Chapter 3

Developing a Framework for Online Collaborative Learning Tools in the Attitude Domain: A Fuzzy Delphi Method

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Abstract

Developing students' attitude domain is as important as developing their cognitive strategies and motor skills, because attitude-related affective skills help students establish ways of inquiry, become active learners, build a sense of responsibility for their own learning, and promote lifelong learning. However, many higher education institutions (HEIs) have overlooked the development of students' attitude due to difficulties designing instruction that evaluates attitude, which is perceived to be subjective. Therefore, instructors need to ensure they incorporate the attitude domain into lesson planning, activity design, lesson delivery, and assessment approaches. However, it is recognized that developing the attitude domain online is difficult compared to the face-to-face setting, given that HEIs are currently undertaking teaching activities remotely on digital platforms due to the Covid-19 pandemic. Although effective

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teaching with technology includes the design of instructional strategies that are linked to the types of skills instructors wish students to learn, instructional strategies for attitude-related skills are less well-defined than those for cognitive skills. There also seems to be little to no guidance on how to support and develop attitude skills in HEIs. Hence, this study seeks to develop a framework for attitude development by employing the Fuzzy Delphi Method to obtain a consensus among 16 experts. The results reveal suitable collaborative learning tools and corresponding assessments to develop the attitude domain among students. This framework provides a guideline for instructors to plan their teaching of the attitude domain from the aspects of instructional strategies, collaborative learning tools, and assessment measures.

Keywords: attitude domain, social constructivism, collaborative learning tools, fuzzy Delphi, Merrill's first principles of instruction

1. Introduction

In the twenty-first century, graduates of higher education institutions (HEIs) are required to possess critical thinking skills, such as the ability to think analytically, synthesize, evaluate, and use cognitive techniques to create new information and solve issues (DeWitt and Koh 2020; Dick, Carey, and Carey 2014; Biasutti and EL-Deghaidy 2015). This indicates that teaching and learning in HEIs should not only focus on imparting facts and concepts as knowledge. However, it appears that the the course design in HEIs prioritizes cognitive strategies and motor skills while ignoring the attitude domain (Sitzmann 2010), despite the fact that a well-designed course should have a combination of cognitive, affective, and psychomotor domains (Bloom 1956).

The attitude domain has remained unexplored, neglected, and underrated by the education system because this affective skill is highly subjective and difficult to assess and design (Taneri 2017; Clouston 2018). Many educational systems have also overlooked students' attitudes and focused more on their cognitive abilities, as it is challenging to measure the achievement of attitude goals using traditional evaluation approaches (Ni et al. 2018; Putman et al. 2020). Consequently, even though students develop intellectual awareness, they lack the necessary social-emotional abilities to live in peace and harmony with others (Dar 2018). This shows that the fundamentals of effective education must be grounded in a combination of academic and social-emotional development (Dar 2018; Bleakley et al. 2020). Although cognitive

skills are important to promote active learning and critical thinking, incorporating emotions, feelings, and values is equally crucial for permanent learning to take place (Taneri 2017; Dar 2018). In this regard, effective teaching of the affective domain will assist students in examining, reflecting on, and revising their own values and beliefs, ultimately moulding individuals who are creative and innovative (Taneri 2017; Clouston 2018).

Therefore, to develop the attitude domain in HEIs, instructors need to incorporate this domain into lesson planning, activity design, lesson delivery, and assessment approaches (Clouston 2018). However, it should be acknowledged that developing the attitude domain using online delivery is difficult compared to the face-to-face classroom setting. With the sudden shift away from brick-and-mortar teaching due to the Covid-19 pandemic, HEIs are currently conducting their teaching and learning remotely on digital platforms. Therefore, effective teaching with technology should include the design of instructional strategies that are linked to the types of skills instructors wish students to learn, such as attitude.

