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DEVELOPMENT OF MEANINGFUL LEARNING SCALE (MeLearn)

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Abstract:
In the 21st century educational landscape, a meaningful learning environment is important. Meaningful learning encourages dynamic students' involvement in learning. Nevertheless, the dearth of the scholarly literature of measurement for meaningful learning has been found. Hence, this study proposes to develop and validate a meaningful learning scale (MeLearn). The study conceptualized meaningful learning in five dimensions. An Exploratory Factor Analysis (EFA) is used to expose the appropriate items for MeLearn as well as validity and reliability. The current study chose the cross-sectional research design, while the data was collected from 289 university students, using a structured survey.This study finalized MeLearn to thirty-one (31) items yielding five (5) dimensions, i.e., cooperative learning (7 items), active learning (5 items), authentic learning (6 items), constructive learning (6 items) and intentional learning (7 items). The eigenvalues of the five dimensions of MeLearn fell within 1.17 and 12.21 with the total variance explained is 51.9 %. The reliability indexes ranged from 0.838 to 0.885. The rigorous development procedure and analysis of MeLearn have warranted that the scale is reliable and valid. The research provides insightful information about the dimensions and items of meaningful learning scale which can be interpreted more easily and meaningfully.

Keywords: Meaningful Learning, Cooperative Learning, Active Learning, Authentic Learning, Constructive Learning, Intentional Learning

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INTRODUCTION

Meaningful learning is about active, constructive,and long-lasting activities throughout students' learning. Most significantly, it allows the students to participate fully in the learning process. Meaningful learning combines several teaching and learning activities that allow students to develop knowledge, reflect on the activities, and articulate the information gained in them [1]-[2]. Meaningful learning discusses an understanding of how the information learned fits together. It opposes rote learning, which is the memorization of repetitive information [3]. Meaningful learning stimulates students' intellectual curiosity and engages them in dynamic instructional activities, thus encouraging the growth of holistic human characteristics which are in line with the 4.0 industrial revolution (4IR) [4].

Even though it is accepted that meaningful learning has been studied to some extent in several previous studies (e.g. [1]-[2], [5]-[6]), yet, the literature review revealed that there is still no mutualagreement define the dimensions of meaningful learning among the researchers as well as the items to assess meaningful learning. Measuring these meaningful learning is interesting which includes a dynamic learning process. The existing literature typically focused on the development of rubrics for each dimension of meaningful learning (i.e. cooperative learning, active learning, authentic learning, constructive learning, and intentional learning). Although there is evidence to evaluate meaningful learning by using the rubric, a review in the measurement of meaningful learning has suggested the requirements to develop and validate an instrument with the appropriate

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dimensions to measure meaningful learning. Recent research by [6] proposed a more rigorous evaluation of meaningful learning dimensions and development of a Likert scale survey which consists of all the dimensions of meaningful learning. The recommendations were made instead of the importance of creating a meaningful learning environment [7]-[8] which could also facilitate the 21st-century learning [9]-[10].
This research, therefore, aims to address the gaps in the literature, which is to develop and validate a scale for measuring the level of meaningful learning experience among students.The proposed new practical scale of learning, named as MeLearn. This study has scrutinized five dimensions of meaningful learning (cooperative learning, active learning, authentic learning, constructive learning, and intentional learning) as the core dimensions to measure meaningful learning experience.

LITERATURE REVIEW

In [11] who was a cognitive psychologist, explained that meaningful learning involves students in an active process of meaning-making where they interpret their learning experiences cognitively rather than regurgitate information. Meaningful learning is about how an individual learns, the description of teaching and learning activity, and how it should be structured. Meaningful learning happens within "knowledge construction, reproduction; conversation, not reception; articulation, not repetition; collaboration, competition; and reflection, not prescription" [12]. Meaningful learning comprises understanding how informal learning fits together, while rote learning is the memorization of replicative knowledge.

