- Introduction

First, it is evident that the integration of e-learning in higher education has improved the learning environment by making it more flexible and innovative, hence increasing students' participation and performance [1]. That positive effects of e-learning on knowledge gain and competency enhancement can be achieved through offering alternative learning resources and promoting interactivity and individual approaches to education has been postulated previously [2-4]. However, though many contributions have examined an overall influence of e-learning in learning, little is researched in terms of the effects of the integration of e-learning into higher education institutions in the Gulf region, especially Oman [5-7]. However, the use of e-learning presents a number of challenges, though the benefits for their efficient implementation are evident [8, 9]. The literature review shows that there are students who have increased learning outcomes and others who do not remember large amounts of content that are taught in class because of low motivation and poor teaching techniques [10-12]. Active learning and collaborative activities have to be applied in teaching to intensify the effect of e-learning practices and increase students' engagement [13]. However, the use of particular instructional methods simultaneously with e-learning facilities has not been discussed comprehensively in connection with Omani higher education institutions [14, 15].

The following objectives are therefore developed to help fill these gaps: This research seeks to find out the effects of integrating e-learning and the teaching techniques on knowledge acquisition and competency among higher

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learning institutions in Oman. In detail, this work analyzes the ways identified technologies, including learning management systems and interactive platforms, can improve teaching efficiency and student competency. Therefore, this research adds insights regarding the connection between e-learning integration, teaching approaches, and students' performance contributions to the existing body of knowledge and offers useful suggestions for future advancements to Omani HE.

This work highlights the significance of e-learning integration (ELI), teaching methods (TM), and active learning strategies (ALS) in enhancing knowledge retention (KR) among students, with a particular focus on the Gulf region. Because those elements are becoming integrated into education systems across the globe as those systems are also modernized through the use of technology, it is important to comprehend how those components work collectively for the greatest impact on student achievement [16-18]. According to the literature, motivation means the extent to which students are willing to learn, and it is one of the most important determinants of learning, which can be greatly determined by ELI [19-21]. When restricted to the Gulf countries to a certain extent, culture and language affect the learning process, thus emphasizing the need to adopt ELI alongside culturally appropriate TM and ALS [22-24].

Over the last few years, the trends in educational technology have been rapidly changing the learning contexts globally and the Arab Gulf region in particular [25]. E-learning Integration (ELI), Teaching Methods (TM), and Active Learning Strategies (ALS) have come to be known as the major composites in the contemporary forms of learning, and these affect Knowledge Retention (KR) in learners [26, 27]. However, in Oman, and by extension, Gulf nations, there exists a unique dynamic: The target population of related study comprises Arab learners originally from Arab countries where the Arabic language is predominantly used [28]. These and other issues that accompany this dual-language education system affect knowledge acquisition and retention as well as influence methods to teach effectively. One problem faced by Arab students is learning retention, particularly after taking tests and exams [29]. This can be blamed on traditional lecturing, information overload, and a lack of effective learning approaches that do not tally with current learning technologies. To address this, a framework encompassing E-learning and other associated variables that can improve Knowledge Retention through mediating and moderating variables is developed.

This research aims at finding ways of improving KR in Omani higher learning institutions where students are Omani Arabic speakers while faculty teaches in English by analyzing ELI, TM, and ALS. The addition of the mediators (Cognitive Load Management (CLM) and Personalized Learning (PL)) and moderators (Innovative Educational Technologies (IET), Student Engagement (SE), and Cultural Factors (CF)) complicates the nature of the learning process. In light of such antecedents, this research has the merit of revealing how these factors can facilitate our understanding of the factors that hinder learning in the context of the Omani educational system and thus the ways in which the learning environments in the burgeoning states of the Gulf can be optimized.

1-1- Research Problem and Research Gap

There are major cognitive and cultural obstacles associated with the shift to English-medium instruction in Arab educational institutions, especially in Oman. Arab educational institutions, especially in Oman, have obtained sturdy cognitive and cultural influences. Nevertheless, students lack the capacity to memorize knowledge and apply it in their educational practices in the long future after exams because of the technologies that are being used in class. Old-fashioned instructional methods do not capture the linguistic or cultural realities of these students. Therefore, the main research question of this study is how to effectively adopt e-learning and the current approaches to teaching and involvement in the learning process in a way that will provide the best retention of knowledge important under the existing linguistic and cultural environment of the Omani and Gulf region students.

Although there are many studies on the effects of e-learning and new strategies in teaching methods on the academic achievement of students in other countries, there is a lack of adequate literature on Arab learners enrolled in English-medium institutions. To the best of my knowledge, there is little investigation into cognitive load management, personalized learning, and cultural specificity in this context. Moreover, the moderating roles of Innovative Educational Technologies, student engagement, and cultural differences in Arab learning environments have not been clearly investigated. This research addresses this gap by focusing on these factors in Omani institutions while providing a roadmap for the other GCC nations with comparable linguistic and cultural settings.

1-2- Research Contribution and Significance of the Study

This study contributes to the academic discourse in several ways:

- Contextualization of Learning Strategies: Focusing on Arab students studying in English, this paper therefore fills the gap with an emphasis on how instructional practices in second language learning environments should be responsive to the context.

- Novel Conceptual Framework: Thereby, the present study develops a model by combining ELI, TM, and ALS with moderator variables like CLM & PL and mediator variables like SE, CF, and IET for the improvement of knowledge retention within the context of Gulf education.

- Regional Focus: The present study therefore employs Oman as the context for a case through which the foundation for future research on the rest of the Gulf countries could be laid due to the similarities in the education systems faced in Oman and the rest of the Gulf countries.

The rationale for this study therefore hinges on its possibility of enhancing the education of Arab students in English-only institutions. This study provides implications for successful implementation of technology-enhanced learning for policymakers, educators, and the institution in Oman and the larger Gulf region by providing suggestions on how to reduce cognitive load, personalize learning, and consider cultures. Improving the application of these strategies is essential to improve knowledge retention to build the country's skilled workforce to meet the educational goals under the Oman Vision 2040 and other GCC countries' educational development reforms [6, 30, 31]. This research is unique because it targets Arab students who are taught only in English within the backdrop of Oman. The conceptual framework recognizes the learning difficulties in L2 and approaches the design with both instructional and technological interventions specific to the L2 learning context. To the extent that the case of Oman is representative of the other countries in the Gulf region experiencing these issues, the present research contributes by offering insights into these nations. As a result, this research opens a new perspective on the support of Arab students during their tertiary education by integrating e-learning options and the integration of learning preferences based on cultural backgrounds and language requirements in a bilingual environment.

2- Literature Review

Culturally relevant instruction has been found to improve learners' enrollment and achievement because the culture of the learners and their background are respected by their teachers [32]. For example, although in the Anglo-American educational context autonomy and performance are cardinal principles of education, in the Gulf educational contexts the technique of KR needs to include the reception of collectivism and team learning environments to augment the efficiency of KR [33, 34]. Moreover, as ALS engages the students in participating proactively in the learning process, it ensures adoption of the best practices from traditional and contemporary education to enhance positivity of outcome, embracing every student [35].

The use of e-learning and technology in learning has in the recent past been discussed in literature as factors that can aid teaching and learning [36]. Still, findings have it that the impact of e-learning and technology on student achievement is inconclusive [37, 38]. More empirical research is required to find out about the circumstances within which use of technology is more effective for students learning, especially in other regions of the world besides the Western world, as well as where the medium of instruction is EFL.

However, there are a few who have published research on the adoption of e-learning and innovative educational technologies employed in the higher learning institutions in the Gulf region with special reference to Oman [37, 39, 40]. So far, most studies that have explored e-learning in the context of the Gulf region have shifted towards learner characteristics and acceptance rather than the establishment of relationships with learning outcomes. Further research is required to examine the relationships between the teaching approaches, learning processes, and use of technologies in order to influence the students' acquisition of knowledge within the context of a collecting bilingual culture. Other factors, such as cognitive load and learner characteristics, have been considered as plausible moderators of the effectiveness of e-learning; however, these ideas have not been effectively examined in postsecondary non-Western settings [41]. Other factors such as the level of students' participation, the culture of the learning organization, and technology factors including social innovative educational technologies may enhance or hinder e-learning, but they still need to be tested under structural equation modeling with purposively sampled university students in the Gulf region [42]. In conclusion, this study targets a relevant and distinct research question wherein the focus is placed on how e-learning systems can be enhanced using pedagogical and technological practices to enhance advantages with respect to knowledge retention for students in the Gulf nations. These contextualized findings will enable the formulation of site-specific education policies and e-learning initiatives appropriate for enhancing learning outcomes for students of diverse linguistic and cultural backgrounds.

Therefore, this paper aims at examining how the interaction between ELI, TM, and ALS influences KR of culturally related information by Gulf students. While comparing these results with the findings of similar studies made in Western cultures where the role of culture is considerably less significant, the study will endeavor to provide recommendations

that are beneficial for refashioning the general educational system in the Gulf area for outcomes that are more favorable to students of diverse origins.