However, instructional strategies for attitude-related skills are less well-defined than those for cognitive strategies (Hwang and Chang 2016; El Sakka 2019). There seems to be little to no guidance on how to support and develop attitude skills in the HEI context. Hence, in this study, a framework for teaching the attitude domain was developed to serve as a guideline for instructors in designing learning tasks that promote positive attitudes towards learning by engaging students in real-world problem-solving.

2. Literature Review

2.1. Social Constructivism

According to the social constructivist viewpoint, knowledge and new ideas are created through social interactions (Vygotsky 1978). The reason for using this theory is that, in social constructivism, learning is self-directed and students share their learning experiences with peers who have the same cultural values (Vygotsky 1978; So and Brush 2008). This is in complete opposition to the traditional teacher-centered method of learning where the instructor is regarded as an expert in the transmission of information while the student is supposed to accept the information without critique (Ntshwarang, Malinga, and Losike-Sedimo 2021).

Learning is an active process; students neither learn in isolation nor passively absorb information. In the social constructivist learning environment, students learn best when collaborating with their peers through knowledge construction (Adebola, Tsotetsi, and Omodan 2020; Mpungose 2020). During these social interactions, students work together to achieve common learning goals by establishing group understanding, engaging in discussions, and applying knowledge to promote meaningful learning (Johnson and Johnson 2014). Individual learning happens when learners first internalise newly learned knowledge, then externalise it by sharing, comparing, and synthesising different viewpoints through peer interactions, and finally, create new knowledge through the collaboration process (DeWitt and Koh 2020; Palmer 2005; Xie 2013).

Collaboration is significant for any online learning environment, especially in the technology-intense era where students are actively constructing knowledge in a community of practice; in this regard, social learning activities can support students' achievement of collaboration (Orooji and Taghiyareh 2018). Therefore, it is imperative to design high-quality instruction by linking learning to students' experiences through problem-solving. Instructors can do this through collaborative learning with tools such as discussion forums, wikis, blogs, podcasts, virtual walls, and many more.

2.2. Online Collaborative Learning and Tools in Higher Education

In the context of higher education, collaborative learning is transforming the learning process into a less linear one that goes beyond the traditional classroom setting, so that students can construct knowledge by sharing, discussing, and producing various concepts in a dynamic and instantaneous manner (Garcia et al. 2015; Marhan 2006; Lee and Markey 2014). Collaborative learning is frequently regarded as important from the educational standpoint, as students must have collaborative skills before entering the workforce.

Collaborative skills can develop in a face-to-face or computer-assisted context. In line with this, collaborative learning has been shown to be a successful educational approach in both traditional and online learning environments (Almareta and Paidi 2021; Özçinar 2015).

Online collaboration can be facilitated by a variety of technology tools for content creation (wikis, blogs, podcasts, Nearpod, Blendspace, Edpuzzle), social space and microblogging (Facebook, Instagram, Twitter, YouTube), communication and video conferencing (instant messaging, discussion forums, Skype, Teams, Zoom), content curation (virtual walls, Padlet, Jamboard, Wakelet, Sway), and online office applications (Google Doc, OneNote) (Vasodavan, Dewitt, and Alias 2021; Sadaf, Newby, and Ertmer 2016).

Collaborative learning tools are also known as Web 2.0 applications, which allow students to create rich and varied information resources to be shared and published on the internet (Liu, Wang, and Tai 2016; Biasutti 2017). Significant research has attempted to investigate how the features of Web 2.0 technologies can be leveraged to support a social constructivist learning approach. Collaborative learning tools have proven to be beneficial for learning in this context because they facilitate collaboration, engagement, and knowledge-sharing (Sadaf, Newby, and Ertmer 2016; Almareta and Paidi 2021; Sun et al. 2018), create opportunities for discussion and dialogue (Mehta, Miletich, and Detyna 2021; Duret et al. 2018), and enable authentic learning via real-world experiences (Han and Resta 2020; Chen et al. 2018).

