

# Screencasts: The Mediating Role of Relevance in the Relationship Between Attention and Confidence in the ARCS Model

Lindie Grebe, University of South Africa, South Africa

## ABSTRACT

The main objective of the study was to investigate the potential mediating effect of relevance in the relationship between attention and confidence in Keller's ARCS model during screencasts in distance education. The paper responds to calls for further research into the ARCS model in different delivery systems, cultural settings, and learner populations, and in terms of the relationship between the motivational components. The study employed design-based research to address practical problems in distance education and used the IMMS survey to collect data. Exploratory factor analysis revealed two factors, attention with interest and basic attention for attention, and two factors, ease of use and self-confidence for confidence. This paper contributes to advance knowledge of design principles, which instructional designers could use when designing learning materials in order to motivate online students.

## KEYWORDS

ARCS Model, Attention, Confidence, Design-Based Research, Distance Education, Relevance, Satisfaction, Screencasts, Technology-Enhanced Learning, Volition

## INTRODUCTION

This article responds to calls for further research into Keller's (1987a, 2008a, 2008b, 2010) ARCS model of improving motivation in instructional design in different delivery systems, cultural settings, and learner populations (Simsek, 2014, p. 94; Li & Keller, 2018). It further also responds to calls by researchers such as Loorbach, Peters, Karreman and Steehouder (2015) for more research into the relationship between the motivational components of attention, relevance, confidence and satisfaction of the ARCS model. Milman and Wessmiller (2016) highlights the models' potential for asynchronous and geographically dispersed learning. This article responds to these dimensions in terms of the mediating role of *relevance* in the relationship between *attention* and *confidence* of the ARCS model in the context of a mega university on a developing continent, which integrally delivers asynchronous learning across widespread geographical regions. In particular, this article reports on a study that utilised screencasts that were based on design principles for multimedia by

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Mayer (2009, 2014) to investigate the mediating effect of relevance on the components of the ARCS model. Hodges (2004) asserts that being motivated in terms of the ARCS model, may assist students to become self-regulated and improve their performance.

Technology has become an integral part of society and students' lives and scholars support the use of technology in learning (Butcher & Rose-Adams, 2015; Dede, 2013). Notwithstanding the proliferation of technology devised to support and enhance learning, an essential educational fundamental, namely motivation, has not received adequate attention, especially in computer-based instruction (Kim & Keller, 2011; Loorbach et al., 2015). Over the years various authors such as Broadbent (2016), and Cho and Heron (2015) argued that online environments such as distance education, offer distinctive challenges for instructional designers and academics in terms of the motivation of students. Motivation and self-efficacy are important factors for students to be self-regulated in independent learning. Keller and Suzuki (2004) also argue that although technology with its innovative features may add to the appeal of learning materials, the initial attraction may be lost once the novelty effect wears off. Therefore, Keller (2008a, 2010) recognise difficulties with the motivational aspect of teaching and learning pertaining to stimulating and sustaining students' motivation.

The literature reveal a lacunae in terms of the implementation of screencasts to enhance motivation and the use of design-based research with the IMMS to study the effects of screencasts on students' motivation (Li & Keller, 2018). This article studies the ARCS model and Keller's (1987a) IMMS instrument to establish how motivated students are, in different contexts and populations, as well as the inter-relationship between components. A few studies such as research by Chang and Lehman, (2002), and Means, Jonassen and Dwyer (1997) investigated the effect of relevance enhancing strategies to improve student motivation, but there is a silence relating to the mediating effect of relevance between attention and confidence in the ARCS model. Such research is therefore warranted. By using design-based research, the aim is to advance knowledge of design principles, which instructional designers and academics should keep in mind when designing learning materials in order to motivate online students.

## **LITERATURE REVIEW**

Authors such as Dick and Carey (1996), Keller (1987a, 1987b, 2008a, 2010), Kurt and Kecik (2017), Wlodkowski (1985), and Zhang (2017) have described the concept of motivation and affirmed the critical role of motivation in the context of learning and the design of learning materials. For Keller (2010, p.3) motivation is "what people desire, what they choose to do, and what they commit to do". Keller's (1987a, 2008a, 2008b, 2010) ARCS model of improving motivation in instructional design serves as the theoretical underpinning for this study. Keller (1987a, 1987b) argues that in order to improve motivation, instructional designers must systematically follow two requirements, namely there must be an understanding of motivation in terms of the important components to learn and secondly instructional designers must understand which strategies to implement when designing learning materials. Keller (1987a, 1987b, 2008a, 2008b) developed the ARCS model of motivation. This model consists of five components that need to be present for students to become and remain motivated, namely attention, relevance, confidence, satisfaction and volition.

### **Attention**

Attention is the first category of the ARCS model and a prerequisite for learning according to Keller (1987a, 2008a). Students' attention need not only be captured, but sustained (Keller & Suzuki, 2004). According to Keller (1987a), and Keller and Suzuki (2004), the implications for instructional designers and practitioners are to include strategies that will stimulate students' interest, curiosity and knowledge-seeking.

## Relevance

Attention alone is not adequate to ensure motivation. Students need to perceive the instructional materials consistent with their personal goals. Means et al. (1997) concur that learning materials relevant to students' personal goals increase their effort, with direct effect on academic performance. Keller (2008a, p. 177) continues that relevance connects the instructional environment, "which includes content, teaching strategies, and social organization, and the learner's goals, learning styles and past experiences".

## Confidence

Keller, (2008a, p. 177) relates confidence to students having trust in their own abilities to learn. Incorporated in the principle of confidence are variables which relate to students' frame of mind in terms of "personal control and expectancy for success". Keller (2008a, p. 177) suggests that in order to support students to attain confidence and positive expectancies for successful outcomes, they need to "experience success under conditions where they attribute their accomplishments to their own abilities and efforts". Keller (1987a, 1987b, 2008a, 2008b) maintains that confident students tend to be more focused and are inclined to believe that they can realize their goals by way of their own doings.

## Satisfaction

According to Keller (2008a, p. 177) the first three principles relate to "conditions that are necessary to establish a student's motivation to learn". The fourth principle, satisfaction, is essential to promote and develop continuing motivation to learn. Students need to feel positive about their learning experiences, as well as "anticipate and experience satisfying outcomes to a learning task" (Keller, 2008a, p. 177).

## Volition

Keller (2008a, 2008b) included volition as the fifth principle in an extended ARCS model which he refers to as ARCS-V, in his interview with Simsek (2014, p. 93). Keller (2008a) explains that being able to overcome distraction from goals, students need to employ volitional strategies to maintain self-regulation and persistence.

## Screencasts

A screencast is a digital recording of what is happening on the screen, accompanied with an audio recording explaining the concepts on the screen. Various researchers such as Bolliger, Supanakorn and Boggs (2010), Hill and Nelson (2011), Jordan, Birgit, Lowe, Mestel and Wilkins (2012), and Mathieson (2012) describe screencasting as a powerful tool in providing quality supplementary instruction to students in distance education.