3- Research Methods

The method of research being introduced here is Structural Equation Modeling (SEM), which is a versatile statistical method for studying interactions between and among various variables. This study approach is most suitable for use in educational research since it assists in determining the effect of different constructs on knowledge gain. Smart-PLS is Partial Least Squares based software that aids the execution of SEM through features that ease model estimation and assessment. In this study, undertakings will follow the postulated structural modelling, applied scientific approach to enrich and validate the research findings.

3-1- Conceptualize the Model

To start with, this work formulates the theoretical model from the available literature and models. The research questions, objectives, and hypotheses have been carefully prepared and reviewed multiple times by experts in the field. Then we define the variable constructs of the proposed model and the hypothesized connections between them, and then we sketch a depiction of the suggested methodology as described in Figure 1. It aids in variable identification in the course of the research happening. This is useful in operationalizing the constructs involved in this study.
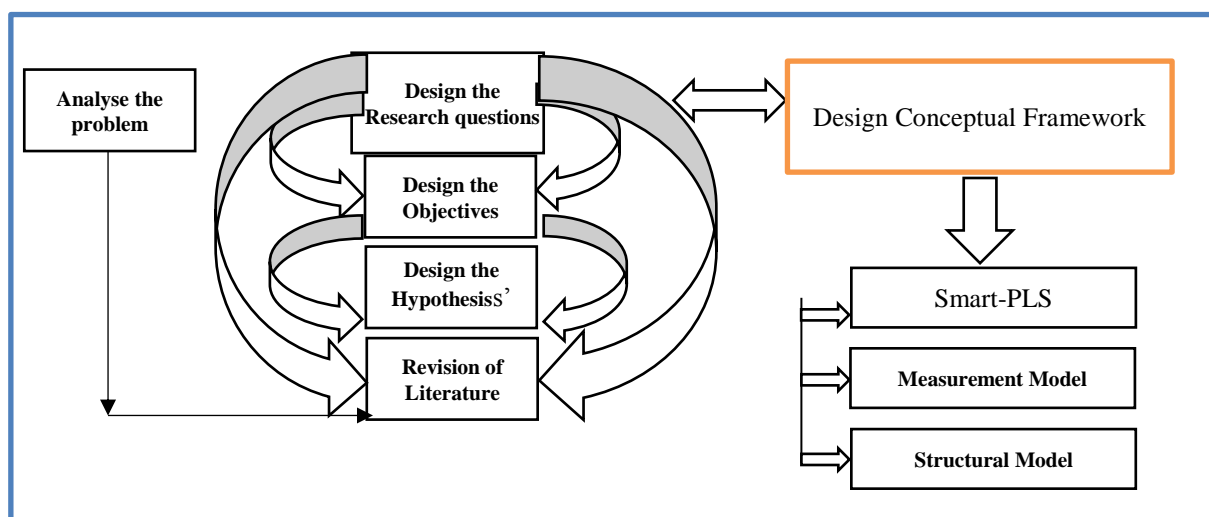

Figure 1. Research Methodology

3-2- Research Questions

1) What is the role of the integration of E-learning (ELI) on KR and its impact on Omani students?

2) Which Teaching Methods (TM) influences Knowledge Retention (KR).

3) How do Active Learning Strategies (ALS) affect Knowledge Retention (KR)?

4) In what ways do Cognitive Load Management (CLM) and Personalized Learning (PL) moderate the relationship between ELI, TM, and ALS on Knowledge Retention?

5) What is the role of Innovative Educational Technologies (IET), Student Engagement (SE), and Cultural Factors (CF) on or as mediators between ELI, TM, ALS, and Knowledge Retention?

3-3- Research Objectives

1) To assess the direct impact of E-learning Integration (ELI), Teaching Methods (TM), and Active Learning Strategies (ALS) on Knowledge Retention (KR) among Omani students.

2) To test how much Cognitive Load Management (CLM) and Personalized Learning (PL) could mediate the relationship between ELI, TM, ALS, and KR.

3) To explore the moderating role that Innovative Educational Technologies (IET), Student Engagement (SE), and Cultural Factors (CF) play in the relationships between ELI, TM, ALS, and Knowledge Retention

3-4- Hypothesis

H1: The integration of e-learning (e-learning integration—ELI) has a positive impact on Knowledge Retention (KR).

H2: There exists a positive correlation between Teaching Methods (TM) and Knowledge Retention (KR).

H3: ALS significantly correlates positively with KR.

H4: Cognitive Load Management (CLM) mediates the ELI and KR.

H5: The proposed CLM acts as a mediator between TM and KR.

H6: Personalized Learning (PL) also plays a role as a mediator between ELI and KR.

H7: Personalized Learning (PL) also plays a role as a mediator between ALS and KR.

H8: Therefore, Innovative Educational Technologies (IET) plays a role as a moderator between ELI and KR.

H9: Student Engagement (SE) acts as a moderator to the correlation between ELI and KR.

H10: Student Engagement (SE) acts as a moderator of the relationship between TM and KR.

H11: Student Engagement (SE) acts as a moderator of the relationship between ALS and KR.

H12: Cultural factors (CF) act as a moderator of the relationship between ALS and KR.

H13: Cultural Factors (CF) act as a moderator of the relationship between ALS and PL.

Figure 2 presents the developed conceptual framework, which is based on the literature review, research questions, objectives, and hypotheses.
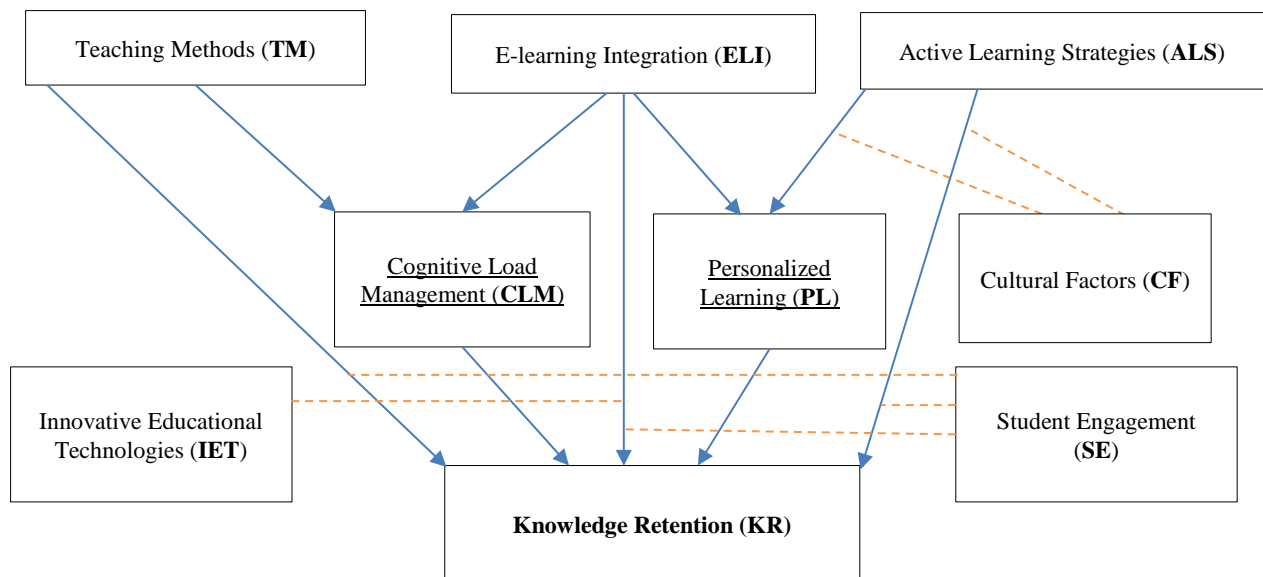

Figure 2. Conceptual Framework

3-5- Data Collection

To test the conceptual framework, a quantitative research technique was used through survey research design employing Structural Equation Modeling (SEM). The study is focused on the students in Omani institutions where data is collected through a survey instrument that assesses the relationship between the ELI, TM, ALS, and KR, with the moderating and mediating roles of the CLM, PL, IET, SE, and CF. A survey was administered to a non-random sample of students using convenience-sampling techniques. To ensure content validity of the survey, the survey was previewed and cross-checked by experts several times. The survey was published on Google Forms on April 22, 2024. The survey link was distributed through WhatsApp and email to colleagues working in Omani institutions, asking them to share it with their students and encourage participation in the study. By the end of July, we had received 839 responses. The structure and questions of the survey can be accessed in Google Forms (Survey) [43].

3-6- Data Cleaning

The data cleaning process included cases where some questions were unanswered or when there were missing responses or irregular responses. First, we ensured that the lowest and maximum values in the dataset were right on the Likert scale, which ranges from one to five. In order to do this, we sought any irregularities and, by extension, the data that was missing from the core fields of the program, but it was impossible to find any. Finally, in the analysis of any replies that were not considered to be normal, we used the standard deviation (SD). The values indicated in the descriptive statistics with a standard deviation min of 0.466 and a standard deviation max of 1.484 acceded to the criterion reported in past research studies by Hair et al. [44, 45]. The standard deviation STDEV is accepted to be below 0.25 according to the criterion established.