Therefore, rote learning is forgotten rapidly whereas meaningful learning is not [11], [13]. Recently, several studies tried to integrate technological advancement into the educational landscape to support meaningful learning (e.g. [2]-[3], [14]). The meaningful learning framework recommended by [15]-[16] which has five dimensions, namely: (i) cooperative learning, (ii) active learning, (iii) authentic learning, (iv) constructive learning, and (v) intentional learning was adopted as a guide to the research.In [13], [16] stated that the educational use of technology integration should allow learners to involve in meaningful learning.

The integration of technology and content resources with e-learning activities can lead to meaningful learning. Previous findings showed that all the five attributes (cooperative learning, active learning, authentic learning, constructive learning, and intentional learning) of meaningful learning we're able to assist the academics in increasing the quality of teaching and learning. Analyzing and classifying e-learning activities are based on the five dimensions of meaningful learning. These characteristics were done by a handful of researchers (e.g. [2]-[3], [17]). The designing of e-learning activities can be assessed using rubrics concerning the five dimensions of meaningful learning that was developed by [5]. Apart from that, in [6] also carried out a piece of research to measure the designing of lesson activities by teachers to determine the strengths and weaknesses of teacher's technological pedagogical content knowledge in terms of the five meaningful learning dimensions proposed by [16]s' framework. Meaningful learning rubrics were also developed in a study by [14] by referring to the five dimensions of meaningful learning framework proposed by [15].

Background of Meaningful Learning

The underlying dimensions of meaningful learning construct were adopted from [16]'s meaningful learning framework that has five dimensions, namely: (i) cooperative learning, (ii) active learning, (iii) authentic learning, (iv) constructive learning, and (v) intentional learning. A comprehensive elaboration on the underlying dimensions of the meaningful learning construct in this research is presented below.

i) Cooperative learning

The cooperative dimension of meaningful learning emphasizes the need for interaction among learners and instructorsin the instructional process [16]. Cooperative learning which includes discussion and group activities is known as the most natural way to learn [5]. Cooperative learning can be effectively extended through what [18] described as a situation in which students work together in activities such as report writing, creation of concept maps, or group projects. Lesson activities that support group work and interaction among learners as well as between learners and instructors would better exemplify the application of the cooperative learning dimension of meaningful learning. The more an activity stimulates students to interact, the more it is regarded as cooperative learning [5]-[6].

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ii) Active learning

The most important element of active learning is to involve and engage the students in learning activities [16], [19]. Integrating content resources with e-learning activities that involve students in the practice and exploring new knowledge enables high-level active learning [6]. Learning experiences become highly valuable when the learning activities provide students with chances to actively contribute to the learning process. This contradicts

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the traditional approach where students were exposed to a passive transmission of information from teachers or instructors. An active learning process occurs when students do not just listen to lectures but also actively engage in the learning process through reading, writing, discussions, andhands-on-activities [5]. Active learning involves activities such as group discussions, demonstrations, presentations, and coaching [20]. It requires students to actively think about what they have learned and encourages a more meaningful learning process. Active learning also discussed that students are primarily involved in exploring new information, participating, practicing,and discussing through their learning process. Students in active learning do not passively listen but actively manipulate, explore information, and observe the results [16].

iii) Authentic learning

Authentic learning discusses lesson activity that engages studentsthe real-world experience, recognizing and solving the problem of the experience [5][6]. Authentic learning is a type of learning which relates to real-world experiences, complex problems, and their solutions [2], [21]. In [22], [16] highlighted that the authenticity of learning implies that learning is a more meaningful and incisive, real-world task. Authentic learning is focused on student-centered activities that exercise applications related to real-world experience and determine the problem of the experience. The more the learning activity assisted students to make associations between the real-world experiences related to the subject learned, the more it was contemplated as authentic [5]. The authentic dimension of meaningful learning is also considered about the encouragement of personal meaning-making of the real-world experiences [23], through the process of analyzing and relating on what the students have learned with the real-world experience.