Therefore, it is vital for instructors to incorporate collaborative learning tools to promote active learning and engagement among HEI students. To achieve this, instructors need to design instructional strategies that are linked to the type of skill or task they wish students to learn, since there is not one size (i.e., learning domain) that fits all instructional tasks (Spector 2016; Jen et al. 2016).

2.3. Gagne Taxonomy of Learning Outcomes

Gagne considered learning to be a continual process built on previous knowledge, as each individual student has unique prior knowledge (Gagné and Merrill 1990; Gagné 1977). Therefore, lessons should always take into account the learner's level of complexity and processing, because different strategies are required to attain various learning objectives (Gagné 1984; Gagné and Briggs 1974). Hence, understanding learning types could assist instructors in determining and analyzing learning goals and outcomes (Smith and Ragan 2005).

Since there is no single way of measuring what has been learned, Gagne highlighted the need for learning domains to distinguish content areas through instructional methods (Krathwohl, Bloom, and Masia 1964; Bloom 1956). This relates to each subject's instructional procedure, practices, and assessments being tailored to specific skills and knowledge levels (Duan 2006; Gagné 1984).

Gagne divided learning capabilities into five major domains: verbal information, intellectual skills, cognitive strategies, attitude, and motor skills. In this study, the focus is on developing the attitude domain. Attitude comprises emotions, feelings, and values that students experience as they progress through their educational journey (El Sakka 2019; Taneri 2017). This affective domain embraces not only feelings and emotions, but also ideas, standards, and beliefs that support student learning (Taneri 2017). While attitude is the reason for a student's behaviour, it does not directly determine performance like other domains (e.g., verbal information, intellectual skills, and cognitive strategies) (Gredler 2009).

Developing the attitude domain among students is crucial because it is a foundational skill that promotes active and continuous learning and cultivates a sense of responsibility for students to take control of their own learning (Taneri 2017). Permanent learning is more likely to occur when learning processes include affective skills because a positive attitude has a significant impact on students' future behavior (Taneri 2017; Clouston 2018; Kahramanoğlu 2018). Therefore, instructors should design instruction with individual differences in mind and emphasize the emotional importance of learning using a variety of integrated support mechanisms, such as a mentor/role model or self-reported questionnaires.

2.4. Merrill's First Principles of Instruction

First Principles of Instruction is an eclectic theory that combines instructional design models and theories (Merrill 2013; Cropper, Bentley, and Schroder 2009). The theory is based on the idea that the first principles are generally relevant to any instructional program and are important for effective, efficient, and engaging instruction (Merrill 2002; 2013; Hall, Lei, and Wang 2020).

The five first principles that arose from Merrill's synthesis state that learning is enhanced when: (1) learners address real-world issues; (2) existing information is activated to serve as a basis for new knowledge; (3) new knowledge is demonstrated to learners; (4) learners apply new skills and knowledge; and (5) learners incorporate new skills and knowledge into everyday life. Figure 1 illustrates the First Principles of Instruction framework.

Students must be engaged in all four levels of performance (i.e., action, operation, task, and problem-solving) for effective instruction to take place (Merrill 2007; Cropper, Bentley, and Schroder 2009). Instruction that is too heavily focused on the action or operation levels suggests that instructors do not engage students in problem-solving because some of the problems that students must learn to solve are extremely difficult.