4- Data Analysis and Results

In order to confirm or reject the presumed hypotheses and to examine the direct, mediating, and moderating roles of the identified variables, Structural Equation Modelling (SEM) was applied using SmartPLS. When developing the measurement and structural models, the first decision we made concerned the selection of the types of the indicator variables for each construct in the model. They define the measurement models, which inform about each construct and its indicators. After the data had been gathered, we checked its reliability and validity to substantially reduce any likelihood that our sample may have been too small. We checked the internal consistency of the data scales we used, and we reached construct validities of both a convergent and discriminant type. In this type of research, it is important that the researcher assert validity in terms of measures used, conveying the constructs being used at this stage appropriately.

4-1- Measurement Model: Validity and Reliability

The metric of Composite Reliability (CR) and Cronbach's Alpha was also used in the context of verifying the validity and reliability of the measurement models. For this purpose, all the items in the dataset that had factor loadings below 0.700 were excluded. For example, the following items have been removed: 1.5TM:0.479; 2.5ALS:0.559; 3.5PL:0.579; 4.1CF:0.649; 4.5CF:0.508; 5.5CLM:0.49; 6.5ELI:0.471; 7.5IET:0.633; 8.5SE:0.457; 9.5KR:0.453. In Figure 3 the results are depicted before the other items have been omitted, while in Figure 4 the results are depicted after the other items have been omitted.
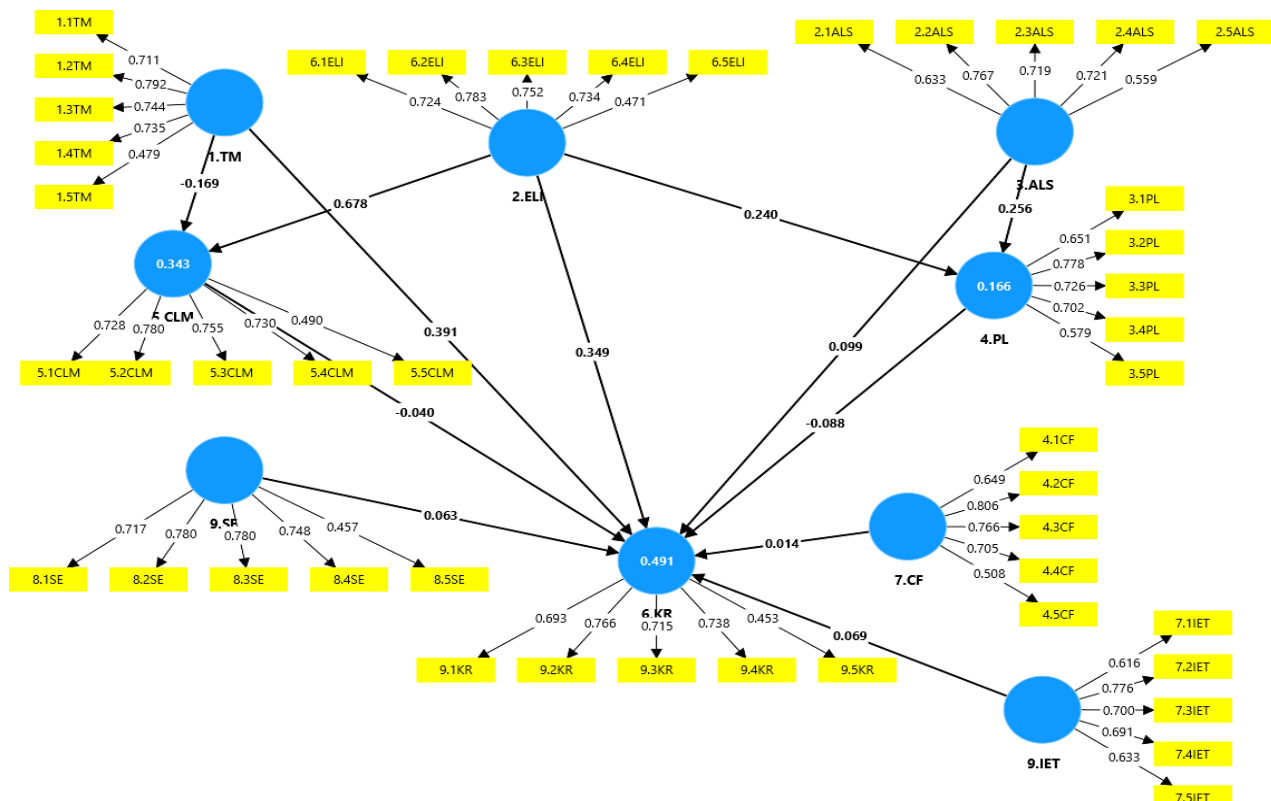

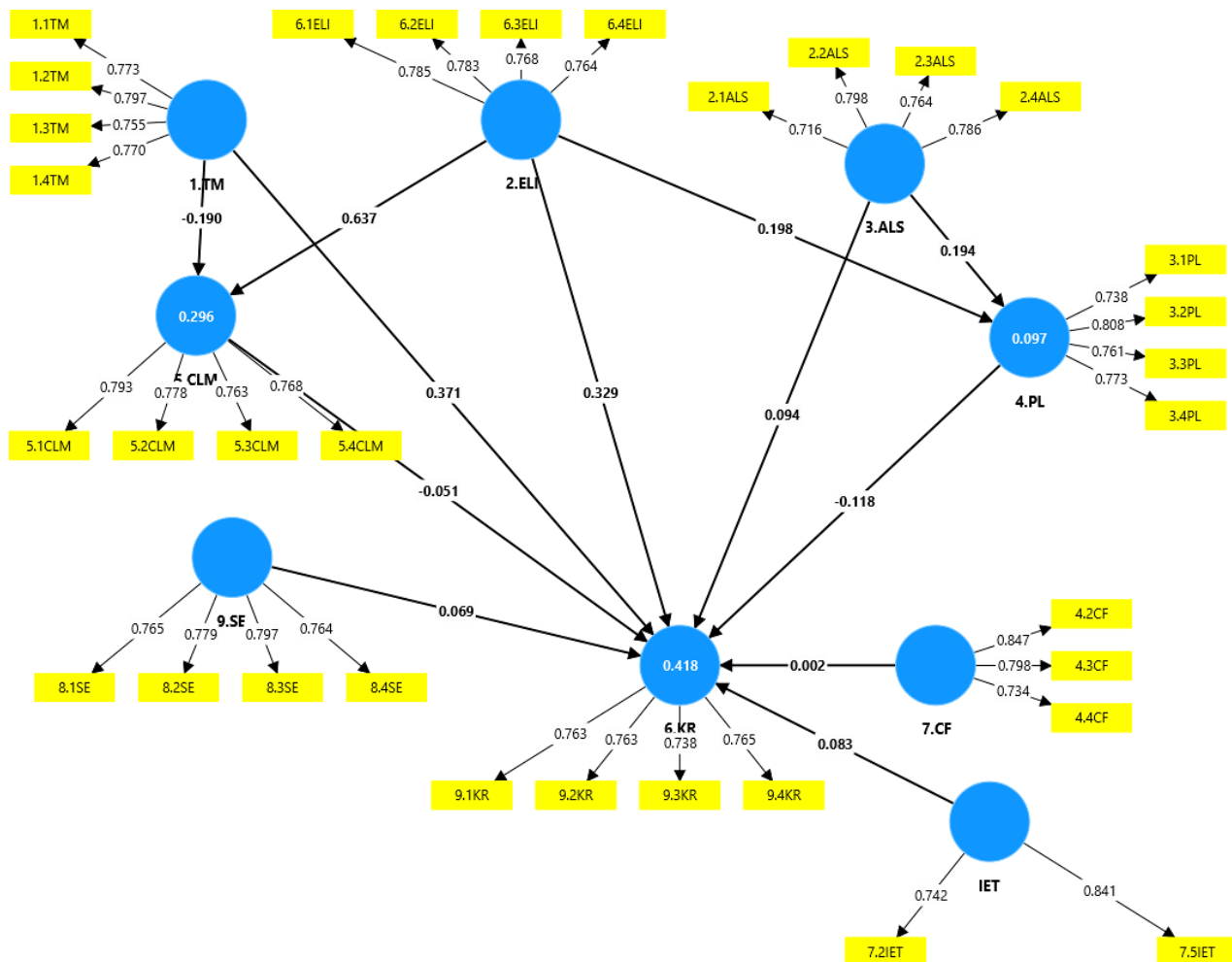**Figure 3. Factor loading (primary data)**

Figure 4. Factor loading (After removal: items < 0.07)

Having derived various measures such as AVE and HTMT through comprehensive testing, the aforementioned conclusion was made. Table 1 here presents all the remaining items along with the factor loadings with the validity and reliability spots. If all of the alpha values where the accuracies are higher than 0.700 and CR values are used as the dependability check and gauge, then the dependability is sound [44]. The convergent validity was as follows: AVE equal to or greater than 0.500 and CR equal to or greater than 0.700. This showed that the discriminant validity of the test was achieved since the factor loadings of each item were confirmed to be higher than their respective cross-loadings.

