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Students' perception towards behavioral intention of audio and video teaching styles: An acceptance study

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A B S T R A C T

Recently audio and video material has been used significantly in various online platforms. The audio-video materials enhance the teaching and learning process by facilitating the transformation of the data and providing a richer interactive environment, hence gaining wide intention within the educational realm. However, empirical studies have not examined the acceptance of the audio and video material depending on a conceptual model where acceptance is the key factor. The present study attempts to overcome this gap in the literature review by investigating the effects of media richness, speed and vividness, perceived concentration, perceived ease of use, perceived usefulness on the acceptance of audio-video material. What distinguishes the current study is the fact that content richness is considered as a mediator that affects all other factors in the conceptual model. The data is collected by distributing the online survey to college students. The results provide mostly insight and support for students' intention to use audio-visual resources in a conceptual model. The technology characteristics of speed and vividness as well as TAM constructs were significant predictors of technology acceptance. However, it is concluded that the external factor of the perceived concentration has no impact on the students' perception and intention to use audio-visual resources. In the recommendation, some theoretical and practical implications are stated along with the focus on technology designers, change managers, and users.

1. Introduction

Teaching that is based on online platforms is highly dependent on the successful delivery of the information (Alghizzawi, Ghani, et al., 2018; Alghizzawi, Salloum, & Habes, 2018; Salloum, Al-Emra, Habes, & Alghizzawi, 2019; Al Kurdi et al., 2021; Capuyan et al., 2021; Salloum et al., 2021; Taryam et al., 2021). The failure in delivering the material to the students may lead to failure in achieving learning objectives. Therefore the interactive learning media can incorporate a variety of audio and video material that suits the development of the digital era (Alaali et al., 2021; Habes, Salloum, Alghizzawi, &

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Mhamdi, 2019; Al-Maroof et al., 2021a,b,c; Mouzaek et al., 2021; Yousuf et al., 2021). To be able to transfer the audio and video material efficiently, an information technology system is required (Mutia, Gimin, & Mahdum, 2020; Rosa, 2015; Sudibyo, 2013). According to (Kennedy, Latham, & Jacinto, 2015; Miarso, 2007), the increasing significance of media variations in facilitating interactive learning has been widely recommended to stimulate students' thoughts, feelings and concerns.

Previous studies that emphasized the importance of the audio and video material within the educational domain have highlighted the significant effects of the audio and video material in achieving the outcomes and objectives (Mutia et al., 2020). Similarly, studies in the non-educational domain have focused on the importance of audio and visual material in implementing economical and medical purposes (Ahmad et al., 2021; Aburayya et al., 2020; AlSuwaidi et al., 2021; Al-Khayyal et al., 2020; Alhashmi, Salloum, & Mhamdi, 2019; M. Alshurideh, 2018; Kang & Lee, 2019; Sadjadi et al., 2020; Ahmad et al., 2021; Shahin et al., 2021). The current study is designed to determine the effect of audio and visual media on a user's acceptance of e-learning platforms with a final goal of measuring the effectiveness of content richness as a mediator on other variables in the model including concentration, vividness and speed. Based on previous studies, users' perceived concentration positively affects the experience of online platforms users thereby creating a promising environment where they can rely on to measure their understanding and comprehension of a newly taught material (Novak, Hoffman, & Yung, 1998; Webster, Trevino, & Ryan, 1993). Furthermore, the study seeks to examine the effects of vividness and speed to accept the audio and visual material. Vividness has a close relation with the quality of the visual display and the richness of the content (Adamo-Villani & Wilbur, 2008). This research framework reflects the fact that e-learning users need to evaluate the online learning platform as a learner or educator. Hence, this study incorporates the acceptance model – TAM and other external factors including perceived concentration and vividness and speed. In addition to using the content richness as a mediator that is implemented to measure the effects of this variable on both TAM and other external factors. What sets this study apart from previous studies is the implementation of the conceptual model that can effectively measure the acceptance of audio and video material used in online learning platforms.

2. Literature Review

The literature review has tackled the video and audio material from different perspectives to achieve completely different aims and concentrating on various samples of the study. These perspectives include the domain of study, the approach and methodology, and the targeted group. As far as the study domain is concerned, previous studies that focus on audio and visual material in the educational domain are higher in number than studies in medical, industrial and economic domains. The significant effect of audio and visual material attracted the attention of many researchers in the educational domain from 2008 to 2021. Studies by (Bassili, 2008; Liu, Liao, & Pratt, 2009) have investigated the effect of the streaming videos on students' perception at the university level in Canada and Taiwan using questionnaires to collect the data. Recently, studies by (Irmawati, Ihsan, & Rasmi, 2020; Michelsanti et al., 2021) focused on two different aspects in the educational domain. The former intends to investigate the impact of Audio-Visual Aids in developing speaking skills of college students whereas the latter examines the Deep-Learning-Based Audio-Visual Speech in the machine learning approach. Within medical domains, the study tackled the importance of using audio and visual material on patient and college students (Choi-Lundberg, Cuellar, & Williams, 2016; Kang & Lee, 2019). Similarly in industrial and economic domains, a study by (Sadjadi et al., 2020) searched for the effectiveness of Video Annotation for Speech Technologies that are collected from 26 organizations in the Audio-Visual SRE19. More interestingly, the audio and visual material has been used for security purposes. The study was based on the Data Flow Model of the FLORIDA Scalable Analytics Platform by adopting a semi-automatic Analysis System. A study by Fonseca, et al, 2017 has investigated the effect of open audio datasets from Freesound in Spain. The study is based on Corpus Analysis.

The previous studies differed in the approach of the study. Based on the table below it seems that the number of studies that used the quantitative approach of study is higher in number than studies that follow the qualitative approach. Previous studies by (Choi-Lundberg et al., 2016; Kang & Lee, 2019; Owusu, 2020) have adopted the quantitative approach where the domain is different. The studies were implemented in medical, industrial and educational domains, respectively. A study by (Mutia et al., 2020) has focused on the economic aspects using the quantitative approach to investigate the effect of blog-based audio-visual learning media on specialists in the economy of banking and money. Despite the fact that they rely on the same approach, they differ in methodology. For instance (Kang & Lee, 2019) have focused on Patient Education Materials Evaluation Tool to study the impact of audio and visual educational material on Korean patient whereas (Choi-Lundberg et al., 2016) used a quasi-experimental design to investigate the effect of audio and video material on the undergraduate medical students' perception.