The screencast project that this article reports on, was initiated by the College of Accounting Sciences (CAS) and supported by the Auditor-General of South Africa. Lecturers addressed specific topics in the screen casts and based the screencasts on design principles for multimedia by Mayer (2009, 2014). Screencasts were aimed at postgraduate accounting students and were uploaded to the learning management system (LMS) for enrolled students to access.

## Materials and Methods

The main objective of the study was to investigate the potential mediating effect of relevance in the relationship between attention and confidence in the ARCS model, ultimately leading to satisfaction and motivation. The study employed a pragmatic design-based research strategy to address practical problems in distance education. This article reports on phases three and four of the first iteration of the study.

Keller (1987a) designed the IMMS instrument to establish how motivated students are when using instructional materials. The IMMS is a 36-question 5-point Likert type scale survey, based on the

ARCS model. It has been used in numerous studies by researchers such as Cook, Beckman, Thomas and Thompson (2009), Di Serio, Ibáñez and Kloos (2013), Keller (2010), Keller and Suzuki (2004), Kim and Keller (2011), Means et al. (1997), and Ocak and Akçayır (2013) who found it to be a valid and reliable instrument. Keller (2010) reported that the internal consistency of the IMMS based on Cronbach's Alpha was satisfactory with the total reliability of .96. Other researchers reported similar values; Cook et al. (2009) reported 0.93 and 0.95, and Ocak and Akçayır (2013) 0.91. The researcher obtained permission from Prof Keller to use the IMMS instrument. Data were collected during both semesters of the academic year by administering the survey online.

The census sampling included 6 327 students enrolled for the two modules referred to as CTA1 and CTA2, across Southern Africa. These students viewed screencasts that were designed based on their CTA study material as part of this study. The total number of views were 9 875. The ages of the students range from less than 25 to over 50, with the greatest percentage (48%) between 25 and 30 years. In terms of gender, the greater percentage consists of female students (58.5%). Most students were from a black (65.6%) cultural background. All 11 South African languages were represented, as well as Chishona from Zimbabwe and Luhya from western Kenya. Almost two-thirds of the students were in the CTA year 1 group (64.8%). One hundred and fortythree student participants completed the survey based on the CTA screencasts presented to them, of which only surveys with the entire fields completed were retained for analysis. Cohen, Manion and Morrison (2000) report that negative aspects of administering surveys are low response rates and incomplete data. An important consideration was the pragmatic design-based research strategy with an aim to improve design principles and understanding, with no intention to generalizing data. In terms of the adequacy of the response rate, Nulty (2008, p. 306) states that "the response rate is technically irrelevant" in cases where the data from a teaching evaluation survey is used to improve the teaching strategy.

## Analysis

A series of analyses were conducted using SPSS version 23. Validity and reliability of the instrument was established by conducting an exploratory factor analysis on the items of each of the four subscales of the IMMS and determining the Cronbach Alpha coefficient. Regression analysis was used to explore the mediating effect of relevance on the relationship between attention and confidence using the steps as described by Baron and Kenny (1986). The causal model implies a relationship between two variables, the independent or causal variable and the dependent or outcome variable. In the mediated causal model, the independent or causal variable has an influence on the intervening or process variable, which consecutively has an influence on the dependent or outcome variable.

Mediation analysis is useful for understanding a process. When testing for mediation, there are four steps in the statistical analysis. Executing the analysis using the four steps, comprise of four conditions that the relationship between the variables must satisfy in order to indicate mediation (Baron & Kenny, 1986).

**Step 1:** This step indicates whether there is an effect that may be mediated; therefore the independent or causal variable must influence the dependent or outcome variable.

**Step 2:** The independent or causal variable needs to correlate with the mediator, showing that the independent or causal variable influences the mediator.

**Step 3:** This step needs to show that the mediator or intervening variable affects the dependent or outcome variable.

**Step 4:** This step establishes whether the effect of the causal or independent variable diminish after controlling for the effects of the intervening variable or mediator, which should be zero. If all four the conditions are met and the influence of independent or causal variable becomes non-significant and not different from zero in the presence of the mediator, the mediator completely or fully mediates the effects of the independent variable in the relationship with the dependent variable. If all the conditions are satisfied, but the effects of the independent variable on the

dependent variable continue to be statistically significant in the presence of the mediator, partial mediation is indicated.

## RESULTS

### Factor Analysis

Exploratory factor analysis used maximum likelihood extraction and direct oblimin rotation to determine the unidimensionality of each of the subscales. Only factor loadings above 0.3 were considered, as summarized in Tables 1 to 4. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy were above the recommended threshold of 0.5 and the Bartlett's Test of Sphericity were statistically significant ( $p < .000$ ) for items in all four constructs (Field, 2013), indicating the appropriateness of factor analysis.

For the attention construct two factors were identified based on the eigenvalue criterion (greater than one) as described by Field (2013), indicating that the attention construct was not unidimensional. The two factors combined explained 57.5% of the variance, factor one explained 42.7% and factor two

Table 1. Factor analysis for the attention construct

Construct	Item and description	KMO & Bartlett's test	Variance explained	Factor Loadings		Cronbach Alpha
				1	2	
<i>Attention</i>		.868 $p < .000$	57.5			
	12: The content is so abstract that it was hard to keep my attention on them. (Reversed)			.810		0.913
	15: The screencasts are dry and unappealing. (Reversed)			.799		
	22: The amount of repetition bores me. (Reversed)			.870		
	29: The presentation style is boring. (Reversed)			.775		
	31: There is too much content. (Reversed)			.866		
	2: There is something interesting at the beginning that got my attention.				.364	0.827
	8: The screencasts are attention-grabbing.				.489	
	11: The quality of the screencasts help to kept my attention.				.711	
	17: The way the information is arranged kept my attention.				.720	
	20: The screencasts include information that stimulates my curiosity.				.814	
	24: I learned things that were surprising or unexpected.				.598	
	28: The variety of screencasts helped keep my attention.				.771	

Table 2. Factor analysis for the relevance construct

Construct	Item and description	KMO & Bartlett's test	Variance explained	Factor Loadings		Cronbach Alpha
				1	2	
	<i>Relevance</i>	.869 $p < .000$	50.4			
	6: It is clear to me how the content relates to things I already know.				.413	(-0.239)
	26: The content is irrelevant because I already know most of it.			.364	(-.577)	0.869
	9: There are examples that indicate how the screencasts could be important to students.			.739		
	10: Completing the exercises successfully after the screencasts is important to me.			.710		
	16: The content is relevant to my interests.			.711		
	18: There are explanations or examples in the screencasts.			.610		
	23: The content and style of presentation convey the impression that the content is worth knowing.			.850		
	30: I could relate the content to my own life.			.620		
	33: The content is useful to me.			.777		

explained 14.8% of the total variance. Items that cluster on the same factor suggest that factor one represents negative stated items which was reversed-scored and appeared to implicate basic attention, while the items of factor two appeared to implicate attention with interest. As the Cronbach Alpha coefficient values were above the acknowledged threshold of 0.7 as explained by Field (2013), the reliability was considered satisfactory.