Table 1. Item Loadings, Reliability, and Validity

	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Teaching Methods (TM)		0.778	0.784	0.856	0.599
1.1TM ← 1.TM	0.773				
1.2TM ← 1.TM	0.797				
1.3TM ← 1.TM	0.755				
1.4TM ← 1.TM	0.77				
Active Learning Strategies (ALS)		0.773	0.787	0.851	0.588
2.1ALS ← 3.ALS	0.716				
2.2ALS ← 3.ALS	0.798				
2.3ALS ← 3.ALS	0.764				
2.4ALS ← 3.ALS	0.786				

E-learning Integration (ELI)		0.778	0.779	0.857	0.600
6.1ELI ← 2.ELI	0.785				
6.2ELI ← 2.ELI	0.783				
6.3ELI ← 2.ELI	0.768				
6.4ELI ← 2.ELI	0.764				
Personalized Learning (PL)		0.778	0.794	0.854	0.594
3.1PL ← 4.PL	0.738				
3.2PL ← 4.PL	0.808				
3.3PL ← 4.PL	0.761				
3.4PL ← 4.PL	0.773				
Cultural Factors (CF)		0.711	0.736	0.836	0.631
4.2CF ← 7.CF	0.847				
4.3CF ← 7.CF	0.798				
4.4CF ← 7.CF	0.734				
Cognitive Load Management (CLM)		0.78	0.78	0.858	0.602
5.1CLM ← 5.CLM	0.793				
5.2CLM ← 5.CLM	0.778				
5.3CLM ← 5.CLM	0.763				
5.4CLM ← 5.CLM	0.768				
Innovative Educational Technologies (IET)		0.415	0.426	0.772	0.629
7.2IET ← IET	0.742				
7.5IET ← IET	0.841				
Student Engagement (SE)		0.782	0.787	0.859	0.603
8.1SE ← 9.SE	0.765				
8.2SE ← 9.SE	0.779				
8.3SE ← 9.SE	0.797				
8.4SE ← 9.SE	0.764				
Knowledge Retention (KR)		0.753	0.757	0.843	0.574
9.1KR ← 6.KR	0.763				
9.2KR ← 6.KR	0.763				
9.3KR ← 6.KR	0.738				
9.4KR ← 6.KR	0.765				

4-2- Validity of their Predictions

To ensure the validity of the model's predictions, both discriminant and convergent validity were assessed. The 'Heterotrait-Monotrait Ratio (HTMT)' values are presented in Table 2, confirming that each construct is distinct from the others. Additionally, the 'Fornell-Larcker' criterion, shown in Table 3. These two methods provide robust evidence for discriminant validity. Further details and interpretations of these results, along with an additional test for discriminant validity, are discussed in the following section.

Table 2. 'Heterotrait-Monotrait ratio (HTMT)'

	1.TM	2.ELI	3.ALS	4.PL	5.CLM	6.KR	7.CF	9.IET	9.SE
1.TM									
2.ELI	0.766								
3.ALS	0.246	0.317							
4.PL	0.659	0.299	0.295						
5.CLM	0.236	0.668	0.326	0.282					
6.KR	0.722	0.724	0.285	0.247	0.269				
7.CF	0.39	0.208	0.114	0.347	0.165	0.222			
9.IET	0.37	0.292	0.214	0.47	0.197	0.272	0.253		
9.SE	0.19	0.15	0.069	0.121	0.086	0.211	0.228	0.196	

Table 3. 'Fornell & Larcker'

	1.TM	2.ELI	3.ALS	4.PL	5.CLM	6.KR	7.CF	9.IET	9.SE
1.TM	0.774								
2.ELI	0.602	0.775							
3.ALS	0.213	0.264	0.767						
4.PL	0.517	0.249	0.246	0.771					
5.CLM	0.193	0.522	0.261	0.237	0.776				
6.KR	0.562	0.557	0.242	0.205	0.211	0.758			
7.CF	0.298	0.16	0.086	0.27	0.122	0.17	0.794		
9.IET	0.311	0.246	0.192	0.377	0.164	0.227	0.197	0.773	
9.SE	0.154	0.114	0.04	0.102	0.058	0.168	0.178	0.159	0.776

4-3- Model of Assessment: Structural Model

In other words, the structural model is used to test the hypothesis. To this end, we conducted the bootstrapping procedure with 10,000 subsamples and the intention to use the "Bias-corrected and accelerated (BCA) bootstrap" method for constructing the confidence interval. A one-tailed test is used in this study because the hypothesis is addressing one aspect of the research question; the significance level used was 0.05.

4-4- Testing Hypotheses Directly

To test the interconnections of ELI, TM, ALS, and KR, the proposed hypotheses H1, H2, and H3 were formulated. Table 4 demonstrates the study findings suggested that there is a highly significant positive relationship between E-learning Integration (ELI) and Knowledge Retention, with a large effect size and high T-statistic, hence supporting H1 (B=0.39, t=9.188, p=0.000). This indicates that incorporating e-learning is a critical success factor in providing a return to practice for the students. Hence, consistent with H2, the cross-tabulation of TM and KR also yielded positive significance. This shows that proper teaching strategies play a critical role in the improvement of the students' recall of content knowledge (B=0.297, t=6.925, t=6.925,p=0.000).Thirdly, the formulated hypothesis H3, which concerned the positive correlation between Active Learning Strategies (ALS) and Knowledge Retention, was also advanced and approved (B=0.091, t=3.002, p=0.000).

Table 4. Testing Hypotheses Directly (H1, H2, H3)

	(O)	S (M)	STD	T	P	Hypothesis
1.TM → 6.KR	0.297	0.298	0.043	6.925	0.000	H2: Accepted
2.ELI → 6.KR	0.39	0.39	0.042	9.188	0.000	H1: Accepted
3.ALS → 6.KR	0.091	0.092	0.03	3.002	0.001	H3: Accepted

However, it interestingly demonstrated a positive correlation was statistically significant, meaning that although knowledge retention was also augmented through ALS to a lesser extent than ELI and TM, it nonetheless occurred.

In summary, the findings offer great support for the hypothesis that such a blend of e-learning, teaching techniques, and active learning practices contributes positively to knowledge mastery.

4-5- Mediation Analysis

Figure 5 validates the implementation of the mediation analysis using "Bootstrapping". Table 5 presents the results of testing. H4: Cognitive Load Management (CLM) mediates the ELI and KR. H5: The proposed CLM acts as a mediator between TM and KR. H6: Personalized Learning (PL) also plays a role as a mediator between ELI and KR.

H7: Personalized Learning (PL) also plays a role as a mediator between ALS and KR.

Table 5. Result Summary (Mediator analysis)

| Total effect		Direct Effect			Specific indirect effect					
B	P	B	P	Hypothesis	B	t	UL	LL	P	Results
0.334	0.000	0.39	0.000	H4:ELI → M → KR	-0.043	2.231	-0.075	-0.013	0.013	Partial Mediation
0.31	0.000	0.297	0.000	H5:TM → CLM → KR	0.013	2.036	0.004	0.025	0.021	Partial Mediation
0.334	0.000	0.39	0.000	H6:ELI → PL → KR	0.013	2.477	0.023	0.006	0.007	Partial Mediation
0.075	0.007	0.091	0.001	H7:ALS → PL → KR	0.015	2.447	0.027	0.006	0.007	Partial Mediation
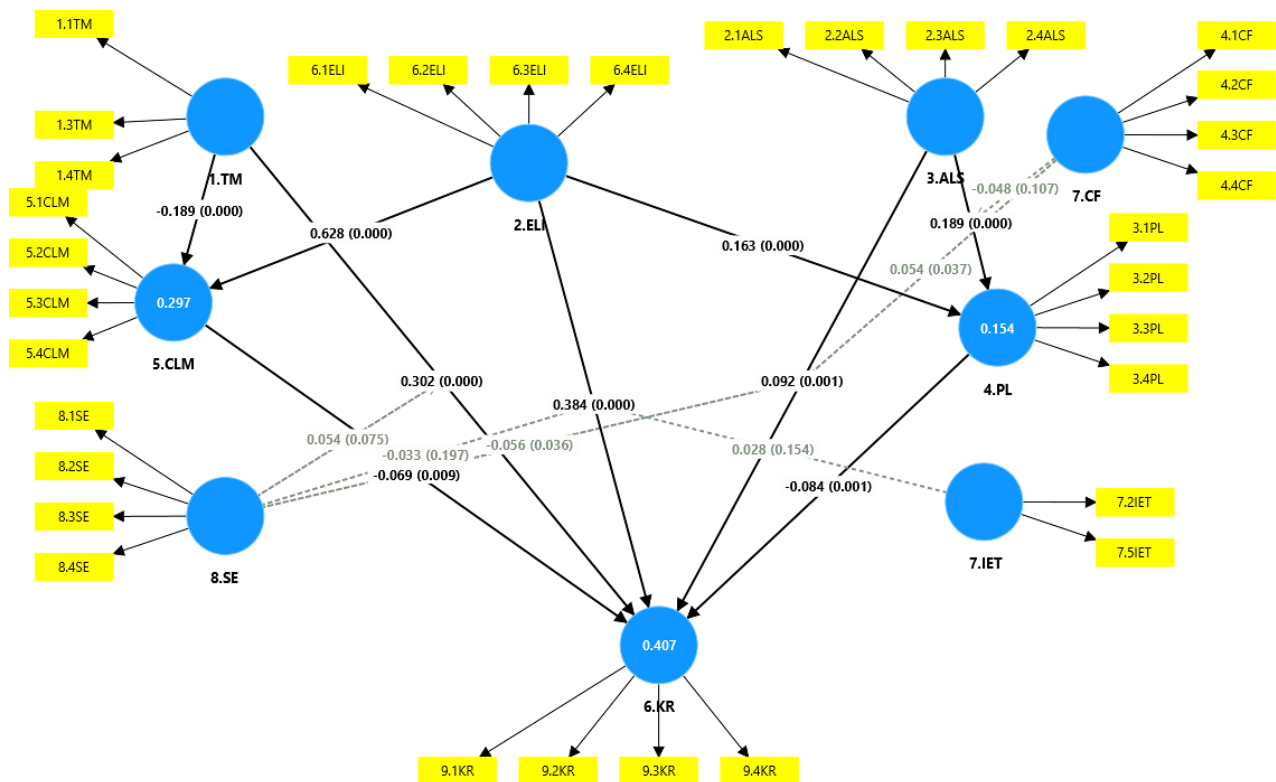
Figure 5. Bootstrapping implementation for Mediator & Moderator analysis