Corpus analysis studies by (Sadjadi et al., 2020) measure the effectiveness of Video Annotation in the industrial domain. Similarly, (Fonseca et al., 2017) have adopted a corpus study to examine the effect of a free sound database. On the other hand, studies that focus on the qualitative approach have adopted a combination of methods or instruments to examine the effectiveness of audio and visual material. They used questionnaires, interviews and observations to implement their final goals (Irmawati et al., 2020; Scolari, Pires de Sá, & Masanet, 2019). A completely different approach was used by (Michelsanti et al., 2021) who relied upon Deep Learning Methods and Fusion Techniques to examine the effectiveness of Deep-Learning-Based Audio-Visual Speech.

Table 1
The Audio-Visual Studies from 2008-2020.

No.	Names and Years of Publications	Type of Audio or Visual Material	Methodology	Sample	Domain of Study	Type of Study	Country
1.	(Kang & Lee, 2019)	audiovisual educational materials	Patient Education Materials Evaluation Tool (PEMAT)	Korean Patient	Medical Domain	Quantitative Study	Korea
2.	(Choi-Lundberg et al., 2016)	dissection audio-visual resources (DAVR)	a quasi-experimental design	undergraduate medical student	Medical domain	Quantitative Study	Australia
3.	(Sadjadi et al., 2020)	Video Annotation for Speech Technologies (VAST) corpus.	Corpus-Analysis Study	26 organizations in the Audiovisual SRE19 and submitted 102 valid system	Industrial Domain	Quantitative Study	USA
4.	(Mathieson, 2012)	Students' perceptions of audiovisual feedback	An open-ended survey instrument.	50 students	Educational Domain	Quantitative Study	N/A
5.	(H. Tseng, 2020)	Students' Perception of Blackboard audio and visual material	Online Learning Questionnaire	385 university students	Educational domain	Quantitative Study/PLSM	USA
6.	(Owusu, 2020)	audio–visual (AV) technologies	Hand-delivery survey technique	432 valid samples of graduate and undergraduate students	Educational Domain	Quantitative research.	N/A
7.	(Irmawati et al., 2020)	Audio Visual Aids for speaking skills	Questionnaire and Interview	Students' performances in speaking tasks	Educational Domain	Qualitative and Quantitative Research	Nigeria
8.	(Mutia et al., 2020)	a blog-based audio visual learning media	research and development (R&D) method	Students and specialists	Economic Domain	quantitative descriptive technique	N/A
9.	(Tabor & Minch, 2013)	Digital Learning Media	Surveys	College Students	Educational Domain	Quantitative research.	N/A
10.	(Michelsanti et al., 2021)	Deep-Learning-Based Audio-Visual Speech	signal processing and machine learning techniques	Data collected for analysis purposes	Educational Domain	Deep Learning Methods and Fusion Techniques	N/A
11.	(Liu et al., 2009)	Streamed audio and streamed video.	Questionnaires	Chung Yuan University students	Educational Domain	Quantitative research.	Taiwan
12.	(Bassili, 2008)	streaming video	Questionnaires	University Students	Educational Domain	Quantitative research.	Canada
13.	(Shaw, Chen, Harris, & Huang, 2009)	Video and audio material in online platform	Questionnaires	Freshmen private university	Educational Domain	Quantitative research.	Taiwan
14.	(Scolari et al., 2019)	Video an d audio in You Tube Media	Questionnaires, workshops, media diaries, interviews, observation of online communities)	Teens	Social domain	Qualitative and Quantitative Research	Eight different countries
15.	(Fonseca et al., 2017)	open audio datasets	open tools and collaborative approaches	audio samples from Freesound	Music Technology domain	Corpus Analysis	Spain
16.	(Schindler, Boyer, Lindley, Schreiber, & Philipp, 2019)	Mass Video Data (FLORIDA)	Data Flow Model of the FLORIDA Scalable Analytics Platform	Video and Audio Data	Security Technology domain	semi-automatic Analysis System	Austria

The targeted group ranges from college students to data selected from a different corpus. Students who have been exposed to various audio and visual material, resources, technologies and aids effectively used these tools to comprehend different learning topics. The audio-visual learning material, technologies and resources have used to achieve different purposes such as developing speaking and listening skills, emplacing audio and visual feedback sent by teachers and perception of audio and video material in Blackboard learning platform (Irmawati et al., 2020; Mathieson, 2012; Tseng, 2020). On the other hand, the corpus analysis includes data from different organizations, open audio databases, media database that are analyzed to achieve various purposes (Michelsanti et al., 2021). Teens are also targeted to measure their perceptions of audio and video material that they experience on YouTube (Scolari et al., 2019).

3. Theoretical Framework

3.1 Technology Acceptance Model (TAM)

TAM has been integrated considerably in computer-based technology acceptance and adoption research in a plethora of fields. Based on reasoned action and planned behavior theories, TAM was formulated by (F. D Davis, 1989) to provide a theoretical basis for explaining technological and organizational factors and challenges influencing users' acceptance of technology. More specifically, the original form of TAM aims to explicate the causal relationships between the fundamental beliefs conducive to technology acceptance and adoption, namely, perceived usefulness, perceived ease of use, attitudes, and intentions to use a system (F. D Davis, 1989). Unlike TRA, various studies applying TAM in organizational settings have demonstrated theoretical justifications and empirical evidence of TAM's viability to predict the direct relationships between key beliefs, i.e., perceived usefulness and ease of use, on the one hand, and behavioral intentions to use a technology system, on the other hand. The direct Belief-Intention relationship in more recent forms of TAM relies on the argument that in organizational contexts, individuals tend to form positive intentions to use a particular system when they hold positive convictions regarding the perceived usefulness and perceived ease of use of the system in question (F. D Davis, 1989).