iv) Constructive learning

Constructive learning is referred to as the process in which students develop understanding through the integration of new knowledge and prior knowledge [16], [5]. In the process of constructive learning, students tend to develop an understanding of what they have learned and can explain it. Students begin constructing their understanding by synthesizing new knowledge and relating it to prior knowledge. It is also essential that the students articulate what they have learned and reflect on their learning activities to allow constructive learning to take place [17]. Besides, constructive learning indicates the extent to which these students reflect on the content knowledge that they engage with [5]. As students reflect on their learning activities, they are given opportunities to engage in evaluation which is categorized as the highest level of the constructive dimension. The lower ranks of the constructive dimension involve learning experiences at the level of Bloom's taxonomy knowledge and understanding, while experiences involving taxonomy assessment and creation ranks are considered to be higher in the constructive dimension [6]. Advanced levels of the constructive dimension are designated by personally reflective knowledge expressions.

v) Intentional learning

Intentional learning is conceptualized as student activities that involve the setting of a learning goal and the control over students' learning [24], [16]. When students are enthusiastically trying to achieve their cognitive target, they tend to consider and learn more because they are accomplishing an intention. They must be capable to articulate their learning aims and supervise their progress. Students learn meaningfully when they plan their everyday learning tasks and search for a way to resolve the problem they discover [16]. Meanwhile, in [5]defined intentional dimension as the degree to which students engage in setting learning goals, identifying learning gaps and, resolving learning gaps. Learning gaps are referred to as the gaps in understanding. In [6] concluded that significant rates of intentionality within a lesson may be interpreted as the occurrence of multiple responses to learning gaps or lack of understanding of the material. The more the activities provide students with opportunities to involve in persistent self-diagnosis and identify the gaps in understanding, the more they are regarded as intentional learning tasks.

Table 1 provided the proposed operational definitions for all the five dimensions of MeLearn.

Table 1. The operationaldefinition for five dimensions of MeLearn

Dimensions	Operational Definitions
Cooperative learning (CL)	Students' willingness to interact with the instructors and collaborate with other learners in the learning process (adapted from [16], [5]-[6])
Active	Students' willingness to

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learning (AL)	participate in the learning activities and explore new information throughout the learning process (adapted from [16], [5]-[6])
Authentic learning (UL)	Students' ability to relate what they have learned to daily. Life experience and real-world phenomena. This dimension measured students' ability. To recognize genuine real-world problems and look for solutions to the problems (adapted from [2], [16], [5]-[6])
Constructive learning (OL)	Students' ability to create a new understanding by integrating prior knowledge with new knowledge, articulate what they have learned, aa and make a reflection on the learning process (adapted from [16]-[17], [5]-[6])
Intentional learning (IL)	Students' ability to set their own learning goals, regulate learning, identify gaps in understanding and resolve their lack of content understanding discovered in the learning process (adapted from [16], [5]-[6]))

METHODOLOGY

This study applied a cross-sectional research design to establish a functional learning scale or MeLearn, which is accurate and reliable. Data was collected through a structured survey questionnaire.

Instrumentation

The following measures and procedures were adapted while creating the MeLearn; from The Standards for Educational and Psychological Testing [25]; referred to hereinafter as the *Standards*). The *Standards* outline a professional overview of the design, implementation, scoring, and reporting of educational and psychological assessments. The Standards aim to provide important guidance and key elements in a testing program for professionals who specify, develop, or select tests, and for those who interpret or evaluate test results [25]-[26]. Figure 1 visualizes all the steps taken to develop the MeLearn.

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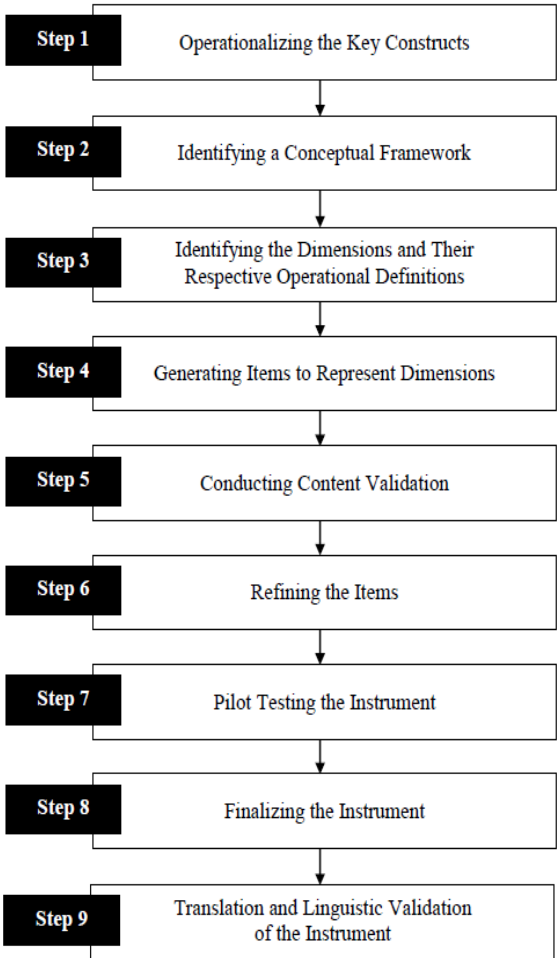