For the relevance construct, the analysis initially identified two factors based on the eigenvalue criterion, indicating that the relevance construct was not unidimensional. The two factors explained 50.4% of the variance. Factor one explained 42.7% and factor two explained 7.7% of total variance. As the Cronbach alpha value for factor 1 was above the acknowledged threshold of 0.7 as described by Field (2013), it was considered satisfactory. The internal consistency of factor 2 (items 6 and 26) was found to be -.239, an unacceptable value for Cronbach alpha indicating a negative average covariance between the two items. Item 26 was initially considered to be included in factor 2. However, due to the fact that item 26 also loaded on factor one, it was subsequently decided to include item 26 in factor one. As item 6 was the sole item in factor 2, it was decided to omit factor 2 with item 6. The recalculated Cronbach alpha was 0.798 and only factor one was included in the subsequent analysis process.

Two factors were identified for the confidence construct based on the eigenvalue criterion, thus indicating that the confidence construct was not unidimensional. The two factors explained 54.7% of the variance, factor one explained 36.1% and factor two explained 18.6% of the total variance. The items that cluster on the same factor suggested that factor one appeared to implicate ease of use while factor two appeared to implicate self-confidence. As the Cronbach alpha values for the

Table 3. Factor analysis for the confidence construct

Construct	Item and description	KMO & Bartlett's test	Variance explained	Factor Loadings		Cronbach Alpha
				1	2	
<i>Confidence</i>		.798 $p < .000$	54.7			
	1: When I first watched the screencasts, the content was easy to understand.			.329		0.767
	3: The material was difficult to understand. (Reversed)			.935		
	7: The screencasts had too much information – it was hard to remember important points. (Reversed)			.480		
	19: The content was too difficult. (Reversed)			.843		
	34: I could understand the material. (Reversed)			.728		
	4: After the screencasts, I felt confident that I knew what I was supposed to learn.				.719	0.837
	13: The screencasts made me confident that I could learn the content.				.822	
	25: The screencast made me confident to pass tests.				.673	
	35: Good organization of the content made me confident to learn the material.				.837	

Table 4. Factor analysis for the satisfaction construct

Construct	Item and description	KMO & Bartlett's test	Variance explained	Factor Loadings		Cronbach Alpha
				1	2	
<i>Satisfaction</i>		0.875 $p < .000$	52.2			
	5: Completing exercises after screencasts gave me a feeling of accomplishment.			.707		0.841
	14: I enjoyed the screencasts and would like to know more about the topic.			.811		
	21: I enjoyed studying the material in the screencasts.			.802		
	27: Lecturer feedback rewarded my efforts.			.320		
	32: It felt good to successfully use screencasts.			.796		
	36: It was a pleasure to use well-designed screencasts.			.774		

two factors were above the acknowledged threshold of 0.7, the internal consistency (reliability) was considered satisfactory.

The analysis confirmed unidimensionality for the satisfaction construct, as the analysis identified only one factor based on the eigenvalue criterion, explaining 52.2% of the variance. The Cronbach alpha value was above the acknowledged threshold of 0.7 and considered satisfactory.

### Descriptive Statistics For The Six Factors

The mean, standard deviation, skewness and kurtosis of each of the identified factors indicated that it can be assumed that these factors are normally distributed. Table 5 summarizes the descriptive statistics.

Comparing the average mean of the different factors, indicates that most of the participants agreed or strongly agreed with the statements of Confidence2 (self-confidence)  $M=1.82$ , Satisfaction  $M=1.83$ , Relevance  $M=1.85$  and Attention2 (attention with interest)  $M=1.93$ . It seemed as if the participants mostly agreed and to a lesser extent were uncertain in terms of the statements of the factors Confidence1 (ease of use)  $M=2.07$  and Attention1 (basic attention)  $M=2.07$ .

### Correlation

A Pearson's correlation coefficient was computed to evaluate the relationship between the factors attention1 (basic attention), attention2 (attention with interest), relevance, confidence1 (ease of use) and confidence2 (self-confidence) and satisfaction. Table 6 provides an overview of the Pearson correlation values.

The correlation coefficients between each of the factors with all the other factors were statistically significant at the 1% (0.01 level (2-tailed)) except for the correlation between attention2 (attention with interest) and confidence1 (ease of use), which were significant at the 10% level ( $p=0.052$ ).

There were very strong, positive correlations between the factor satisfaction and factors attention2 (attention with interest)  $r= .837, p < .01$ , relevance  $r= .854, p < .01$  and confidence2 (self-confidence)  $r= .881, p < .01$ . Satisfaction and confidence1 (ease of use)  $r = .295, p < .10$ , were weakly correlated along with Confidence1 (ease of use) and Attention2 (attention with interest)  $r = .221, p < .10$ . These results are in line with Keller's (2010) assertion that there can be high inter-correlations between the factors as the IMMS was designed to measure context specific attitudes.

### Regression Analysis

Regression analysis was used to explore the mediating effect of relevance on the relationship between attention and confidence. The factor analysis identified two factors for attention, namely basic attention (attention1) and attention with interest (attention2), and two factors for confidence, namely ease of use (confidence1) and self-confidence (confidence2). The second factor for relevance consisted

Table 5. Descriptive statistics for the six factors

	Attention1	Attention2	Relevance	Confidence1	Confidence2	Satisfaction
Mean	2.0675	1.9251	1.8517	2.0650	1.8147	1.8313
Median	2.0000	2.0000	1.8750	2.0000	2.0000	1.8333
Std. Deviation	.85015	.56040	.52016	.66886	.60890	.54379
Skewness	.871	.332	.091	.644	.405	.577
Kurtosis	.483	.298	-.544	.760	.120	.464
Minimum	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	4.40	3.71	3.00	4.00	3.75	3.67

**Table 6. Pearson correlation values for satisfaction, attention1, attention2, relevance, confidence1 and confidence2**

Variables		Satisfaction	Attention1	Attention2	Relevance	Confidence1	Confidence2
Satisfaction	Pearson Correlation	-					
	Sig. (2-tailed)						
	N	80					
Attention1	Pearson Correlation	.410**	-				
	Sig. (2-tailed)	.000					
	N	72	77				
Attention2	Pearson Correlation	.837**	.465**	-			
	Sig. (2-tailed)	.000	.000				
	N	78	74	82			
Relevance	Pearson Correlation	.854**	.544**	.824**	-		
	Sig. (2-tailed)	.000	.000	.000			
	N	72	69	73	75		
Confidence1	Pearson Correlation	.295**	.786**	.221	.411**	-	
	Sig. (2-tailed)	.009	.000	.05	.000		
	N	77	72	78	72	80	
Confidence2	Pearson Correlation	.881**	.448**	.780**	.847**	.303**	-
	Sig. (2-tailed)	.000	.000	.000	.000	.006	
	N	80	77	82	75	80	85

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

of one item and only one factor (relevance) was included in the rest of the analysis. The following paragraphs provide the different mediating effects of relevance on the relationships between the two attention factors and the two confidence factors, in order to answer the research question.