In addition to its theoretical purposes, TAM fulfills practical values by developing parsimonious measurement scales for predicting system use in organizations (Fred D Davis, 1989). According to (F. D Davis, 1989), two factors are decisive determinants of a user's intention to use a technological system, namely, perceived usefulness (PU) and perceived ease of use (PEU). First, perceived usefulness refers to the degree to which a potential technology user believes that using a particular system of interest offers a better advantage or is a more effective substitute over other methods. Thus, a system is expected to enhance a user's job performance. Second, on the other hand, perceived ease of use designates the extent to which a potential user believes that using the target system would be free of great efforts or difficulty, and hence, the degree to which a user would be capable of harnessing the technology in question to achieve his or her job tasks smoothly, successfully and efficiently (Davis, 1989). Furthermore, TAM hypothesizes a causal linkage between PU and PEU, assuming that PU influences PEU (Davis, 1989). The casual paths that TAM hypothesizes have been empirically substantiated in a wide range of end-user computing technologies and user populations. Previous related studies have indicated that perceived usefulness and perceived ease of use are positively and significantly related to the intention to use learning materials that are designed using multimedia and sensorial rich resources, especially in virtual and augmented reality settings (e.g., (Liu et al., 2009; McLean & Wilson, 2019; Nagy, 2018; Saeed, Yang, & Sinnappan, 2010)). Therefore, the current study makes the following hypotheses;

H_1: PU is positively and significantly related to the intention to use audio and video learning materials among undergraduate students.

H_2: PEU is positively and significantly related to the use of audio and video learning materials among undergraduate students.

3.2 Flow Theory

3.2.1 Concentration

The flow theory was formulated by (Csikszentmihalyi & Csikszentmihalyi, 1975) to examine optimal experiences of deep absorption in engaging self-rewarding activities in which an individual perceives challenges as compatible with their skills and competencies. In a state of flow, individuals have clear proximal goals and receive immediate feedback to adjust their progress on the activity (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2014). In other words, flow is a state of a holistic sensation people undergo when they do an activity with total involvement (Csikszentmihalyi, 1988). According to the flow theory, when individuals are occupied in an experience, they perform at their utter capability, and hence they become mentally and emotionally detached, disregarding awareness of surrounding factors such as fatigue, hunger, noises, or other factors. The flow theory originates from intrinsically motivated subjective experience phenomena, which are intrinsically rewarding and enjoyable as the main reasons for pursuing an activity. Being in flow is a subjective mental condition where individuals are intensely absorbed in an engaging activity, with manageable challenges, tackling a series of goals, continuously processing feedback, and altering action based on that feedback (Nakamura & Csikszentmihalyi, 2014). The state of flow is also characterized by an intensive, focused concentration on what one is doing at the moment, merging action and awareness in a state of dynamic equilibrium, loss of reflective self-awareness, a sense of control over one’s action, distortion of temporal experience, and perceiving the experience as being intrinsically motivating (Nakamura & Csikszentmihalyi, 2014).

In the context of virtual and e-learning, the flow theory postulates that a user has perceived concentration, which influences their intention to adopt virtual learning platforms. Thus, the flow theory is used to measure constructs like "perceived concentration", and "cognitive absorption" which are comparably defined concerning virtual and digitized learning environments as a state of mind where an individual learner pays exclusively focused attention to an object or a learning experience, making an individual lose consciousness of anything else other than the experience (Liu et al., 2009). Previous related literature has demonstrated empirical evidence confirming significant positive relationships between flow experience and continued intention to use e-learning systems (e.g., (Joo, Joung, & Kim, 2014; Rodríguez-Ardura & Meseguer-Artola, 2016; Zhao, Wang, & Sun, 2020)). Therefore, the current study hypothesizes that;

H_3: Perceived level of concentration is positively and significantly related to the intention to use audio and video learning materials among undergraduate students.

3.3 Virtual Reality Attributes

3.3.1 Vividness

Vividness is a crucial attribute of virtual reality from the telepresence view. Virtual reality is conceptualized as a particular type of experience mediated in a technologically simulating environment. The concept of virtual reality consists of two main dimensions; presence and telepresence. Presence refers to the perceived presence in an environment mediated by a communication technology medium (Steuer, 1992). From the telepresence view, virtual reality is characterized by sensations of vividness and interactivity (Sukoco & Wu, 2011). According to (Steuer, 1992), vividness refers to **"***the representational richness of a mediated environment as defined by its formal features, that is, how an environment presents information to the senses" (p. 11)***.** Additionally, (Steuer, 1992) maintains that vividness is *"the ability of technology to create a sensorially rich mediated environment"(p.80).*

A sense of vividness improves the quality of the procedural learning experience online since vividness increases the representational richness of information presented through, for example, video materials as compared to text materials only (Griffith & Gray, 2002; Hernandez, 2011). The utility of vividness of video materials stems from the visual aid that a procedural learning experience provides to users through visual realistic and dynamic demonstrations, which are assumed to amplify cognition (Lee & Lehto, 2013). Hitherto, previous literature has found evidence substantiating the positive association between a sense of vividness and perceived usefulness of video learning materials, using YouTube, for example (Lee & Lehto, 2013). In online shopping, vividness corresponds to aesthetic appeal. It increases the visual display of actual products by associating them with imaginary objects creating clear images in customers' minds, hence powerfully persuading them to purchase (Flavián, Gurrea, & Orús, 2017). Relatedly, vividness has significantly positively affected technology attributes, including perceived usefulness, ease of use, and perceived enjoyment of augmented reality mobile applications (McLean & Wilson, 2019). Similarly, the current study assumes that:

H_4: *Perceived level of vividness is positively and significantly related to the intention to use audio and video learning materials among undergraduate students.*

3.4 Media Richness Theory

3.4.1 Content Richness

Media richness theory aims to determine classifications of media, e.g., rich (face to face) and lean (numeric and text media), that enhance users' concentration by elevating their capacity to process information (Daft & Lengel, 1986). The richness of media helps identify and design technologies that reduce uncertainty and equivocality in various settings. For example, studies conducted in business settings to assess media richness found that rich media vs. lean media, utilizing communication channels is more effective in presenting unanalyzable tasks and complex tasks in addition to tasks that subjective interpretation of information to reach consensus, leading to improved decision making and enhanced performance (Dennis, Kinney, & Hung, 1999; Liu et al., 2009). On the other hand, lean media help handle routine activities (Suh, 1999). Furthermore, higher quality video materials lead to higher levels of user satisfaction and less completion time (Liu et al., 2009).