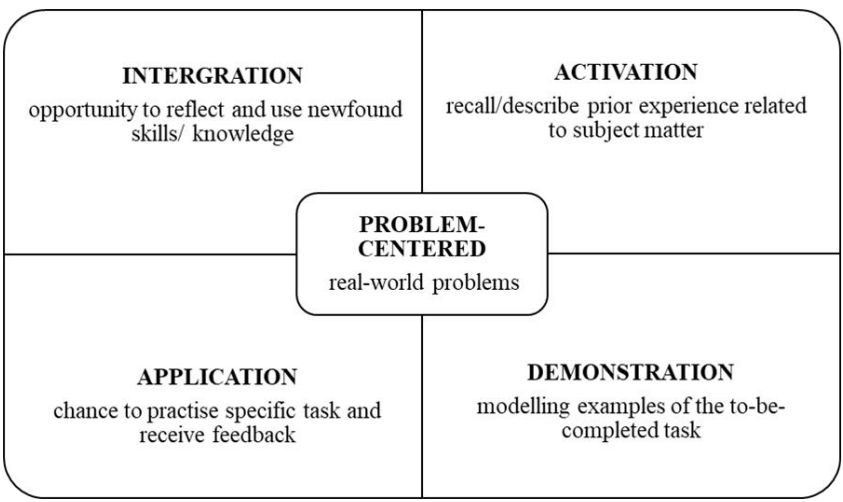

Figure 1. First Principles of Instruction (Merrill, 2013).

Even though the First Principles of Instruction took root in learning and instruction research over two decades ago, the theory is still able to promote learning despite the rapid change brought by modern educational tools. Using this systematic process, instructors can design and deliver instruction that incorporates different collaborative learning tools. Hence, the objective of this study was to develop a framework that serves as a guideline for teaching the attitude domain by identifying suitable instructional strategies, collaborative learning tools, and assessment measures through experts' opinions and consensus.

3. Research Design

This section discusses the Fuzzy Delphi Method (FDM), a technique used in Design and Development Research (DDR) to obtain agreement among a panel of experts on the elements and sub-elements of instructional strategies, resources, and assessments that develop the attitude domain among students. FDM can be applied during any phase of the DDR to gain consensus from a panel of experts (Mustapha and Darulsalam 2018; Sulaiman et al. 2020; Jamil et al. 2013).

FDM is not a new method, but has been improved upon to become a more effective and time-efficient measurement tool than the traditional Delphi method by introducing fuzzy set numbering and fuzzy set theory to it (Murray, Pipino, and Gigch 1985). The Delphi method is an effective measurement for decision-making since it can be used to resolve complex issues in a particular context by focusing on group decisions instead of individual opinions (Baumfield et al. 2012). However, the approach involves numerous rounds of questionnaires and interviews with experts to obtain more accurate and precise data, which is time-consuming and requires multiple repetitions (Leng et al. 2013; Saido et al. 2018). Thus, the FDM was developed to overcome the above-mentioned issues by applying fuzzy set numbering and fuzzy set theory to consolidate expert opinions using cumulative frequency and cumulative fuzzy scores (Wu et al. 2014; Ishikawa et al. 1993).

3.1. Participants

The purpose of the FDM in this study was to gather the expert panel members' views and consensus on the elements required for instructional strategies, collaborative learning tools, and assessments to develop students' attitude domain. The number of experts involved in the FDM can range from a minimum of 10 to a maximum of 50 to maintain uniformity among the experts (Adler and Ziglio 1996; Jones and Twiss 1978; Damigos and Anyfantis 2011). In this study, 16 experts were selected using purposive sampling to verify the reliability of the data collected.

In the FDM, experts are a reliable resource due to their ability to evaluate and assess relevant knowledge and experience pertaining to a specific subject (Mustapha and Darulsalam 2018).

As a result, involving more than 10 experts would increase the reliability of the findings. The criteria for selecting a panel of experts are crucial to ensure the data output and findings are reliable and valid (Mustapha and Darulsalam 2018; Saido et al. 2018). Therefore, the experts were chosen based on their expertise and contributions to their respective fields. Research indicates that experts are individuals with a university/professional qualification, experience, and competence in a field of study through exposure obtained from training and practice (Donohoe and Needham 2009; Manakandan et al. 2017).