***Effect of Relevance on the Relationship Between Basic Attention (Attention1) and Self-Confidence (Confidence2)***

A summary of the regression analysis exploring the possible mediating effect of relevance on the relationship between the factor representing basic attention and the factor representing self-confidence is presented in Table 7.

Figure 1 illustrates the mediation model for the effect of relevance1 on the relationship between basic attention and self-confidence.

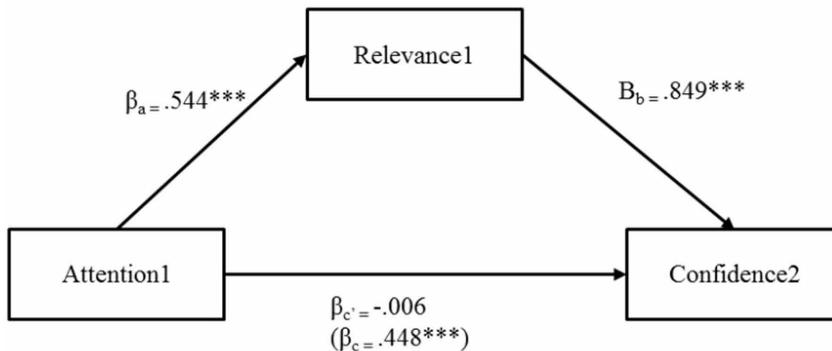
Results indicated that the factor representing basic attention (attention1) was a statistically significant predictor of the factor representing self-confidence (confidence2),  $\beta_c = .448$ ,  $SE = .075$ ,  $p < .001$  and that the factor indicating basic attention was a statistically significant predictor of relevance,  $\beta_a = .544$ ,  $SE = .064$ ,  $p < .001$ . The results further indicate that the factor representing basic attention was no longer a statistically significant predictor after controlling for the mediator, relevance,

**Table 7. Regression analysis for the possible mediating effect of relevance in the relationship between basic attention (attention1) and self-confidence (confidence2)**

Regression steps	Step 1			Step 2			Step 3		
	<i>B</i>	SE	$\beta$	<i>B</i>	SE	$\beta$	<i>B</i>	SE	$\beta$
Testing for mediation									
Step 1: Attention1 to confidence2 (Path $\beta_c$ )	.324	.075	.448***						
Step 2: Attention1 to relevance (Path $\beta_a$ )				.339	.064	.544***			
Step 3: Relevance1 to confidence2 (Path $\beta_b$ )							.999	.092	.849***
Step 4: Attention1 to confidence2 (Path $\beta_c$ )							-.004	.057	-.006 ns
<i>R</i>	.448			.544			.456 (attention1) .846 (attention1, relevance)		
<i>R</i> <sup>2</sup>	.201			.296			.208 (attention1) .715 (attention1, relevance)		
F (p value)	18.616 (.000)			28.216 (.000)			17.622 (.000).(attention1) 82.822 (000) (attention1, relevance1)		

Note: Standardized Beta-coefficients are presented. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

**Figure 1. Mediation model for the relationship between attention1 and confidence**



and  $\beta_c = -.006$ ,  $SE = .057$ , not significant. Therefore, relevance was a mediator (full mediation) and relevance was statistically significant,  $\beta_b = .849$ ,  $SE = .092$ ,  $p < .001$ , in the relationship between the factor representing basic attention and the factor representing self-confidence.

**Effect of Relevance on the Relationship Between Attention with Interest (Attention2) and Ease of Use (Confidence1)**

Table 8 summarizes the regression analysis exploring the possible mediating effect of relevance on the relationship between the factor representing attention with interest and the factor representing ease of use.

Figure 2 illustrates the mediation model for the effect of relevance1 on the relationship between attention2 and confidence1.

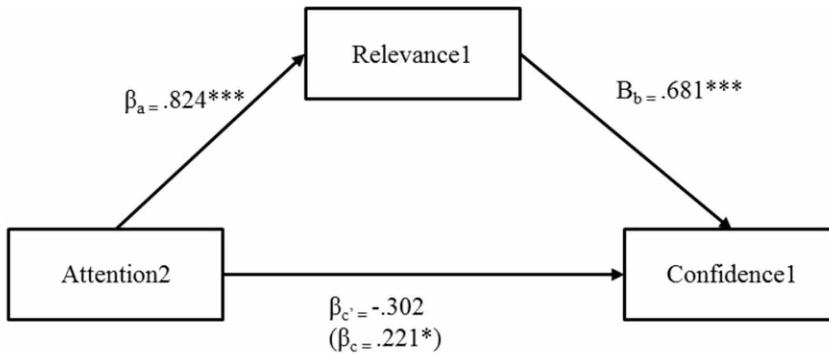
Results indicated that the factor representing attention with interest (attention2) was a statistically significant predictor of the factor representing ease of use (confidence1) at the 10% level,  $\beta_c = .221$ ,  $SE = .133$ ,  $p = .052$  and that the factor representing attention with interest (attention2) was a statistically significant predictor of relevance,  $\beta_a = .824$ ,  $SE = .051$ ,  $p < .001$ . The results further indicate that the factor representing attention with interest (attention2) was no longer a statistically significant predictor after controlling for the mediator, relevance,  $\beta_c = -.302$ ,  $SE = .229$ , not significant, but still much greater than zero. The path of relevance to the factor representing ease of use (confidence1) was statistically highly significant,  $\beta_b = .681$ ,  $SE = .264$ ,  $p = .001$ , therefore indicating partial mediation.

**Table 8. Regression analysis for the possible mediating effect of relevance on the relationship between attention with interest (attention2) and ease of use (confidence1)**

Regression steps	Step 1			Step 2			Step 3		
	B	SE	$\beta$	B	SE	$\beta$	B	SE	$\beta$
Testing for mediation									
Step 1: Attention2 to confidence1 (Path $\beta_c$ )	.263	.133	.221*						
Step 2: Attention2 to relevance (Path $\beta_a$ )				.721	.059	.824***			
Step 3: Relevance to confidence1 (Path $\beta_b$ )							.931	.264	.681***
Step 4: Attention2 to confidence1 (Path $\beta_c$ )							-.359	.229	-.302 ns
R	.221			.824			.261 (attention2) .463 (attention2, relevance)		
R <sup>2</sup>	.049			.680			.068 (attention2) .214(attention2, relevance)		
F (p value)	3.909 (.052)			150.712 (000)			4.971 (.029).(attention2) 9.116 (.000)(attention1, relevance)		

Note: Standardized Beta-coefficients are presented. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Figure 2. Mediation model for the relationship between attention2 and confidence1. Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\*  $p < .001$



**Effect of Relevance on the Relationship between Attention with Interest (Attention2) and Self-Confidence (Confidence2)**

A summary of the regression analysis exploring the possible mediating effect of relevance on the relationship between the factor representing attention with interest (attention2) and the factor representing self-confidence (confidence2) is provided in Table 9.

Figure 3 illustrates the effect of relevance on the relationship between attention2 and confidence2.