4-6- Testing Hypotheses H4, H5, H6, and H7

The following results give information on the hypotheses related to the mediation effects between variables E-Learning Integration (ELI), Teaching Methods (TM), ALS, Cognitive Load Management (CLM), Personalized Learning (PL), Knowledge Retention (KR). H4: E-Learning Integration (ELI) → Cognitive Load Management (CLM) → Knowledge Retention (KR).

Total Effect (B = 0.334, P = 0.000): In this study the total effect of ELI on KR is high and found to be significant.

Direct Effect (B = 0.39, P = 0.000): It is clear from the results above that ELI has a considerable and substantial direct effect on KR.

Specific Indirect Effect (B = -0.043, T = 2.231, P = 0.013): The negative indirect effect involving CLM is highly significant, implying that the mediation is at least partial.

Explanation:

Whereas CLM was found to negatively partially mediate the relationship between ELI and KR, the hypotheses for the other variables were supported. The negative mediation suggests that the enhancement of the cognitive load is inversely proportional to the overall effect of ELI on knowledge retention. H4 is partially supported with moderation by interactions between the variables used in the analysis.

H5: Teaching Methods (TM) → Cognitive Load Management (CLM) → Knowledge Retention (KR).

Total Effect (B = 0.31, P = 0.000): Teaching Methods (TM) have a positive correlation with KR.

Direct Effect (B = 0.297, P = 0.000): As expected, the results indicated that the direct impact of TM on KR was substantial and statistically considerable.

Specific Indirect Effect (B = 0.013, T = 2.036, P = 0.021): Taken together, the findings point to partial mediation because the positive and significant indirect effect proceeds through CLM.

Explanation:

Ownership of TM partially mediates the relationship of cognition load management and KR positively. Which implies that improved optimization of cognitive load improves teaching methods and knowledge gains. H5 is partially supported through mediated communication.

H6: E-Learning Integration (ELI) → Personal Learning (PL) → Knowledge Retention (KR). Total Effect (B = 0.334, P = 0.000): ELI significantly impacts KR.

Direct Effect (B = 0.39, P = 0.000): The results further revealed that ELI has a direct and strong positive relationship with KR.

Specific Indirect Effect (B = -0.013, T = 2.477, P = 0.007): The indirect effect through PL is negative and significant, indicating partial mediation was observed.

Explanation:

It indicates that while ELI has a direct positive effect on KR, the employment of personalized learning may weaken the impact partially with a negative mediation suggesting misalignment with the learners' preferences or the cognitive load reduction. H6 is accepted with partial mediation.

H7: ALS → Personal learning environments (PLE) → Knowledge reconstruction (KR)

Total Effect (B = 0.075, P = 0.007): ALS positively influences KR.

Direct Effect (B = 0.091, P = 0.001): There is a strong and direct relationship between ALS and KR.

Specific Indirect Effect (B = -0.015, T = 2.447, P = 0.007): The value is negative and significant for the indirect effect through PL, so there is evidence for partial mediation.

Explanation:

Personalized learning also has a negative partial mediation role in the relations between ALS and KR, like it with H6. This may suggest that although ALS enhances assistive knowledge retention, some aspect of personalization could be the cause of it. The research hypothesis, H7, is supported with partial mediation.

4-7- Summary of Findings

H4, H5, H6, and H7 are all supported with partial mediation. CLM and PL are identified as key mediators, and these mediating effects are moderated. In the case of ELI and ALS, the mediation effects are negative, potentially due to cognitive load issues affecting the use of personalized learning procedures in enhancing knowledge acquisition.

These findings indicate that even though novel pedagogy approaches, including ELI, TM, ALS, and PL, are helpful, their feasibility depends on how they combine with cognitive load and personalization in learning environments. Table 5 demonstrates the mediator analysis of the proposed hypotheses for H4, H5, H6, and H7. H4 (CLM mediates the relationship between ELI and KR): Consequently, the results depict the indirect effect negatively with an estimated coefficient of -0.043 and a T-statistic of 2.231, with the P-value < 0.013. This implies that CLM moderates the ELI and KR relationship, but the negative sign shows that where there is a high level of CLM, the positive effect of ELI on knowledge retention is mitigated. Therefore, the next hypothesis, H4, is also approved, but the negative mediation requires further analysis.

H5 (CLM mediates the relationship between TM and KR): The estimated coefficients show the results to have a small, yet statistically significant positive indirect effect of 0.013, T-statistic = 2.036, p = 0.021. This, therefore, implies that CLM moderates the relation between TM and KR positively. H5 is accepted, which suggests that effective management of cognitive load may improve the impact of teaching strategies on the level of knowledge retained.

H6 (PL mediates the relationship between ELI and KR): It was thus determined there exists a very small but negative relationship between PL and KR where mediation was determined by ELI with a T-statistic of 2.477 and a P-value of 0.007 at -0.013. However, akin to CLM, this mediation is negative; while the assessment of tailored learning is a part of the ELI learning process, it could lessen the chances of retaining knowledge. The negative mediation of H6 is accepted, although it emphasizes the rather ambiguous functions of PL.

H7 (PL mediates the relationship between ALS and KR): The moderation analysis reflected a small negative value of -0.015 of the mediator, PL, in relation to ALS and KR, along with a high T-statistic of 2.447 and a very low P-value of 0.007. H7 is accepted with the negative influence of the attitude indicating that personalized learning might reduce the impact of ALS on knowledge retention.

Analysis of the findings indicates that while CLM and PL have mediated the effect on the knowledge retention of ELI and ALS , the negative effects of mediation indicated by ''for'', ''regardless'' and 'by" imply that perhaps due to the complexities that mediation brings, innovation brings less overall relationship value. These results may be due to the higher cognitive load required for the accomplishment of copying tasks or misalignment between learning personalization and content delivery.

4-8- Moderator Analysis

Testing Hypotheses H8 to H13 from the Moderation Results

Red and green colors appear in Table 6 to show that the moderating impact of Innovative Educational Technologies (IET), Student Engagement (SE), and Cultural Factors (CF) is significant or non-significant on the correlations between E-Learning Integration (ELI), Teaching Methods (TM), ALS, and Knowledge Retention (KR) or Personalized Learning (PL) (see Figures 6 and 7).