Figure 1. Process of developing the MeLearn

In step 1, the relevant literature on meaningful learning (e.g. [2], [6], [16]) was reviewed to develop a proper conceptualization of meaningful learning. From this review, the operational definitions of meaningful learning were decided. Next, the researcher identified a conceptual framework for meaningful learning. Most of the literature review proposed five dimensions of meaningful learning. All thedimensions were adopted as the framework as they were relevant to the research's context. In step 3, five dimensions of meaningful learning were identified (i. cooperative learning; ii. active learning; iii. authentic learning; iv. constructive learning; and v. intentional learning) and the respective operational meanings have also been defined for each dimension.

In step 4, an initial pool of items representing all the dimensions was developed. All the items were adopted and adapted from previous instruments and rubrics with relevant input from the preliminary study and supporting literature. The researcher continued to revise and refine the instrument to avoid any redundancy, double-barrelled questions, overly long and confusing items. The proposed scale comprised 10 items for each dimension of meaningful learning. Then, the researcher conducting content validation in step 5 by using the content validity ratio (CVR) approach. A thirty-expert panel was invited to review the items in terms of content and dimension representativeness, clarity, relevance, and format. The percentage of expert agreement is determined using the equation below:

Content validity ratio, $CVR = (\eta e - N/2) / (N/2)$

ηe = number of panellists indicating "essential", N = total number of panellists

The present research had decided to adopt the revised CVR values by [27] who stated that when the total number of experts is 30 (N = 30), the minimum value (critical value) must be reached for each item is 0.333. The CVR value helped the researcher to improve the instrument and decide which items to retain or remove. Based on expert judgment, some ten percent (10%) of the items required minor modifications and refinement to

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make them usable for the research. In step 6, each item was revised and refined after taking in all the comments from the experts as preparation for pilot testing.

The pilot study was performed in phase 7 to verify that the items were clear to the respondents in context and to assess the validity and reliability of the building scale. The pilot study was administered to two hundred and eighty-nine (n = 289) students who volunteered to fill in the questionnaire. Out of the 289 students, 204 were female (70.6%) while the remaining 85 were male (29.4%). Careful consideration also was given to any feedback and suggestion given by respondents to further improve the quality of the scale. An Exploratory Factor Analysis [28] was used to determine the construct validity to estimate the internal consistency of the retained dimensions, this research applied the Cronbach's alpha formula. The instrument was finalized in phase 8 after an extensive review of the products based on material validation (expert judgment) and the results of pilot tests. The researcher decided to develop the scale in two languages, i.e. English and Malay because Malay is the national language of Malaysians. Once the items were finalized, the instrument was reviewed, proofread, and translated into Malay. Two experts proficient in both English and Malay were appointed in the last step to carry out a linguistic validation of the instrument to ensure that items in the two languages were conceptually equivalent.

Data Analysis

Data collected for the pilot study were entered into and analyzed using Statistical Package for the Social Science (SPSS) statistics software version 22. An exploratory factor analysis [28] was used to determine the construct validity of MeLearn. The correlation matrix of the intervariable was performed to define the underlying dimensions determined by the variables. Second, the factor loadings were estimated, and the initial factors were then subjected to direct oblimin rotation to increase the interpretability of the dimensions. The method is consistent with the assumption that the underlying constructs are conceptually related, and the need to achieve the simplest structure of the element. Third, Kaiser's criterion for important factors, screen test, factor loading significance test, and extracted factor interpretability was used to determine the number of dimensions to be retained. Eventually, the Cronbach's alpha formula was applied to measure the internal accuracy of the retained measurements.