Results indicated that the factor representing attention with interest (Attention2) was a statistically significant predictor of the factor representing self-confidence (Confidence2),  $\beta_c = .780$ ,  $SE = .074$ ,  $p < .001$  and that the factor representing a higher level of attention (Attention2) was a significant predictor of relevance,  $\beta_a = .824$ ,  $SE = .059$ ,  $p < .001$ . The path from the factor representing attention with interest (attention2) to the factor representing self-confidence (confidence2) (path c) is reduced in absolute size, but is still different from zero,  $\beta_c = .249$ ,  $SE = .117$ ,  $p = .032$  when the mediator, relevance is introduced,  $\beta_b = .626$ ,  $SE = .133$ ,  $p < .001$ , indicating partial mediation.

**Effect of Relevance on the Relationship Between Basic Attention (Attention1) and Ease of Use (Confidence1)**

Table 10 summarises regression analysis exploring the possible mediating effect of relevance on the relationship between the factor representing basic attention (attention1) and the factor representing ease of use (confidence1).

Figure 4 illustrates the effect of relevance1 on the relationship between attention1 and confidence1.

Results in step 1 indicated that that the factor presenting basic attention (attention1) was a statistical significant predictor of the factor presenting ease of use (confidence1),  $\beta_c = .786$ ,  $SE = .060$ ,  $p < .001$  and that in step 2 the factor presenting basic attention (attention1) was a statistical significant predictor of relevance1,  $\beta_a = .544$ ,  $SE = .064$ ,  $p < .001$ . Step 3 indicated that the path from basic attention (attention1) to ease of use (confidence1) (path c) increased in absolute size,  $\beta_c = .880$ ,  $SE = .067$ ,  $p < .001$  and is statistically significant. Relevance1 was not statistically significant,  $\beta_b = -.076$ ,  $SE = .103$ , not significant, therefore, it indicates that relevance was not mediating the relationship between the factor presenting basic attention (attention1) and the factor presenting ease of use (confidence1).

Figure 5 summarizes the results of the regression analysis exploring the mediating role of relevance in the relationship between attention and confidence.

**Discussion**

While past research by Chang and Lehman (2002), and Means et al. (1997) suggests the importance of *relevance* in student motivation, little research exists on the mediating effect of *relevance* in the relationship between *attention* and *confidence*. Additionally, scholars such as Li and Keller (2018),

Table 9. Regression analysis for the possible mediating effect of relevance on the relationship between attention2 and confidence2

Regression steps	Step 1			Step 2			Step 3		
	B	SE	$\beta$	B	SE	$\beta$	B	SE	$\beta$
Testing for mediation									
Step 1: Attention2 to confidence2 (Path $\beta_c$ )	.824	.074	.780***						
Step 2: Attention2 to relevance (Path $\beta_a$ )				.721	.059	.824***			
Step 3: Relevance to confidence2 (Path $\beta_b$ )							.736	.133	.626***
Step 4: Attention2 to confidence2 (Path $\beta_c$ )							.256	.117	.249*
R	.780			.824			.765 (attention2) .843 (attention2, relevance)		
R <sup>2</sup>	.608			.680			.586 (attention2) .711 (attention2, relevance)		
F (p value)	124.093 (.000)			150.712 (000)			100.374 (.000) (attention2) 86.212 (.000) (attention2, relevance)		

Note: Standardized Beta-coefficients are presented. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Figure 3. Mediation model for the relationship between attention2 and confidence2. Note: \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

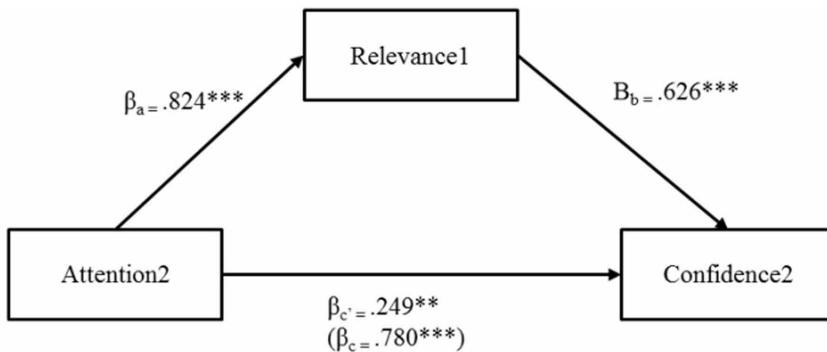


Table 10. Summary of the regression analysis for the possible mediating effect of relevance on the relationship between basic attention (attention1) and ease of use (confidence1)

Regression steps	Step 1			Step 2			Step 3		
	B	SE	$\beta$	B	SE	$\beta$	B	SE	$\beta$
Testing for mediation									
Step 1: Attention1 to Confidence1 (Path $\beta_c$ )	.635	.060	.786***						
Step 2: Attention1 to relevance (Path $\beta_a$ )				.339	.064	.544***			
Step 3: Relevance to Confidence1 (Path $\beta_b$ )							-.094	.103	-.076
Step 4: Attention1 to Confidence1 (Path $\beta_c$ )							.710	.067	.880***
R	.786			.544			.837 (attention1) .840 (attention1, relevance)		
R <sup>2</sup>	.618			.296			.701 (attention1) .705 (attention1, relevance)		
F (p value)	113.182 (.000)			28.216 (.000)			149.993 (.000).(attention1) 75.226 (000) (attention1, relevance)		

Note: Standardized Beta-coefficients are presented. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

Figure 4. Mediation model for the relationship between attention1 and confidence1