Table 6. Moderator Results

	(O)	SED	T	P
7.CF × 3.ALS → 4.PL	-0.048	0.039	1.242	0.107
7.CF × 3.ALS → 6.KR	0.054	0.03	1.785	0.037
7.IET × 2.ELI → 6.KR	0.028	0.028	1.019	0.154
8.SE × 2.ELI → 6.KR	-0.033	0.039	0.853	0.197
8.SE × 1.TM → 6.KR	0.054	0.038	1.44	0.075
8.SE × 3.ALS → 6.KR	-0.056	0.031	1.8	0.036

H8: IET as a moderator between ELI and KR Innovative Educational Technologies (IET) Innovation to enhance the educational process In order to contribute to the development or enhancement of the interaction and KR, we present, as the moderator element in between, IET = Innovative Educational Technologies that kept our hope alive and drove us to look for ways that can clearly define or enhance the ingredients for the interaction between the learner and the environment or KR Educational Technology as innovation to Original Sample (O): 0.028 T Statistics: 1.019 P Value: 0.154 Result: **Not Accepted**

Explanation: Hypothesis 9 has suggested a negative moderation effect of IET in the ELI– KR relationship, but the result is not a significant one. This implies that, in this case, utilization of advanced education technologies does not adversely impact the impact of e-learning integration on mastery of content. H9: Student Engagement (SE) as the Mediator between ELI and KR Original Sample (O): -0.033 T Statistics: 0.853 P Value: 0.197 Result: **Not Accepted**

Explanation: SE does not substantially mediate the effects of ELI on KR. There is no evidence that shows that the level of student engagement positively or negatively enhances the effects of e-learning integration on knowledge retention. H10: This study is aimed at testing the hypothesis that Student Engagement (SE) acts as a moderator between TM and KR. Original Sample (O): 0.054 T Statistics: 1.44 P Value: 0.075 Result: **Not Accepted**

Explanation: However, it has been evidenced that SE has only a positive moderation effect and, therefore, the result only reaches the level of a significance test at the 0.0932 level instead of the required 0.05 level for statistical significance. Therefore, SE does not present a strong moderation effect in mediating this relationship. H11: Roles of Student Engagement (SE) as the mediating variable in the relationship between ALS and KR Original Sample (O): -0.056 T Statistics: 1.8 P Value: 0.036 Result: **Accepted**

Summary of Accepted and Rejected Hypotheses:

- **Accepted:**

  o **H11:** SE moderates the relationship between ALS and KR.

  o **H12:** CF moderates the relationship between ALS and KR.

- **Not Accepted:**

  o **H8:** IET moderates the relationship between ELI and KR.

  o **H9:** SE moderates the relationship between ELI and KR.

  o **H10:** SE moderates the relationship between TM and KR.

  o **H13:** CF moderates the relationship between ALS and PL.

Explanation: At Step 2, the results support H2 with SE significantly moderating the ALS to KR relationship. This means that students' engagement can either help improve or reduce the effectiveness of ALS on knowledge retention which mean that when students are more engaged more retention of knowledge is enhanced by ALS.

H12: Moderation Analysis of CF between the variables ALS and KR

Original Sample (O): 0.054

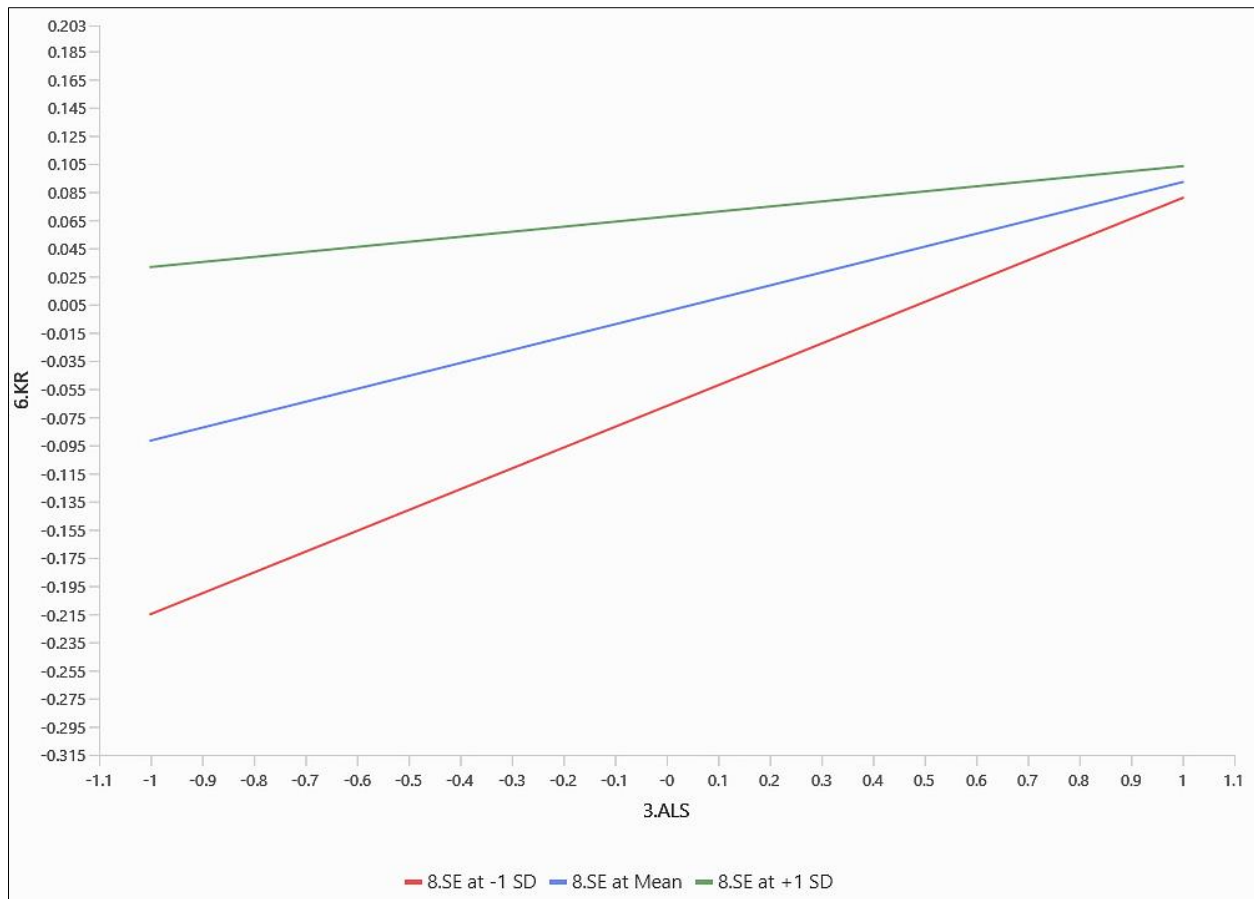T Statistics: 1.785

P Value: 0.037

Result: Accepted

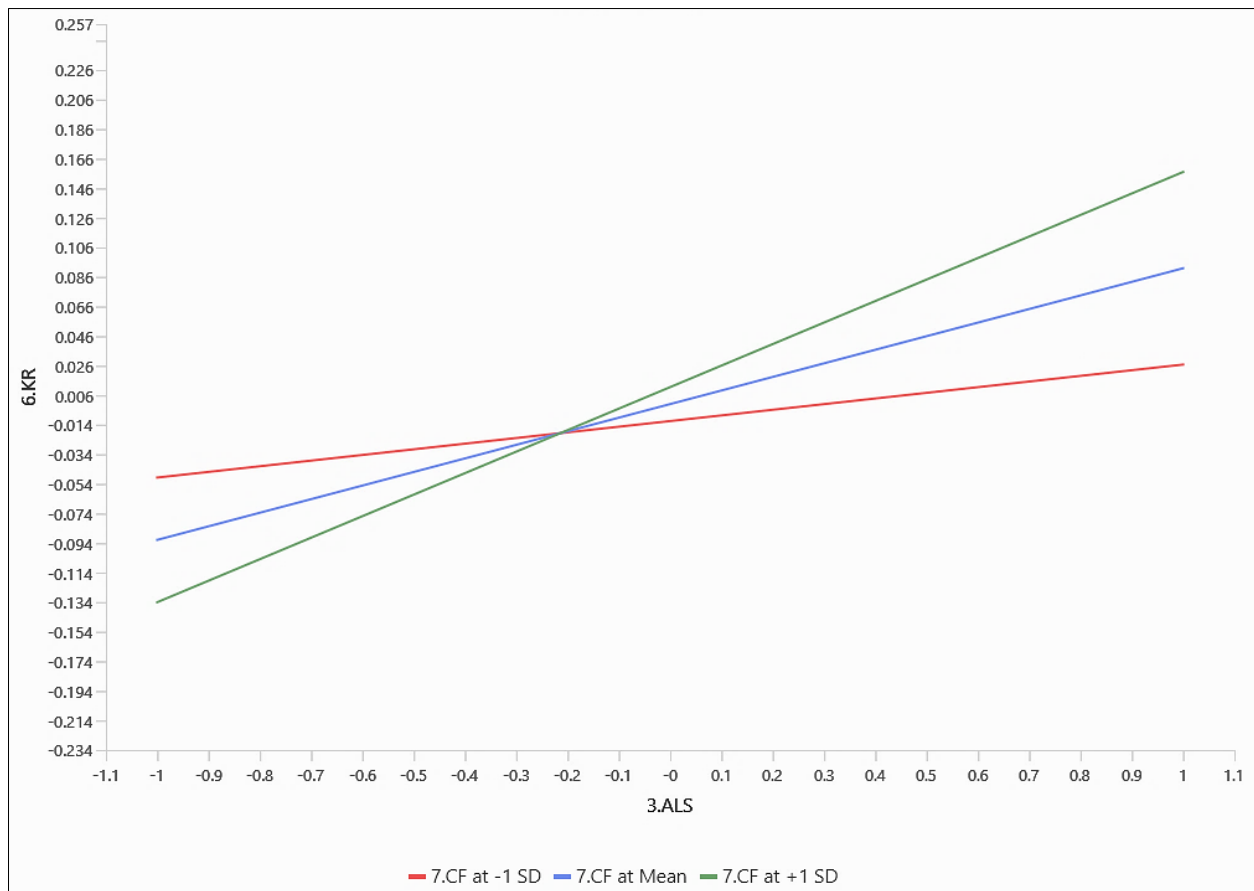**Figure 6. Slope analysis for H11: 8.SE x 3.ALS → 6.KR**

Figure 7. Slope analysis for H12: 7.CF x 3.ALS → 6.KR

ALS has a very strong positive relationship where CF significantly moderates the relationship to KR. This implies that these aspects of culture—tradition, norms, etc.—affect how ALS is on knowledge retention. It is, however, found that when there are favorable cultural antecedents to learning, ALS does better in enabling the acquisition of knowledge to be retained.