In business settings, customer behavior research has significantly substantiated the influences of mobile media richness on the stages of customer behavior, including attention, interest, search, action, and share (C.-H. Tseng & Wei, 2020). When used for educational purposes, rich media, opposed to text media, increases learning benefits and learner satisfaction in learning experiences involving content characterized by high uncertainty and equivocality (Sun & Cheng, 2007). In computer science education, media richness research has proved that perceived media richness positively and significantly influences perceived ease of use and usefulness of Web 2.0 technologies such as blogs and podcasts (Saeed et al., 2010). Moreover, (Saeed, Yang, & Sinnappan, 2008) have indicated that the media richness of *Second Life*, a 3-D multi-user virtual environment using avatars proxies, positively and significantly impacts the perceived ease of use and perceived usefulness of these communication platforms. As media richness has proven to exert significant variations in the perceived attributes of technology and virtual reality which in turn directly influence intention to use technology and virtual reality applications/platforms, it is plausible to presume that:

H5: *Media richness moderates the relationship between perceived usefulness and intention to use audio and video learning materials among undergraduate students.*

H6: *Media richness moderates the relationship between perceived ease of use and intention to use audio and video learning materials among undergraduate students.*

H7: *Media richness moderates the relationship between perceived concentration and intention to use audio and video learning materials among undergraduate students.*

H8: *Media richness moderates the relationship between perceived vividness and intention to use audio and video learning materials among undergraduate students.*

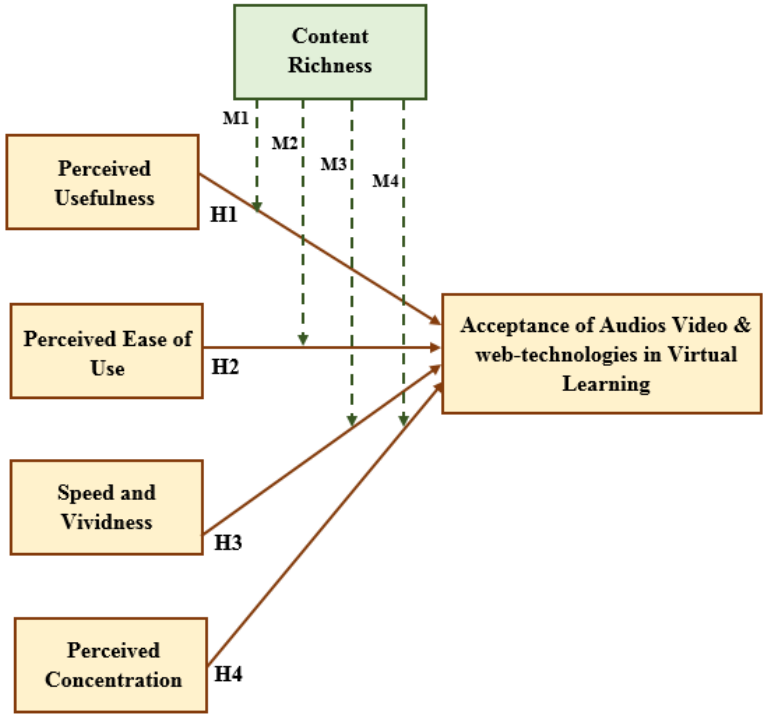

Fig. 1. Research model

4. Research Methodology

4.1 Data collection

During the winter semester of 2020/2021 from 20th January 2021 to 30th April 2021, the data was collected via online surveys among the students studying in UAE universities. Research team gave 1000 questionnaires to random students where 86% of the participants responded making up to the response rate i.e., 861 students. According to the team these 861 responses of questionnaires were authentic and appropriate. It is believed that the 861 valid responses were suitable for the given sample size like the anticipated sampling size for a population of 1500 in 306 respondents. The sample size of 861 was comparatively higher when taking trivial details into account. Thus, the evaluation along with the structural equation modelling is as suitable as sample size that was used to ensure the hypotheses. Significantly, the hypotheses were introduced on the basis of current theories though; e-learning context catered them. In order to appraise the measurement model, the researchers' team used structural equation modeling (SEM) (SmartPLS Version 3.2.7). Better and improved treatment would be resulted from the final path model.

4.2 Personal /Demographic Information

The assessment of the personal/demographic information was shown through Table 1. Respectively, the ratio of males to females was 42% and 58%. For 57% of the respondents, the student's age was from 18 to 29 years while 43% of the respondents were above 29. Majority of the respondents were having university degrees with a knowledgeable environment. Further, 62% of respondents had bachelor's degree and 33% had a master's degree, 5% of the respondents were having a doctoral degree. When the respondents are easily approachable and they are willing to volunteer, the "purposive sampling approach" was used as suggested by the (Al-Emran & Salloum, 2017; Hamadneh et al., 2021). This study sample comprised the students

from various colleges; from various age groups, they were part of different programs at different levels. Additionally, the demographic data was calculated with the assistance of IBM SPSS Statistics.

Table 2
Demographic data of the respondents

	Factor	Frequency	Percentage
Gender	Female	501	58%
	Male	360	42%
Age	Between 18 to 29	490	57%
	Between 30 to 39	326	38%
	Between 40 to 49	30	3%
	Between 50 to 59	15	2%
Education	Bachelor	534	62%
	Master	286	33%
	Doctorate	41	5%

4.3 Study Instrument

To validate the hypothesis, this study has introduced a survey instrument. There were 24 items included in the research for measuring the eleven constructs in the questionnaire. In Table 2, there were sources of these constructs. The authors altered and revised the questions from the prior studies in order to improve the efficiency of the paper.