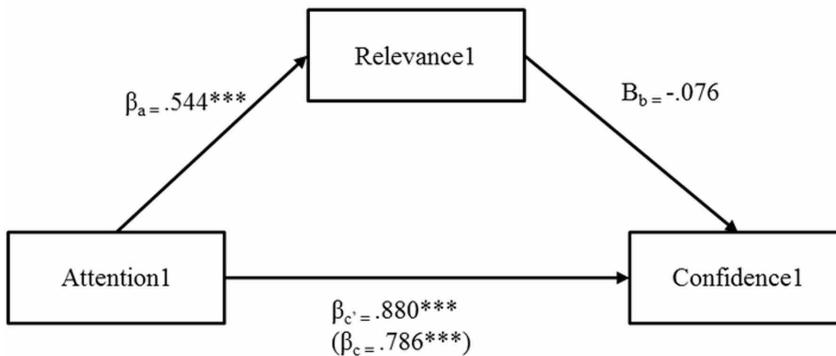
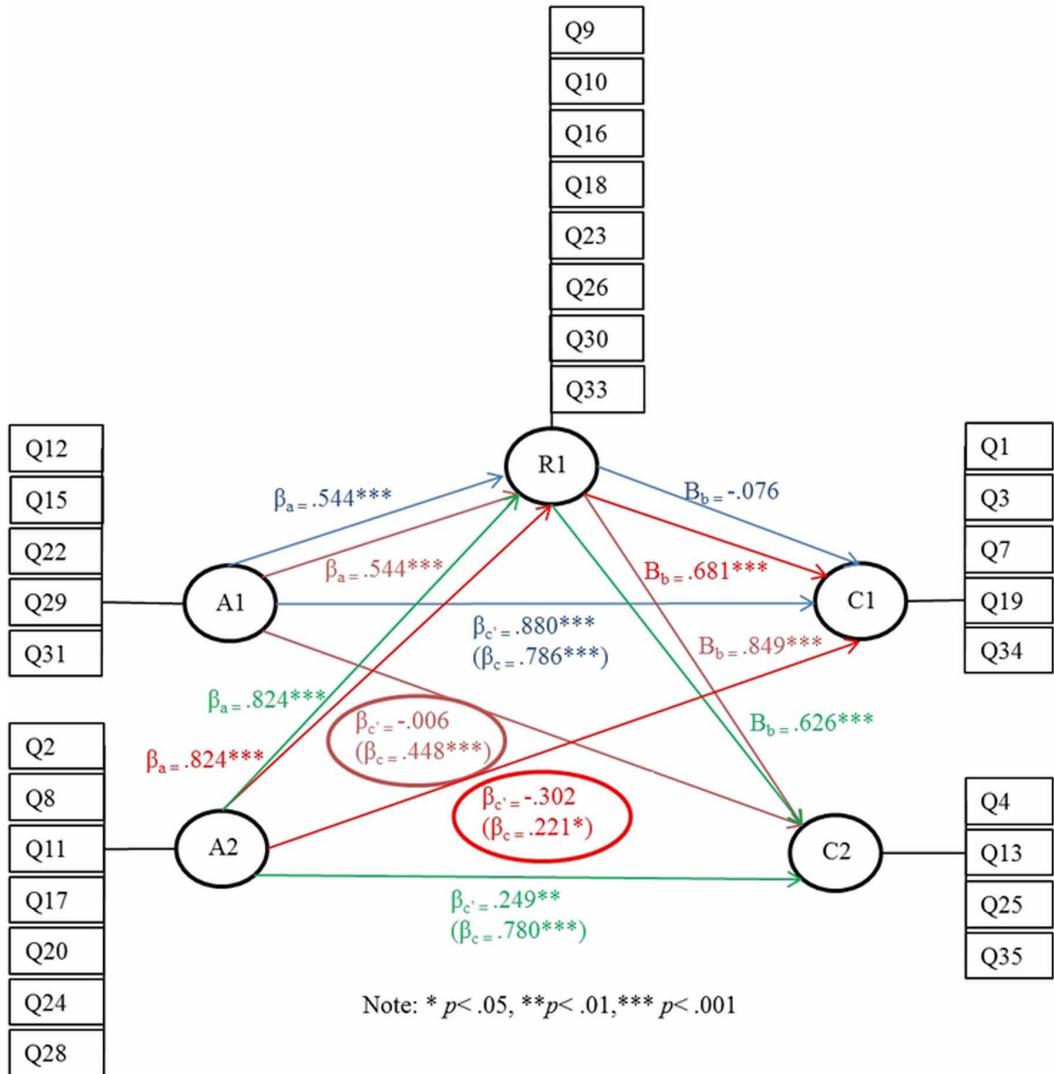


Figure 5. Results of regression analysis



Kim and Keller, (2011), and Loorbach et al. (2015) identify exploring the relationships between the components is an under-theorised area.

**Role of Relevance in the Relationship Between Basic Attention and Self-Confidence**

The results of this study clearly suggest that relevance is a mediator in the relationship between the factor representing basic attention (attention1) and the factor representing self-confidence (confidence 2). In terms of a mediational model, which is causal, relevance is presumed to cause the outcome (confidence 2) and not vice versa (Baron & Kenny, 1986; Judd & Kenny, 1981). With complete mediation as in this case, attention1 no longer affects confidence2, as path c, the direct effect, is zero.

To develop this line of argument, the thesis is as follows: if there is basic attention and the students perceive the screencasts as relevant to their interests (an implicit requirement that Keller describes), they will be self-confident in their ability to achieve their goals.

For example, as illustrated in figure 8, if students recognize that (1) the content is not abstract, (2) the screencasts are not dry and unappealing, (3) there is no repetition, (4) the style of the presentation is engaging and (5) there is not too much content and it is relevant to their interests, then they will be self-confident in their beliefs that (1) they know what they are supposed to learn, (2) they are able to learn the content, (3) they are able to pass a test on the content and (4) the good organization of the material assisted in learning the material presented in the screencasts.

As relevance is a full mediator in this instance, the results suggest that basic attention has no effect on students being self-confident in achieving their goals. The results with regards to the importance of relevance underscores the results of previous studies by Chang and Lehman (2002), and Means et al. (1997) and provides a novel view on the mechanism of the mediating effect of relevance in the relationship between attention and confidence.

Significantly, this finding has important implications in terms of motivation and self-regulation, as Bandura (1992) contends that if individuals believe in their own ability to achieve, they will set goals for themselves, anticipating positive outcomes in the realisation of their goals.

### Role of Relevance in The Relationship Between Attention with Interest and Ease of Use

In addition, results indicated partial mediation of relevance in terms of the relationship between the factor representing attention with interest and the factor representing ease of use, as illustrated in Figure 7.

Figure 6. Mediating effect of relevance on the relationship between basic attention and self-confidence