In this study, the experts were chosen based on specific criteria, including academic qualification, subject matter, expertise, and contributions to their respective fields. In particular, the criteria in this study were experts in educational/instructional technology who have: (1) a doctoral degree qualification in educational technology/instructional technology/continuing professional development; (2) at least 10 years of teaching experience; (3) a scholarly publication in ISI/SCOPUS; (4) hands-on experience in keeping up with current knowledge in the field as well as in conducting innovative teaching and learning using different kinds of technology tools. Table 1 shows the summary of the FDM experts' details.

Table 1. Summary of the FDM experts' details

Number of experts	Designation	Area(s) of Expertise	Teaching Experience (Years)
2	Professor	Educational Technology	21-40
1	Professor	Continuing Professional Education and Teacher Education	28
3	Assoc Prof	Instructional Technology	24-30
1	Assoc Prof	Instructional Technology; Professional and Continuing Education.	27
9	Senior Lecturers	Educational Technology	15-27

3.2. The Fuzzy Delphi Method (FDM) Instrument

In this study, the instruments used for data collection were semi-structured interviews with a panel of experts and an FDM questionnaire developed based on themes that emerged from the analysis of the expert interviews. The

opinions of the experts were gathered in two stages: (1) an interview session with a selected panel of experts and (2) distribution of the FDM questionnaire, which was developed from the interview data, to the panel of experts.

In the initial stage, a critical review of the literature was conducted on the use of collaborative learning tools, the taxonomy of learning (attitude domain), and Merrill's First Principles of Instruction. The purpose of the literature review was to develop an interview protocol for the semi-structured interview. During the semi-structured interview, four experts were presented with Merrill's First Principles of Instruction matrix and were asked for their opinion on the instructional strategies that could be used in the module, suitable collaborative learning tools, and assessment measures for developing the attitude domain among students. The interviews with these four experts were transcribed and thematically analyzed to design the items for the FDM questionnaire. The FDM questionnaire consisted of four sections containing 40 items, all of which were rated on a seven-point Likert scale. The higher the rating on the scale (seven-point) compared to the five-point fuzzy linguistic, the more precise and accurate the data; thus, the greater the reliability and validity of the FDM findings (Jamil et al. 2013; Manakandan et al. 2017; Tsai et al. 2020).

In Section A, experts were mainly asked their personal details. In Section B, they were questioned about whether they agreed with the proposed instructional strategies based on Merrill's First Principles of Instruction. In Section C, the experts were asked their agreement with the collaborative learning tools being used as a teaching resource to teach the attitude domain. Finally, in Section D, experts were asked their agreement on the assessments that could be used in the module to develop the attitude domain. Experts were free to write their opinions and remarks in the space next to each item.

3.3. Data Analysis

The FDM questionnaire was distributed to the panel of 16 experts and their views were systematically analyzed by adopting the four steps in the FDM suggested by Jamil et al. (2013). Step 1 was to select the linguistic scale. The triangulation of fuzzy numbers is the process of transforming experts' agreement from a Likert scale to fuzzy numbers. The seven-point linguistic scale was selected in this study, given the greater accuracy of the data due to the higher number of scale points (Jamil et al. 2013; Sulaiman et al. 2020). The rationale for using fuzzy numbers was to reduce the ambiguity of an

expert's judgement that could not be evaluated on a Likert scale (Sulaiman et al. 2020). The fuzzy numbers for the seven-point linguistic scale are shown in Table 2.

Step 2 entailed using the triangular fuzzy numbers to identify the average responses for every fuzzy number, which involved three mean points where (m1) indicated the average minimum value (m1) the experts agreed upon for a particular item, (m2) was the most reasonable value, and (m3) was the maximum value that the experts agreed upon. Step 3 was to determine the threshold value (d), which was important because it determined the percentage of agreement among the experts. There are two criteria for a triangular fuzzy number. First, experts are considered to have reached an agreement if the value of the threshold (d) is less than or equal to 0.2 (Sulaiman et al. 2020; Diamond et al. 2014). The second criterion is the percentage of expert agreement, where for an item to be accepted, the consensus of all experts must be more than 70%; otherwise, the FDM survey needs to be repeated until a consensus is achieved (Saido et al. 2018; Jamil et al. 2013). The value of threshold (d) was calculated using the equation below:

$$d(m\tilde{n}) = \sqrt{\frac{1}{3}[(m_1 - n_1) + (m_{2-}n_2) + (m_{3-}n_3)]}$$

Table 2. Seven-point fuzzy scale

Linguistic variable	**Fuzzy scale**		
	m1	m2	m3
very strongly disagree	0.0	0.0	0.1
strongly disagree	0.0	0.1	0.3
disagree	0.1	0.3	0.5
not sure	0.3	0.5	0.7
agree	0.5	0.7	0.9
strongly agree	0.7	0.9	1.0
very strongly agree	0.9	1.0	1.0

Finally, Step 4 was the defuzzification process. By using a cut value of 0.5, the fuzzy (A) score value was calculated. The measured item is approved if the fuzzy score value (A) is equal to or more than 0.5, and is rejected if the value is less than 0.5.

The following equation was used to determine the defuzzification value (DV) for each questionnaire item: DV = 1/3* (m1 + m2 + m3) (Wu et al. 2014; Damigos and Anyfantis 2011). Additionally, ranking was determined in the DV process by identifying item elements that are important for developing the attitude domain among students. A greater Amax value corresponds with a higher ranking (Sulaiman et al. 2020). Elements having the highest DV were considered vital and were given top emphasis in the framework. The formula below was used to calculate the Amax value: Amax = ¼ (m1+m2+m3).

3.4. Discussion and Findings

The findings from this research guide the development of a framework for teaching the attitude domain to students. Based on the FDM results, this section reports and discusses the consensus reached by 16 experts regarding instructional strategies, collaborative learning tools, and assessment measures based on real-world problems. The experts unanimously agreed that developing students' attitude domain is important to encourage the latter's emotional growth, such as in the form of a positive attitude and increased enthusiasm for learning.

3.4.1. Instructional Strategies for Developing the Attitude Domain

Different teaching strategies can be used to develop the attitude domain among students. The proposed instructional strategies were based on four core principles centered on problem-solving. Consensus was achieved on all principles; hence, all four phases of Merrill's First Principles of Instruction were included in the module. The threshold value (d), the DV, and the ranks for each item to develop the attitude domain, as per the experts' consensus, are shown in Table 3. No ranking was required for the principles since the phases are arranged accordingly from the activation phase to the demonstration phase, the application phase, and the integration phase.

Table 3. Instructional strategies based on Merrill's First Principles of Instruction to develop students' attitude domain

Questionnaire Items	**Defuzzification Value (DV)**			**Threshold value (d)**	**Ranking**
	m1	m2	m3		
Developing a suitable attitude (affective domain) can be done by:					
Phase 1 Activation: Give students a self-report survey to measure their current attitude as well to gain their attention, and make them recall prior knowledge using stories or videos.	0.788	0.788	0.788	0.172	Not Applicable
Phase 2 Demonstration: Instructors show an appealing and credible role model through video or animation.	0.738	0.738	0.738	0.217	
Phase 3 Application: Students produce content in form of vodcasts, podcasts, videos, and blogs.	0.788	0.788	0.788	0.193	
Phase 4 Integration: Allow students to design and develop a product as well as share the product online	0.813	0.813	0.813	0.167	

Note: Conditions to be met: Triangular Fuzzy Number: Threshold value *(d)*$\leq$ 0.2; Percentage of expert consensus $\geq$ 75%.