Table 3
Measurement Items

Constructs	Items	Instrument	Sources
Acceptance of Audio and Videos in Virtual Learning	AAV1	Audio and video material helps me to accept virtual learning.	
	AAV2	Audio and video material facilities my acceptance of any online platform.	
Perceived Ease of Use	PEOU1	It is easy for me to remember how to do my homework after watching a video or audio text.	(Fred D Davis, 1989)
	PEOU2	I think that it is easy to use audio and video text to do what I want.	
	PEOU3	I think watching audio and video text facilitates the process of learning new material.	
	PEOU4	It is easy to do multi-tasks after watching an audio or video texts.	
Perceived Usefulness	PU1	Using the audio and video in the virtual learning improves my performance.	(Fred D Davis, 1989)
	PU2	Using the audio and video in the virtual learning is useful to do different tasks.	
	PU3	Using the audio and video in the virtual learning is useful to understand difficult material.	
	PU4	Overall, I find that using the audio and video in the virtual learning is useful in my educational process.	
Speed and Vividness	SV1	Audio and video material has enough visual realistic and dynamic sources	(Steuer, 1992)
	SV2	Using realistic and dynamic audio and video resources is useful as a tool in my study	
	SV3	The vividness of audio and video martial urges me to use them frequently.	
	SV4	Overall, I find that using vivid audio and visual resources are useful.	
Perceived Concentration	PC1	I was able to concentrate in my class after watching the audio and video in the virtual learning.	(Liu et al., 2009)
	PC2	My attention was higher when I watch the audio and video in the virtual learning.	
	PC3	I was able to concentrate deeply in different activities after watching the audio and video in the virtual learning.	
Content Richness	CR1	I think it is useful to watch the audio and video in the virtual learning if they are up to date.	
	CR2	I think it is important to watch the audio and video in the virtual learning if they are relevant to my study.	
	CR3	I think it is enjoyable to watch the audio and video in the virtual learning if they are related to my studying material.	
Content Richness as Mediator	CRM1	I think the up to date and relevant audio and video materials are free of effort	
	CRM2	I think the up to date and relevant audio and video materials are easy to use.	
	CRM3	I think the up-to-date and relevant audio and video materials have high quality.	
	CRM4	I think the up-to-date and relevant audio and video materials help me to concentrate.	

4.4 Pilot study of the questionnaire

With the help of pilot study, the reliability of the questionnaire items was assessed. In this pilot study, about 50 students were chosen randomly from the selected population. Depending on the 10% of the total sample size of this research, the sample size of 500 students was used where the research criterion was closely monitored. For the internal reliability with the help of IBM SPSS Statistics ver. 23, the Cronbach's alpha test was employed for assessing the outcomes pilot study thus, there were appropriate suggestions given for the measurement items. The reliability coefficient of 7/100 was considered suitable when the given frame of social science research studies was considered (Nunnally & Bernstein, 1978). In Table 3, the Cronbach alpha figures for the seven measurement scales are shown.

Table 4
Cronbach's Alpha values for the pilot study (Cronbach's Alpha ≥ 0.70)

Construct	AAV	PEOU	PU	PC	SV	CR
Cronbach's Alpha	0.89	0.827	0.836	0.817	0.815	0.893

Note AAV, Acceptance of Audio and Videos in Virtual Learning; PEOU, Perceived Ease of Use; PU, Perceived Usefulness; PC, Perceived Concentration; SV, Speed and Vividness; CR, Content Richness**.**

4.5 Survey Structure

The questionnaire surveys were distributed among the students (Al-Emran & Salloum, 2017) comprising of three segments in the study

- The first part focused on the personal data of the respondents.
- In the second section, two items posing the main question about Acceptance of Audio and Videos in Virtual Learning were taken into account.
- The third part concentrated on the twenty-two items showing the Perceived Ease of Use, Perceived Usefulness, Perceived Concentration, Speed and Vividness, and Content Richness**.**

These 24 items were scaled with the help of five-point Likert Scale that had the degrees of: strongly disagree (1), disagree (2), neutral (3), agree (4) and strongly agreed (5).

5. Findings and Discussion

5.1 Data Analysis

For conducting the data analysis in this paper, the partial least squares-structural equation modeling (PLS-SEM) was used with the assistance of SmartPLS V.3.2.7 software (Ringle, Wende, & Becker, 2015). The collected data was studied with the help of two-step assessment approach involving the structural model and measurement model (J. Hair, Hollingsworth, Randolph, & Chong, 2017). There are various reasons of choosing the PLS-SEM in this paper. In the scenario where the available study aims to establish current theory, the PLS-SEM is considered to be the most suitable option (Urbach & Ahlemann, 2010). Secondly, with the help of PLS-SEM, the investigative studies comprising of the complex models can be dealt properly (Hair Jr, Hult, Ringle, & Sarstedt, 2016). Also, PLS-SEM analyzes whole model in a single attempt rather than grouping them into separate parts (Goodhue, Lewis, & Thompson, 2012). Further, PLS-SEM provides concurrent analysis for both the measurement and structural model that will simultaneously produce accurate measurements (Barclay, Higgins, & Thompson, 1995).

5.2 Convergent validity

The source (J. Hair et al., 2017) suggested that we must take considering the construct reliability (including composite reliability (CR), Dijkstra-Henseler's (PA), and Cronbach's alpha (CA)) and validity (including convergent and discriminant validity) into account in order to evaluate the measurement model. While finding out the construct reliability, it has been proven by Table 4 that the Cronbach's alpha (CA) has the values between 0.813 and 0.899 and these values are greater than the threshold value that is 0.7 (J. C. Nunnally & Bernstein, 1994). Also, according to this table the outcomes prove that the values of composite reliability (CR) are between 0.833 and 0.938, which are clearly larger than the recommended value of 0.7 (Kline, 2015). It is recommended for the researchers to use Dijkstra-Henseler's rho (pA) reliability coefficient for the documentation and evaluation of construct reliability (J. Hair et al., 2017). Like CA and CR, the values of 0.7 or greater must be shown by the reliability coefficient ρA in the investigative work while for higher stages of research, the above 0.80 or 0.90 should be used (J. F. Hair, Ringle, & Sarstedt, 2011; Henseler, Ringle, & Sinkovics, 2009; J. C. Nunnally & Bernstein, 1994). According to the table 4, the reliability coefficient ρA of each measurement construct is greater than 0.70. These outcomes have guaranteed the construct reliability and finally, it was considered that all the constructs are accurate and free from defects.