Exploratory Factor Analysis (EFA)

EFA performs a vigorous part to assess the inter-relationships among the items of five dimensions of MeLearn. It compresses a group of objects into one dimension with minimal knowledge loss and can be more simply and meaningfully inferred [29]. According to [30], if the researcher previously adjusts the instruments and changes statements that are appropriate to the current study, then the EFA procedure must be conducted. It is because the current area of research can be different from previous studies, or in terms of socio-economic, ethnic, and cultural status, the current sample population is substantially different from previous research. Therefore, some items may have been developed earlier, and may no longer be suitable for the current study. Researchers will, therefore, recalculate the importance of construct validity and internal reliability for the current scale, the Cronbach Alpha 's new importance[30].

Firstly, the Measure of Sampling Adequacy by Kiser-Meyer-Olkin (KMO) and BartletTesttest of Sphericitywas estimated to determine that the use of the analysis was appropriate. The common agreement or acceptance index of KMO is above 0.6 while Bartlett's test of sphericity should be significant at ($P<0.05$) for the factor analysis to be appropriate [28], [30]. The total variance explained was then scrutinized as an extraction process to reduce the items into a practicable number. The proportion of the total variance explained by the retained factors should be at least 50% [31]. In this step, items with eigenvalues exceeding 1.0 are extracted into different dimensions [30], [32]. As well, the rotated component matrix was inspected and only items with a factor loading above 0.4 were retained [29], [33].

RESULTS AND DISCUSSION

Result of Exploratory Factor Analysis

There were five dimensions and 50 newly developed items proposed after the content validation process. 10 items belong to each dimension. At first, KMO and Bartlett's Test was examined to all the developed items. The summary of the results is given in Table 2:

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Table 2. KMO and Bartlett's Test ofMeLearn

Meaningful Learning Scale (MeLearn)	**Kaiser-Meyer-Olkin Measure of Sampling Adequacy**		.956
	Barlett's Test of Sphericity	**Approx. Chi-Square**	9893.111
		Df	465
		Sig.	.000

By referring to Table 2, the measure of sampling adequacy by KMO is excellent since it exceeded the required value of,0.6 and Bartletts' Test of Sphericity is significant [28], [30]. Hence, KMO valueswhich approach to 1.0 and Bartlett's test significance value is 0.0 indicate that the data is acceptable and appropriate for the next process to proceed. Then, the eigenvalues of the five dimensions of MeLearn fell within 1.17 and 12.21. This denotes that the items are categorized into five dimensions and would be contemplated for the next analysis. The total variance explained is 51.9 %. Table 3 below shows all 31 items had a factor loading above 0.4, and therefore all 31 items were considered under five dimensions of MeLearn. The other 19 items from the 50 items were removed.

Reliability Analysis

As shown in Table 4, all reliability indexes for each dimension of meaningful learning were found to be above 0.70, which are considered desirable for social science and educational research [28], [30], [34]. The finalized of the MeLearn scale comprised of a total of 31 items with 7 items in cooperative learning and intentional learning, 5 items in active learning, 6 items in authentic learning, and constructive learning.

Table 4. Reliability for five dimensions of meaningful learning and their respective number of items

Dimension	**Number of Items**	**Cronbach's Alpha**
Cooperative Learning	7	0.885
active learning	5	0.383
Authentic Learning	6	0.864
Constructive Learning	6	0.876
Intentional Learning	7	0.849

The findings reveal that MeLearn has adequate validity and reliability to measure students' meaningful learning experience. The MeLearn assesses five dimensions (i) cooperative learning, (ii) active learning, (iii) authentic learning, (iv) constructive learning, and (v) intentional learning which is related to the students' meaningful learning experience. Content validity determines how well the dimensions and elements of a concept can be successfully defined, and it keeps up the construct validity of the scale. In the current research, the preliminary studies and previous literature review contributed to the development of the MeLearn in defining the elements and dimensions of meaningful learning constructs. Establishing item CVRs helped the researcher to improve the scale and decide which items to retain or remove. The decisions to discard, modify, or keep items were not exclusively made based on empirical data. Then, the EFA was used to ascertain the construct validity and reliability of the MeLearn.