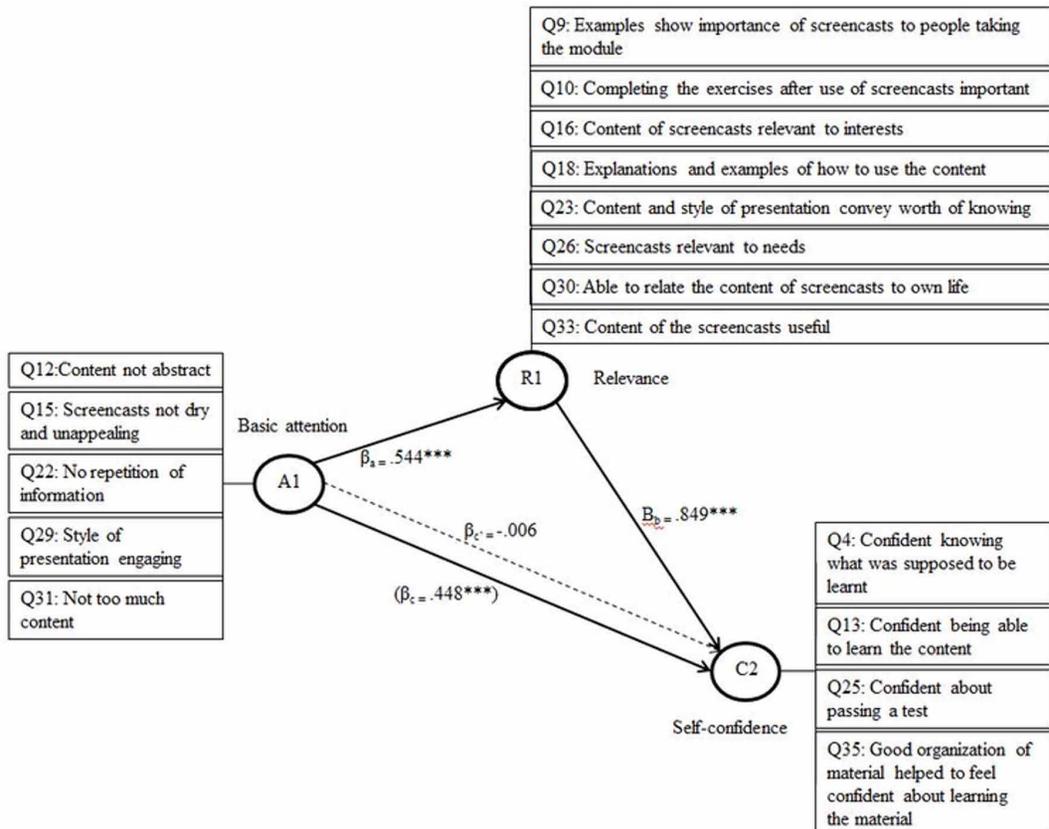
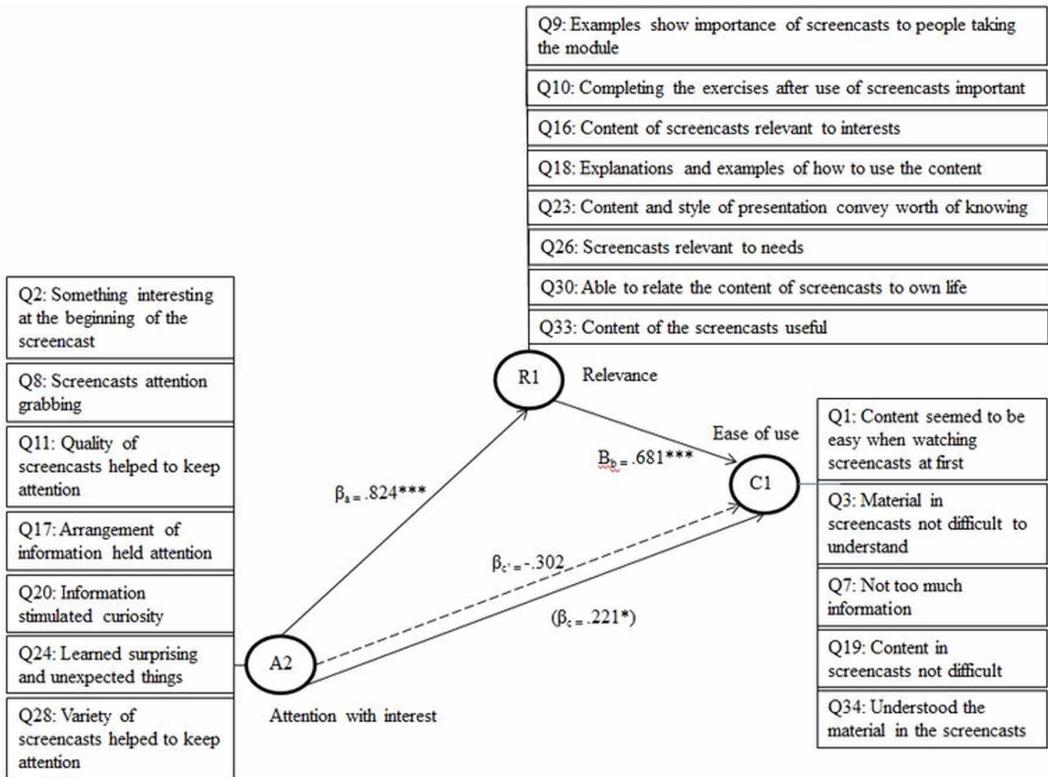


Figure 7. Mediating effect of relevance on the relationship between attention with interest and ease of use



In this instance, the results suggest that if the students perceive the screencasts as (1) attention-grabbing, (2) of a high quality, (3) attention grabbing at the start, (4) interesting, (5) containing surprising and unexpected material (6) containing sufficient variety to hold their attention, and are relevant to their needs, then students will perceive (1) the content as easy when watching the screencasts at first, (2) the study material as easy to understand, and (3) the screencasts as not having too much information.

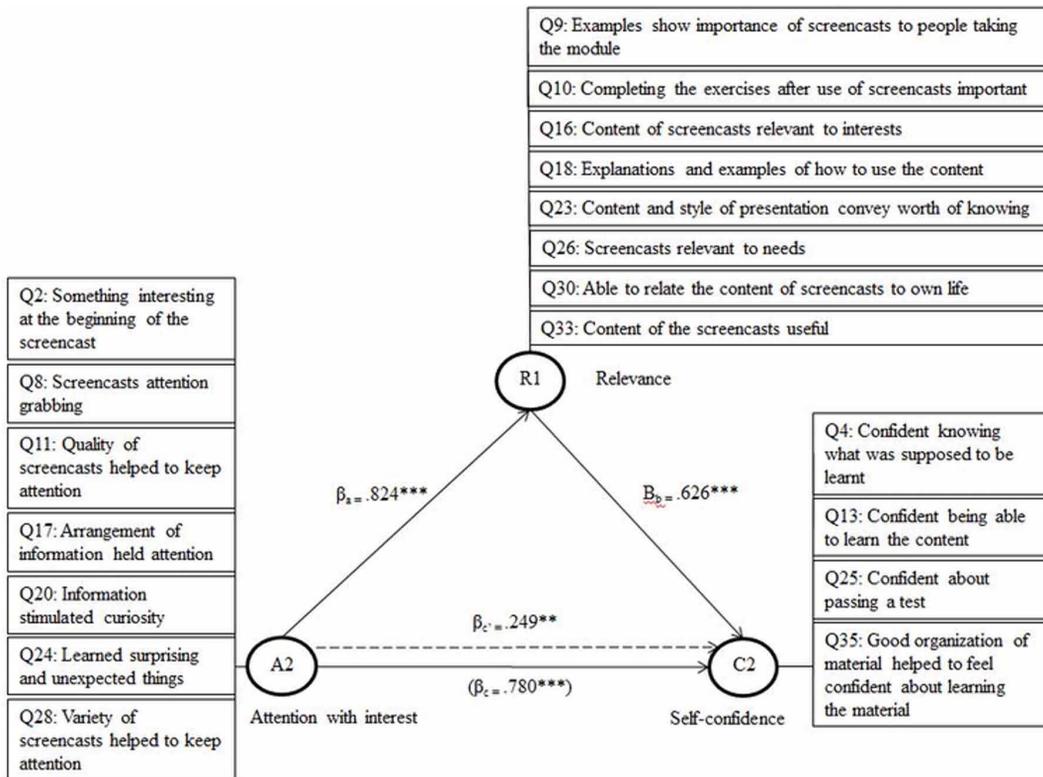
As relevance is a partial mediator in the relationship between attention with interest and ease of use, the results suggest that although relevance is an important factor, attention with interest still have an effect in predicting the ease of use of the screencasts.

**Role of Relevance in The Relationship Between Attention with Interest and Self-Confidence**

The results also suggest partial mediation of relevance in the relationship between attention with interest and self-confidence as illustrated in Figure 8.