For the measurement of convergent validity, there is a requirement to test the average variance extracted (AVE) and factor loading (J. Hair et al., 2017). The rate of 0.7 was lower than the values of all factor loadings as shown by the outcomes of table 4 while the results of Table 1 show that the values generated by the AVE were ranging between 0.700 and 0.823 that are greater than the threshold value of .5. Depending on the expected results, the convergent validity for all constructs can be attained effectively.

5.3 Discriminant validity

For the measurement of discriminant validity, two criteria that are required to be measured are Fornell-Larker criterion, and the Heterotrait-Monotrait ratio (HTMT) (J. Hair et al., 2017). The Fornell-Larker condition, confirmed the prerequisites as per the results of Table 5 as all the AVEs along with their square roots are bigger than its correlation with other structures according to (Fornell & Larcker, 1981).

In Table 6 below, we can see the HTMT ratio that shows that the threshold value is greater than the value of each construct (Henseler, Ringle, & Sarstedt, 2015). Thus, the HTMT ratio has been introduced. With the help of these findings, the discriminant validity is measured. Following the outcomes of this study, there were no problems reported about the of the measurement model with the regards to its validity and reliability. Thus, the structural model can be assessed with the supplementary usage of the collected data.

Table 5
Convergent validity results which assure acceptable values (Factor loading, Cronbach's Alpha, composite reliability ≥ 0.70 & AVE > 0.5)

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	PA	AVE
Acceptance of Audio and Videos in Virtual Learning	AAV1	0.726	0.899	0.862	0.865	0.736
	AAV1	0.741				
Perceived Ease of Use	PEOU1	0.855				
	PEOU2	0.830	0.827	0.938	0.941	0.823
	PEOU3	0.818				
	PEOU4	0.817				
Perceived Usefulness	PU1	0.802				
	PU2	0.761	0.816	0.859	0.846	0.700
	PU3	0.768				
	PU4	0.836				
Perceived Concentration	PC1	0.702	0.882	0.882	0.827	0.808
	PC2	0.842				
	PC3	0.840				
Speed and Vividness	SV1	0.817				
	SV2	0.851	0.827	0.833	0.848	0.820
	SV3	0.850				
	SV4	0.761				
Content Richness	CR1	0.748				
	CR2	0.805	0.813	0.854	0.825	0.784
	CR3	0.849				
	CR4	0.809				

Table 6
Fornell-Larcker Scale

	AAV	PEOU	PU	PC	SV	CR
AAV	**0.881**					
PEOU	0.403	**0.806**				
PU	0.514	0.370	**0.893**			
PC	0.291	0.461	0.543	**0.844**		
SV	0.227	0.335	0.596	0.550	**0.899**	
CR	0.508	0.111	0.181	0.299	0.259	**0.808**

Note AAV, Acceptance of Audio and Videos in Virtual Learning; PEOU, Perceived Ease of Use; PU, Perceived Usefulness; PC, Perceived Concentration; SV, Speed and Vividness; CR, Content Richness**.**

Table 7
Heterotrait-Monotrait Ratio (HTMT)

`	AAV	PEOU	PU	PC	SV	CR
AAV						
PEOU	0.630					
PU	0.222	0.517				
PC	0.273	0.711	0.630			
SV	0.566	0.603	0.501	0.332		
CR	0.241	0.332	0.160	0.141	0.221	

Note AAV, Acceptance of Audio and Videos in Virtual Learning; PEOU, Perceived Ease of Use; PU, Perceived Usefulness; PC, Perceived Concentration; SV, Speed and Vividness; CR, Content Richness**.**

5.4 Model fit

The following fit measures mentioned are provided by the SmartPLS: The standard root mean square residual (SRMR), exact fit criteria, d_ULS, d_G, Chi-Square, NFI, and RMS_theta show the model fit in PLS-SEM (Trial, n.d.). The difference between the experiential correlations and model implied correlation matrix has been proven by SRMR (Hair et al., 2016) and the values lesser than 0.08 are said to be a good model fit measure (Hu & Bentler, 1998). A good model fit is shown by the NFI values greater than 0.90 (Hu & Bentler, 1998). The NFI proves a ratio of Chi2 value of the proposed model to the null model or benchmark model (Lohmöller, 1989). The NFI value will be higher when the parameters are large thus, it has been not recommended to use NPI as a model fit indicator (Hair et al., 2016). The two metrics outlining discrepancy between empirical covariance matrix and covariance matrix implied by composite factor model are the squared Euclidian distance, d_ULS, and the geodesic distance d_G (Dijkstra & Henseler, 2015; Hair et al., 2016). RMS theta is only appropriate for the reflective models and assesses the degree of outer model residuals correlation (Lohmöller, 1989). The nearer the RMS theta value is to the zero, the better the PLS-SEM model, and their values less than 0.12 are considered a good fit, and values other than this will show need of fit (Henseler et al., 2014). According to (Hair et al., 2016), the saturated model estimates association between all constructs, while on the other hand, the expected model takes total consequences and model structure into consideration.

Table 8
Model fit indicators

	Complete Model	
	Saturated Model	**Estimated Mod**
SRMR	0.053	0.054
d_ULS	0.761	1.407
d_G	0.554	0.554
Chi-Square	442.067	453.506
NFI	0.795	0.795
Rms Theta	0.053	

It was assumed that the required goodness-of-fit for the PLS-SEM model was sufficient enough to display global PLS model validity because of the RMS_theta value of 0.053 as shown in Table 7.