The findings agree with the evidence found by several other researchers that meaningful learning is a multidimensional concept--consisting of cooperative learning, active learning, authentic learning, constructive learning, and intentional learning [2], [5], [6], [16].The findings also could inform teaching and learning theories and practices, and be used to fill the deficiencies present to measure how dynamic and meaningful throughout the students' learning experience.

Limitations of the Study

Application of the validated MeLearn may provide insightful information to students, instructors or lecturers, and higher learning institutions. Students can measure their level of meaningful learning experience to make necessary improvements to increase their learning process. The scores may also assist lecturers or instructors in knowing their students' learning levels in general and in specific dimensions. The lecturers or instructors enable to use the information in giving clear, positive and consistent

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Code Item	Items	Dimension				
		Cooperative Learning	Active Learning	Authentic Learning	Constructive Learning	Intentional Learning
	I enjoy ... throughout the learning process.					
CL6	accomplishing the learning task given in groups	0.702				
CL7	consulting with instructor r for advice	0.693				
CL4	being engaged with other learners	0.667				
CL5	discussing with the instructor	0.664				
CL8	discussing with other learners to share understanding	0.643				
CL3	being involved in group project activities	0.636				
CL2	creating concept maps in groups	0.624				
	I love to ... throughout the learning process.					
AL4	participate in learning activities		0.624			
AL5	explore the new information		0.581			
AL6	practice the content learned		0.553			
AL2	give full attention		0.497			
AL3	share my ideas/ knowledge/ information		0.471			
	I manage to ... with/ from what I have learned throughout the learning process.					
UL6	recognize related problems in real-world phenomena			0.772		
UL7	relate problems of real-world phenomena			0.695		
UL5	relate my daily life experiences			0.614		
UL8	identify solutions to problems related to daily life experiences			0.539		
UL4	get involved in exploring real-world phenomena			0.527		
	I enjoy ... in the learning process.			0.436		
OL2	creating a new understanding from prior and new knowledge				0.634	
OL3	making a reflection about what has been learned				0.618	
OL1	relating new and prior information				0.608	
OL5	summarizing what I have learned				0.576	
OL4	visualizing what I have learned				0.560	
OL6	evaluating my understanding of the content knowledge				0.528	
	I prefer to ... in the learning process.					
IL6	identify the gaps in my understanding					0.678
IL4	plan my schedule to complete learning tasks					0.642
IL5	manage my learning tools systematically (e.g. filing)					0.606
IL2	set my own academic achievement goals					0.539

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Table 3.Rotated Component Matrix of MeLearn

	s					0.504
IL3	plan my learning activities					0.503
IL9	solve the gaps in content understanding discovered					0.446

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feedback to their students to enhance their learning meaningfully. It can also provide detailed information for instructors to develop constructivist instructional strategies and adopt mastery learning goals which may lead to more meaningful teaching and learning.

CONCLUSION

The study contributes to the body of knowledge and measurement of the meaningful learning experience. The EFA results formed a structure that extracts five dimensions of MeLearn. The final dimensions of MeLearn are cooperative learning, active learning, authentic learning, constructive learning, and intentional learning. All the dimensions can be assessed by 31 items developed in this research. The reliability for the five dimensions of meaningful learning displayed high Cronbach's Alpha value, meets Bartlet Test achievements (significant), KMO (> 0.6) and factors loading exceeds the minimum threshold of 0.4. This reveals that the items not set aside are applicable in this research [30], [34]. The rigorous development procedure of MeLearnhas warranted that the scale is reliable and valid. It can be concluded that the research findings in totality have a lot of significance especially for students of higher learning institutions in Malaysia as well as for instructors and university administrators. Students' meaningful learning are important issues that must be further discussed and examined to facilitate the 21st-century education landscape.

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