Following the same line of argument as in the preceding cases, the results suggest that if students perceive the screencasts as (1) attention-grabbing, (2) the quality of the screencasts contributing to hold their attention, (3) there is something at the beginning of the screencasts that pique their attention, (4) containing information that stimulate their curiosity, (5) containing surprising and unexpected elements and (6) the variety of screencasts kept their attention and was relevant to their needs, then students will be self-confident (1) that they know what they are supposed to learn, (2) in their ability to learn the content, (3) in their ability to pass a test on the content and (4) that the good organization of the screencasts assisted in their learning of the study material.

Figure 8. Mediating effect of relevance on the relationship between attention with interest) and self-confidence



As relevance is a partial mediator as in the preceding case, the results suggest that although relevance is an important factor, attention with interest still has an effect in predicting the self-confidence of students.

### Role of Relevance in The Relationship Between Basic Attention and Ease of Use

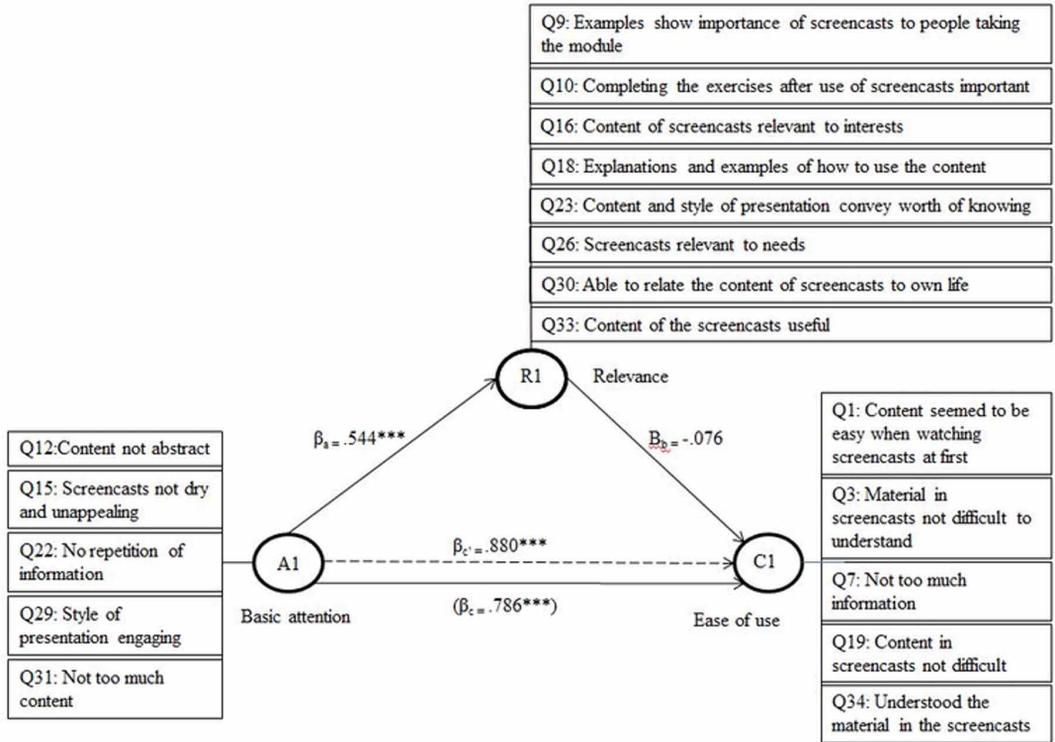
Results failed to show the role of relevance as a mediator in the relationship between the factor presenting basic attention (attention1) and the factor presenting ease of use (confidence1) as illustrated in Figure 9.

Results suggest that relevance is not a mediator in the relationship between basic attention and ease of use. This implies that basic attention has a direct effect on ease of use. Therefore, if students recognize that (1) content is not abstract, (2) screencasts are as not dry and unappealing, (3) there is no repetition, (4) the presentation style is engaging and (5) content is limited, they will perceive the screencasts in terms of ease of use as (1) content is easy, (2) material is easy to understand, (3) screencasts do not contain too much information, (4) content in the screencasts is easy and (5) they are able to understanding the content.

## CONCLUSION

This article addressed gaps in the literature and responded to calls for further research into Keller's ARCS model in different delivery systems, cultural settings, and learner populations, as well as in terms of the relationship between the ARCS motivational components. This article further applied the model to asynchronous and geographically dispersed learning in the context of a mega university

Figure 9. Mediating effect of relevance on the relationship between basic attention ease of use



in Southern Africa, which integrally delivers asynchronous learning across widespread geographical regions. In particular, it explored the mediating role of *relevance* on the relationship between *attention* and *confidence* in the use of screencasts as additional learning material for postgraduate accounting students.

While past research suggested the importance of *relevance* in student motivation, little research exists on the mediating effect of *relevance* in the relationship between *attention* and *confidence*, and the relationships between these components remain an under-theorised area. This study utilised the IMMS 36-question 5-point Likert-type scale survey, based on the ARCS model, to establish how motivated students are when using instructional materials. Exploratory factor analysis revealed two factors, attention with interest and basic attention for first principle, attention, in Keller’s ARCS model. Furthermore, two factors, ease of use and self-confidence for the third principle, confidence, were revealed by the factor analysis. Results of the regression analysis suggested the following:

*Full mediation of relevance on the relationship between the factors basic attention and self-confidence.* The results with regards to the importance of relevance underscores the results of previous studies and provides a novel view on the mechanism of the mediating effect of relevance in the relationship between attention and confidence. Significantly, this finding has important implications in terms of motivation and self-regulation, that if individuals believe in their own ability to achieve, they will set goals for themselves, anticipating positive outcomes in the realisation of their goals.

*Partial mediation of relevance on the relationship between attention with interest and ease of use.* As relevance is a partial mediator in the relationship between attention with interest and ease of use, the results suggest that although relevance is an important factor, attention with interest still have an effect in predicting the ease of use of the screencasts.

*Partial mediation of relevance on the relationship between attention with interest and self-confidence.* As relevance is again a partial mediator, results suggest that although relevance is an important factor, attention with interest still has an effect in predicting the self-confidence of students.

*No mediation of relevance on the relationship between the factors basic attention and ease of use.* This implies that basic attention has a direct effect on ease of use. Therefore, if students recognize that content is not abstract, screencasts are as not unappealing, there is no repetition, the presentation style is engaging and content is limited, they will perceive the screencasts in terms of ease of use as easy in general.

These results have important implications for how instructional designers perceive the importance of *relevance* when designing learning materials with the intention of motivating students to learn. Finally, further exploration is needed in different settings and populations to add to the knowledge of the mechanism behind the mediating effect of relevance in the relationship between attention and confidence in the ARCS model. Further research work could focus on a reiteration of this research in other different delivery systems, cultural settings, and learner populations.

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Lindie Grebe is a chartered accountant and senior lecturer at the University of South Africa. She lectures postgraduate accounting sciences through blended learning with technology and face-to-face contact sessions during study schools throughout South Africa. Her research interests include the development of accounting students and professionals in a distance education environment and she is registered for a PhD in corporate governance. She has authored various journal articles and conference papers in this field.