5.5 Hypotheses testing using PLS-SEM

In order to determine the interdependence of various theoretical constructs of the structural model, the structural equation model was used with SmartPLS having maximum likelihood estimation (Al-Emran, Arpaci, & Salloum, 2020; Salloum, Alhamad, Al-Emran, Monem, & Shaalan, 2019). Following this regard, the proposed hypotheses were studied. As shown in Table 9 and Fig. 2, the structure had a high predictive power (Chin, 1998), that's, the percentage of the variance within Acceptance of Audio and Videos in Virtual Learning is about 73%. Depending on the outcomes achieved through the PLS-SEM technique, the developed hypotheses expressed as the beta (β) values, *t*-values, and *p*-values in Table 9. It is evident that all the authors have supported all the hypotheses. Based on the data analysis hypotheses H1, H2, H3, and H4 were supported by the empirical data. Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Perceived Concentration (PC) has significant effects on Acceptance of Audio and Videos in Virtual Learning (AAV) (β= 0.358, P<0.05), (β= 0.547, P<0.001), and (β= 0.515, P<0.05) respectively; hence H1, H2, and H4 are supported. The relationships between Acceptance of Audio and Videos in Virtual Learning (AAV) and Speed and Vividness (SV) (β= 0.178, p = 0.658) was found to be statistically not significant, and thus, the hypothesis H3 is generally not supported. The third mediating effect interferes with the other two variables. The mediator factors help in facilitating the relation between the original two contracts paving the way for a clear justification concerning the associations among these variables. The association embraces a group of relations with at least one other intervening construct which are known as indirect effects. It is part of the researchers' role to investigate the mediating intervening constructs that are implemented by bootstrapping the sampling distribution of the indirect effects (Preacher & Hayes, 2008; Santos-Vijande, López-Sánchez, & Rudd, 2016) which are suitable for simple and different mediator models Bootstrapping. The process should start with the investigation steps, then moving to the next steps which are Indirect Effects + Confidence Interval Bias Corrected. In this type of mediation analysis, we examined the direct and indirect effects of perceived usefulness, perceived ease of use, perceived concentration, and perceived vividness on intention to use audio and video learning materials among undergraduate students (see Table 11 and Fig. 2). Empirical data could substantiate the positive effects illustrated in Exhibit 2. When the more complex cause-effect relationship is examined. We, therefore, combine the simple and the more complex cause effect relationships models in a mediator model (Exhibit 2). In addition to M1, M2, M3, M4 we would need to establish hypothesis M5: The direct relationship between the perceived usefulness and intention to use audio and video learning materials among undergraduate students (Path C) is mediated by media richness (Path A-B), and perceived ease of use and intention to use audio and video learning materials among undergraduate students (Path C) mediated through media richness (Path A-B), and perceived concentration and intention to use audio and video learning materials among undergraduate students (Path C) mediated through media richness (Path A-B), and perceived vividness affects intention to use audio and video learning materials among undergraduate students (Path C) mediated through media richness (Path A-B). If we use the available data to empirically estimate the model, we would obtain the estimated relationships with the expected signs. When extending the model by the perceived usefulness, perceived ease of use, perceived concentration, and perceived vividness we obtain the "true" relationship between perceived usefulness, perceived ease of use, perceived concentration, and perceived vividness with the intention to use audio and video learning materials among undergraduate students through media richness (Alshurideh et al., 2021).

Table 9
R^2 of the endogenous latent variables

Constructs	**R^2**	**Results**
Acceptance of Audio and Videos in Virtual Learning	0.731	High

Table 10
Hypotheses-testing of the research model (significant at p** < = 0.01, p* < 0.05)

H	**Relationship**	**Path**	***t*-value**	***p*-value**	**Direction**	**Decision**
H1	PU → AAV	0.358	3.284	0.041	Positive	Supported*
H2	PEOU → AAV	0.547	12.085	0.000	Positive	Supported**
H3	SV → AAV	0.178	0.317	0.658	Positive	Not supported
H4	PC → AAV	0.515	2.244	0.031	Positive	Supported*

Note AAV, Acceptance of Audio and Videos in Virtual Learning; PEOU, Perceived Ease of Use; PU, Perceived Usefulness; PC, Perceived Concentration; SV, Speed and Vividness.

Table 11
Moderator Analysis Result

H	Relationship	Path a IV→Mediator	Path b Mediator → DV	Indirect Effect	SE Standard deviation	t-value	Bootstrapped Confidence Interval 95% LL	95% UL	Decision
M1	PU * CR → AAV	0.265	0.628	0.166	0.075	5.026	0.019	0.313	Supported
M2	PEOU * CR → AAV	0.349	0.628	0.219	0.064	4.213	0.094	0.345	Supported
M3	SV * CR → AAV	0.458	0.628	0.288	0.052	4.145	0.186	0.390	Supported
M4	PC * CR → AAV	0.141	0.628	0.089	0.040	5.026	0.010	0.167	Supported

Note AAV, Acceptance of Audio and Videos in Virtual Learning; PEOU, Perceived Ease of Use; PU, Perceived Usefulness; PC, Perceived Concentration; SV, Speed and Vividness; CR, Content Richness.