H13: The study also found Cultural Factors (CF) to mediate the relationship between ALS and PL.

Original Sample (O): -0.048

T Statistics: 1.242

P Value: 0.107

Result: Not Accepted

Explanation:

Similarly, in hypothesis 3, the moderating effect of CF is not significant and also does not support the relationship between ALS and PL. This implies that even with differences in culture, ALS has an equally strong impact on personalized learning outcomes.

Summary of Accepted and Rejected Hypotheses:

Accepted:

H11: SE actually reduces the correlation between ALS and KR.

H12: Thus, the proposed theory CF acts as a mediator between ALS and KR.

Not Accepted:

H8: IET plays a moderating role between the two variables of the present study: ELI and KR.

H9: SE considerably reduces the correlation between ELI and KR.

H10: SE imposes a moderation effect between TM and KR.

H13: CF positively interacts with ALS and contributes to its moderation of the PL.

The working hypotheses indicate that the number of active and focused students and cultural factors affect the manner in which ALS affects knowledge retention and therefore must be considered in strategies formulated for education. The rejected hypotheses indicate that the proposed moderators (IET and SE) hold no significant differences in some cases.

Table 7 presents the summary of R-square for Personalized Learning (PL), Cognitive Load Management (CLM), and Knowledge Retention (KR) when the model is run with and without the moderator variables that included cultural factors, student engagement, and innovative educational technologies.

Table 7. R-square with moderator (SR) and without moderator

	R-square (no moderator)	R-square (with moderator)
4.PL	0.097	0.154
5.CLM	0.296	0.297
6.KR	0.415	0.407

R-square (R^2) describes the percentage of the variance in the dependent variable that is predictable by the independent variables. The R-squared values are higher when the degree of differentials of the model is more, which means explaining more of the variability.

1. Personalized Learning (PL):

R^2 without moderator: 0.097

R^2 with moderator: 0.154

Interpretation: The introduction of a moderator leads to an increase in the R-square value of PLs from 0.097 to 0.154 at the variable level. This means that the addition of the moderator enhances the effectiveness of the model in accounting for variability in the outcomes of personalized learning, which points to the fact that the moderator bears a vital relationship with PL.

2. Cognitive Load Management (CLM):

R² without moderator: 0.296

R² with moderator: 0.297

Interpretation: Reliability, explained by R-square, also slightly increases on average from 0.296 to 0.297 for CLM. This signaled that the moderator bears the least or even lacks influence in the extent to which the model can account for CLM variation.

3. Knowledge Retention (KR):

R² without moderator: 0.415

R² with moderator: 0.407

Interpretation: Surprisingly, adding the moderator causes the R-square for KR to be slightly lower than without it at 0.407. This can mean that the moderator worsens the model's ability to explain the level of retained knowledge and is actually slightly worse for it.

What the Results Show:

- Moderation Effect on PL: The presence of the moderator enhances the level of the explained variance for Personalized Learning (PL), thus suggesting that the moderator bears a significant function in determining PL outcomes.

- Moderation Effect on CLM: There is no substantial finding, which means it can be stated that the moderator does not have much influence on the variance of CLM as found in the present study.

- Moderation Effect on KR: Moderation does not enhance the capacity of the model in explaining Knowledge Retention (KR) and actually depresses the R-square value slightly. This may mean the moderator plays an ineffective role in helping explain KR within the confines of this study.

Specifically, the moderator has a positive impact on Personalized Learning (PL) while it has an insignificant impact on Cognitive Load Management (CLM) and Knowledge Retention (KR).

5- Discussion

5-1- Addressing the Research Questions

In this section, this work discusses how we address the proposed research questions through hypothesis testing, which provides detailed answers supported by evidence. The research questions and the corresponding explanations of how this work answers them are discussed as follows:

What are the Teaching Methods (TM) that affect Knowledge Retention (KR)?

- H1: E-learning, which is also referred to as ELI, has a significant positive effect on KR by Omani students. This hypothesis was accepted (B = 0.39, P = 0.000). This implies that integration of e-learning enhances the students' retention of the knowledge delivered in class. Digital learning methods enhance learning by increasing the level of engagement, enhancing access, and improving learning content retention.

- H2: Teaching Methods and Knowledge Retention also have a positive relationship with Teaching Methods (TM) and Knowledge Retention (KR) with a Beta of 0.297 and a p-value of 0.000. This demonstrates that good teaching strategies, including those based on practice, increased participation, and more focus on students, enhance the amount of material that students remember. Presence and a variety of teaching behaviors enhance learning. Active learning strategies (ALS) are such that only the knowledge retention (KR) influences the modality.

- H3: All the subjects showed a statistically significant positive relationship between Active Learning Strategies (ALS) and Knowledge Retention (KR) (B = 0.091, P = 0.001). Active learning fosters an atmosphere of attention and concentration and therefore increases recall of content. Therefore, acquiring active learning strategies is important in enhancing learning achievement.

How do CLM and PL moderate the connection between ELI, TM, and ALS to KR?

- H4: We find partial mediation between ELI and KR through CLM with beta estimates of B = -0.043 and P = 0.013. This suggests that reducing cognitive load can increase e-learning effects on knowledge acquisition moderately inasmuch as students' cognitive resources are optimized in the process of learning.

- H5: Thus, we also find that CLM is a partial mediator of TM, KR (B = 0.013, P = 0.021). This has an implication that proper control of cognitive load in teaching procedures slightly improves students' learning retention capacity.

- H6: The result revealed that PL had a partial mediation between ELI and KR (B = -0.013, P = 0.007). Personalized learning customizes existing e-learning to better meet each student's needs, thereby creating a better chance for retention.

- H7: PL also moderates the ALS to KR relationship (B = -0.015, P = 0.007) and suggests that while personalizing the use of active and passive learning pedagogy, it improves the ability of the former in enhancing knowledge acquisition.

How are Innovative Educational Technologies (IET), Student Engagement (SE), and Cultural Factors (CF) related to ELI, TM, ALS, and knowledge retention?

- H8: However, our results show that IET does not play a major role in mediating the interaction between ELI and KR (P = 0.154). This suggests that though the use of innovative technologies is critical, it may not significantly improve the correlation between e-learning integration and knowledge retention.

- H9: Therefore, SE does not moderate ELI on KR with moderate effect (P = 0.197). This means that although engagement is important, it does not enhance the E-learning retention link as it was expected.

- H10: The analysis found that SE does not moderate the interaction between TM and KR (F = 3.476; P = 0.075). Nonetheless, SE is neither a highly significant moderator in this relationship, nor is it far off from achieving significance.

- H11: The above analysis shows that SE moderates the relationship between ALS and KR with a regression coefficient equal to -0.056 and a p-value = 0.036. The result is that a higher level of SE improves the ability of ALS to increase KR.

- H12: With respect to hypothesis one, it was found that ALS has a positive effect on KR and that the strength of this relationship is significantly reduced where CF is present (B = 0.054; P = 0.037). From this it is evident that cultural issues do intervene too significantly when students from various cultural perceptions approach active learning techniques and retention of knowledge.

- H13: The findings also reveal that CF does not exert a strong influence on the relationship between ALS and PL, meaning that the cultural factor does not fully mediate how ALS causes PL (P = 0.107).

5-2- Selection of Respondents and Representativeness

For this study, 1,630 participants were targeted using a convenience sampling technique from various universities in Oman. However, 839 participants provided valid responses. This approach offered a convenient and easily operationalized sample, and we realize that random or even stratified sampling would have improved the generalizability of the sample. However, the respondents do give a fairly representative sample of the Omani student and faculty population in higher education institutions due to their diversified discipline, level of study, and years of teaching experience. Under this population, we gather both undergraduate and postgraduate students as well as lecturers from several departments in an attempt to have a sectional sample. While the sample is not likely to represent all the students and faculty members, it gives a relevant picture that is congenial with the context of this study.

5-3- Operationalization and Measurement of Mediators

Thus, Cognitive Load Management (CLM) and Personalized Learning (PL) were chosen as mediators according to the fact they play an important role in the e-learning process. CLM was made measurable by evaluating the perceived cognitive load of the participants who completed a five-item Likert-scale questionnaire on the difficulty and mental demand of interacting with the course content. Personalization was assessed based on the extent to which the students ascertained that e-learning tools were personalized for their learning preferences based on a set of questions on adaptability or learner control. These mediators were chosen based on the theoretical and empirical implications of the links between e-learning and teaching methods on one hand and knowledge retention on the other, and confirmed by the SEM study showing the partial mediating role in the contexts of ELI, TM, ALS, and KR.