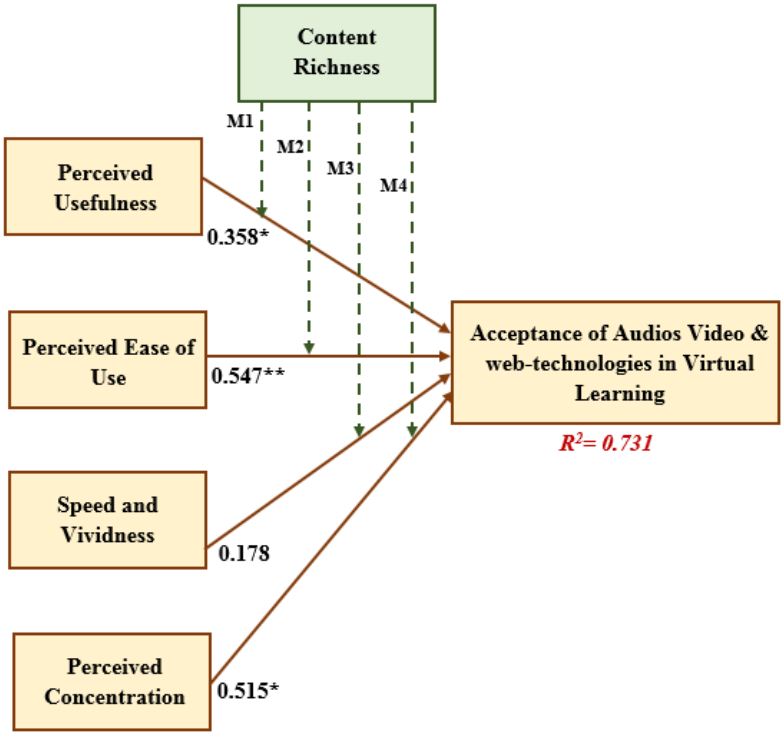

Fig. 2. Path coefficient of the model (significant at p** < = 0.01, p* < 0.05)

6. Discussion of Results

Past studies have provided us with insight into key assumptions influencing students' acceptance of several aspects in the online environment (Chi-Yueh, Ci-Jhan, & Hsiu-Hui, 2017; Lee & Lehto, 2013; Liu et al., 2009; Saeed & Sinnappan, 2009; Sun & Cheng, 2007). However, few studies have shed light on the educational value of audio-visual material (Akhtar & Falk, 2017; Baehr, 2012; Ongena, van de Wijngaert, & Huizer, 2013b). Based on the current study, results have shown that audio-visual material in the educational environment has an efficient and innovative role. In fact, the implementation of TAM helps to identify the crucial factors affecting students' acceptance behavior. With regard to these two constructs, the perceived ease of use and the perceived usefulness have an effective influence on the accepting audio-visual material. Based on the fact that all path coefficients were found statistically significant, the students' perception of the perceived ease of use and the perceived usefulness have a direct effect on the acceptance of the audio and visual material. This stems from the fact that students' are more willing to use the audio-visual resources as a source of learning that is available at any time and they can listen and watch them repeatedly.as a supporting tool in their online educational environment. Students are in favour of getting benefits from the offered educational resources as an alternative to traditional means of education. The current results are in agreement with results presented by (Alla, 2015; C. Lai, Wang, & Lei, 2012; Lee & Lehto, 2013) who explored students' behaviour intention in terms of TAM two constructs, namely the perceived ease of use and perceived usefulness. According to these studies, students do prefer to use such types of resources because the given material satisfies their needs in achieving their learning goals.

Perhaps more significantly, this paper has emphasized the external factors of speed and vividness along with the perceived concentration which is more prominently effective in measuring student's intention to use audio-visual material context. The results of this study support prior research, suggesting that speed and vividness have a positive impact on student's intention to use audio-visual resources in that whenever the level of vividness is high, the level of perceived usefulness will be increased (Chi-Yueh et al., 2017; Hernandez, 2011; J.-Y. Lai & Rushikesh Ulhas, 2012).

However, the study failed to prove that the perceived concentration has an effective role in student's intention to use audio-visual resources. The results of the current study are not inconsistent with previous research where the perceived concentration was considered as an important factor that affects students' perception. A study by (Liu et al., 2009) has shown that concentration has a positive impact on students' ability to be immersed in online activity and supports users' experience in this regard. The concentration enables students to expand their short time span and urge them to use the resources repeatedly (Ghani & Deshpande, 1994; Novak et al., 1998). Accordingly, the high concentration is supposed to have a high impact on the use of audio-visual resources. No one can deny that these resources enhance the psychological state of the students as well as their critical demand for an efficient style of learning (Webster et al., 1993).

6.1 Theoretical and Practical implications

The present study attempts to add value to the crucial factors that affect the behaviour intention to use audio-visual resources. The conceptual model which is designed to measure the acceptance of these resources in relation to two external factors of time and vividness as well as the perceived concentration have paved the way for teachers, instructors, professors and learners to think carefully with the type of resources that are most appropriate to their students. The integration of these factors can better contribute to the acceptance of audio-visual resources in the educational environment. Accordingly, the internet speed, the availability of the internet and the quality of the audio-visual resources have to be reconsidered to suit students' needs and perceptions (Ashaver & Igyuve, 2013; Ongena, van de Wijngaert, & Huizer, 2013a). This study results that are obtained for the current study shed light on the importance of audio-visual resources in the educational environment and offer chances for future researchers to focus deeply on this specific aspect in the online world of education. Most of the influential finding is that audio-visual resources can change the way teachers and students interact in the future of educational environments where both students and teachers can make use of multiple functions of the online platform at the same time. They can use these resources as a means of giving oral feedback instead of writing one. Further, they can clarify difficult issues and the most problematic topics using these resources. It helps in facilitating the implementation of other technology such as those used in flipped classrooms. Hence, these resources are highly preferred and significant that may impede the students' acceptance whenever it is not evident. To conclude, the TAM factors help us practically prove that audio-visual resources have been strongly preferred and highly appreciated by students' due to the fact that they can be used by the concerned parties effortlessly and usefully.

6.2 Managerial Implications

The findings of the current study may have practical implications for software developers and online platform designers when it comes to designing and implementing a learning platform involving audio-visual resources. Future online developers should create a direct connection between Moodle categories and U-tube to facilitate the process of uploading and downloading audio-visual resources. They should pay attention to the urgent need to have categories that can display the audio-visual resources on online platforms and can access them easily.

6.3 Limitations of the Study and Future Studies

One of the limitations of the study is that it focuses on a group of students in general without paying attention to gender distinction. Hence, it would be important to have a future study that investigates if any differences between male students and female students can affect their perception and intention to use these resources. Another limitation is that this study focuses on two main external factors which are speed and vividness as well as perceived concentration. Future research can include other significant external factors such as content richness and satisfaction in their conceptual model. The inclusion of these constructs may give deeper insight into technology acceptance. In addition, this study is limited to a group of participants from UAE, thus, a comparative study that tackles students' perceptions from different universities can be conducted which can explain better students' perceptions and intentions all over the world.

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