5-4- Cultural Factors and Knowledge Retention

Cultural Factors (CF) were found to enhance the effect of Active Learning Strategies (ALS) on Knowledge Retention (KR). In our study, CF incorporated cultural characteristics like collectivism, power distance, and learning from the cultural perspectives of the Gulf region educational context. The above cultural practices influence the ways in which students can implement active learning modes, particularly the collaborative ones. As compared to Western settings, learning conducive to individuals and tailored self-study was not encouraged in the Gulf region; more group study was seen to enhance knowledge recall. Hence, the social environment of ALS implementation is relevant knowledge for evaluating the success of the approach.

5-5- Innovative Educational Technologies and Pedagogical Alignment

Analyzing the results of the study, the moderating role of IET was identified as insignificant when mediating the correlation between ELI and KR, which might be due to the misfit of technologies employed with the adopted approaches to teaching and learning. The Wellbeing & Enhance Learning study assessed the following IETs: learning management systems and multimedia elements of IET; a form of learning such as videos, forums, and quizzes. Still, these technologies were not always implemented hand in hand with active learning approaches and teaching methodologies. Perhaps because the technology used in the classroom remained unintegrated with the teaching and learning approaches, IET may not have had an effect on improving knowledge acquisition. This work has therefore brought out the need for a well-coordinated approach to the use of technological tools where such items are well chosen and applied in harmony with the teaching methods that seek to enhance learning activities.

5-6- Applicability to Other Developing Countries

Altogether, this study offers important implications for Omani HEIs; however, the assumptions introduced here may be helpful for other developing countries where English is not the principle language. Still, the processes of applying these findings would have to be made with several conditions, including language and information technology environments. Especially in countries that do not have access to enhanced e-learning technology, the required changes were identified that would help the deficiency of the given study and would need to be made with reference to available resources only. Further, differences in education systems are prescriptive as to requiring adaptation of modes and approaches of teaching and learning as may apply in the national setting. On an overall note, the most basic tenets of e-learning integration, of the introduction of the active learning model, and of teaching and learning strategies that are learner-centered may have potential not only for the general population of students.

5-7- Broader Trends in Digital Education

This evidence accords with general tendencies in digital education, namely the shift towards engaging, game-based, modular, and intelligent forms of learning. Especially, there are certain approaches, such as gamification and adaptive learning systems, that have the potential to improve students' engagement and their knowledge acquisition due to personalization of the instructional process. Our study did not center on these trends; however, the use of personalized learning together with the application of interactive e-learning falls in line with the shift in educational technology. The next research direction in the current study might be to determine the applicability of these modern approaches, including gamification, to knowledge acquisition and learners' engagement in Omani higher learning institutions.

6- Conclusions

The findings of this study are important for the analysis of the impact of e-learning integration, teaching and active learning methods on knowledge and competency. By including such factors as Cognitive Load Management and Personalized Learning as well as cultural factors promoting learning effectiveness, the research fills the gap in the literature concerning the application of sophisticated technologies in enhancing teaching and learning processes in higher learning institutions in Oman and possibly in other developing nations. The findings also suggest the importance of aligning e-learning technologies with pedagogical methods to maximize their impact on student outcomes.

The use of e-learning, instructional methods and strategies, and active learning has a positive effect on learning achievement for Omani students. CLM and PL act as partial mediators to enhance the impact of e-learning and teaching methods on knowledge acquisition. Active Learning Strategies (ALS) are more important in the learning process; however, the moderating role of students' engagement is much more crucial for the relationship between the learning outcomes—Knowledge Retention (KR). Cultural factors (CF) are found to have an indirect influence on the impact of ALS on KR. This article established that there is an importance of taking culture into consideration in educational practices. Innovative Educational Technologies (IET) were not used to qualitatively moderate the relationship between E-learning integration and Knowledge Retention, which raises some doubts as to whether technologies should be used on their own or require pedagogical support.

6-1- Recommendations

- Enhance E-learning platforms: Teachers and professors should further establish an effective E-learning system for their students, enhancing their availability to increase credibility with information retention.

- Adopt active learning strategies: School should adopt activities that can be used in the learning process and strategies that ensure students are active in the learning process.

- Promote personalized learning: It is appropriate that personalized learning systems be incorporated into e-learning platforms for facilitating learning to suit the preferences of the learning students.

- Manage cognitive load: Teachers should also pick ways of balancing the loads on the upper part of the cognitive system; students should not get overwhelmed, and their ability to engage knowledge should not be hindered.

- Address cultural factors: The cultural expectations of learners need to be understood by institutions in Oman and the Gulf region as they design new strategies in learning to ensure that these strategies are culturally appropriate.

6-2- Future Work

Broader Testing Across Regions: This study was confined to Omani students only. Further research should attempt to replicate these variables in other member countries of the Gulf or Arab region to observe the impact of modifying cultural context on conclusions.

Longitudinal Studies: To have secondary insight on the repercussions of e-learning and the teaching strategies on knowledge longevity in future research, cross-sectional data could be utilized.

Advanced Moderation Analysis: The next studies should investigate other moderating factors, for example, motivation, institutional support, or socioeconomic factors that may influence the relationships established between the e-learning integration and the amount of knowledge retained.

7- Declarations

7-1- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7-2- Funding

7-3- Acknowledgements

7-4- Institutional Review Board Statement

Not applicable.

7-5- Informed Consent Statement

Not applicable.

7-6- Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the author.

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Appendix I: Survey Information

https://docs.google.com/forms/d/e/1FAIpQLSfqbVHtIt_-4wnl7fPshlml0yZABTqHjM5FR8SmBbtxllbNrA/viewform?usp=preview

Table A1. The present research survey

Variable	Question
Teaching Methods (TM) (IV)	The teaching methods employed in my courses enhance my ability to retain knowledge.
	The teaching strategies used in my courses improve my understanding of key concepts.
	The teaching methods in my courses promote active learning and engagement.
	The teaching methods support my ability to apply learned knowledge in practical situations.
	The teaching methods utilized are effective in helping me retain important course material.
Active Learning Strategies (ALS) (IV)	Active learning strategies help me better understand and retain course material.
	Group activities and discussions in my courses contribute to my knowledge retention.
	Active learning strategies, such as problem-solving tasks, improve my critical thinking skills.
	Active learning strategies encourage me to actively engage with the course content.
	I feel that active learning strategies positively influence my long-term retention of knowledge.
E-learning Integration (ELI) (IV)	E-learning tools effectively support my learning and knowledge retention.
	The integration of e-learning in my courses enhances my ability to recall and apply knowledge.
	E-learning platforms are a valuable resource for retaining information learned in class.
	I find that e-learning integration in my courses improves my retention of key concepts.
	The use of e-learning tools helps me to manage and reinforce my learning outside of the classroom.
Personalized Learning (PL) (Mediator)	Personalized learning techniques help me focus on areas where I need improvement.
	Personalized learning strategies enhance my ability to retain information.
	I benefit from personalized learning, as it caters to my individual learning pace and style.
	Personalized learning methods allow me to master subjects more efficiently.
	The personalized approach to learning improves my ability to retain knowledge over time.
Cultural Factors (CF) (Moderator)	Cultural factors in my learning environment influence how I engage with course material.
	Cultural values and norms affect the way I approach knowledge retention.
	Understanding and respecting cultural factors in the classroom helps me retain information better.
	Cultural diversity in the classroom enriches the learning process and knowledge retention.
	Cultural factors positively influence my ability to retain knowledge in academic settings.
Cognitive Load Management (CLM) (Mediator)	Managing cognitive load helps me retain information more effectively.
	Cognitive load management strategies improve my ability to focus and retain knowledge.
	When cognitive load is managed properly, I find it easier to retain complex information.
	Cognitive load management improves my concentration and ability to recall course material.
	Efficient cognitive load management helps me absorb and retain information during learning.
Innovative Educational Technologies (IET) (Moderator)	Innovative educational technologies enhance my ability to retain knowledge.
	The use of innovative educational technologies in my courses has positively affected my knowledge retention.
	Technologies like learning management systems improve my learning outcomes and retention.
	Innovative educational technologies engage me and aid my retention of knowledge.
	The integration of innovative technologies has a strong positive impact on my learning and retention.
Student Engagement (SE) (Moderator)	Higher levels of student engagement increase my ability to retain knowledge.
	Active participation in class positively influences my knowledge retention.
	The more engaged I am in learning activities, the better I retain information.
	Student engagement strategies have a significant impact on my retention of course content.
	When I am actively engaged, I remember course material more effectively.
Student Engagement (KR) (DV)	I am able to retain knowledge from my courses long after completing them.
	I can recall key concepts learned in my courses whenever needed.
	The knowledge I gain from my courses stays with me for a long period of time.
	I retain and apply knowledge from my courses in real-life situations.
	The skills and knowledge gained from my courses remain relevant and memorable.