3.4.2 Collaborative Learning Tools for Developing the Attitude Domain

The experts agreed that the most important collaborative learning tool that should be integrated as a teaching resource to develop students' attitude domain is educational videos, which reported a DV of 0.800. A video is a powerful weapon to evoke and convey human emotions as it inspires learners through drama and audio-visual stories (Snelson and Elison-Bowers 2009; Celis Nova, Onatra Chavarro, and Zubieta 2017). Consequently, the most effective way of changing learners' attitude is through human models/modelling (Bandura 1986; Gagné 1971), which can be demonstrated through the use of video. Video was followed by stories (text-based/web stories or blogs), with a DV of 0.763. By interacting and reading others' personal experiences, students tend to be motivated and responsible for their own learning, because the writer's voice engages them in self-reflection (Garcia et al. 2015; Novakovich 2016). The threshold value (d), the percentages of expert consensus, the DV, and the ranks for each item to develop the attitude domain, according to the experts' consensus, are shown in Table 4.

Table 4. Collaborative learning tools based on Merrill's First Principles of Instruction to develop students' attitude domain

Questionnaire Items	**Defuzzification Value (DV)**			**Threshold value (d)**	**Ranking**
	m1	m2	m3		
Resources for teaching attitude are:					
Educational videos	0.800	0.800	0.800	0.191	1
Stories (text-based/web story or blogs)	0.763	0.763	0.763	0.210	2

Note: Conditions to be met: Triangular Fuzzy Number: Threshold value *(d)*$\leq$ 0.2; Percentage of expert consensus $\geq$ 75%.

3.4.3. Assessment Approaches for Developing the Attitude Domain

In determining suitable assessment approaches for developing the attitude domain, experts agreed that the most important assessment is students' production of an e-portfolio as self-reflection, with a DV of 0.825. The e-portfolio is an alternative way of assessing students' personal achievements

and evidence of their learning (Makokotlela 2020; Slepcevic-Zach and Stock 2018). By creating an e-portfolio, students become reflective thinkers because they are aware of their own learning. This is done by frequently monitoring and documenting their progress in terms of current knowledge, achievements, and personal values (Farahian, Avarzamani, and Rajabi 2021; Douglas et al. 2019).

Table 5. Assessments to develop the attitude domain among students

Questionnaire Items	**Defuzzification Value (DV)**			**Threshold value (d)**	**Ranking**
	m1	m2	m3		
Assessing attitude among students can be done by:					
Students produce an e-portfolio as self-reflection.	0.825	0.825	0.825	0.158	1
Students share and debate among peers on content produced by vodcasts, podcasts, and blogs in forums and social media	0.750	0.750	0.750	0.172	2

Note: Conditions to be met: Triangular Fuzzy Number: Threshold value (d)≤ 0.2; Percentages of expert consensus ≥ 75%.

Another equally important assessment which had high consensus (DV = 0.750) was the learning task where on forums or social media, students share and debate among peers regarding content produced by vodcasts, podcasts, and blogs. Students may create their own podcasts (audio on the web) or vodcasts (combination of audio and visual) to showcase their creativity in the world of digital storytelling (Moryl 2016; Efe 2015). Through blogging, students are able to express their thoughts freely and take ownership of the products they develop (Alsamadani 2017; Ifinedo 2017). The products developed via podcasts, vodcasts, or blogs can later be shared via communication channels for peer discussion and interactions, which highly motivates students to learn (Moryl 2016; Walls et al. 2010). The threshold value (d), the percentages of expert consensus, the DV, and the ranks for each item to develop the attitude domain according to the experts' consensus are shown in Table 5.

3.5. Framework for Developing the Attitude Domain

The framework for developing the attitude domain explains that learning is promoted when students' relevant past experience is activated to be used as a foundation for new knowledge. Instructors could engage students by offering a self-report questionnaire for them to evaluate themselves and make decisions about the areas they need to improve their self-expression (Borg and Edmett 2019; İlhan-Beyaztaş and Özdemir 2018). The self-report is a non-judgmental tool that allows students to self-monitor the attitudes, emotions, and feelings that might influence their learning experience (El Sakka 2019).

Instructors can also gain students' attention by recalling prior knowledge using stories or videos. Research shows that videos are a key motivating tool that exemplify real-life practices (Celis Nova, Onatra Chavarro, and Zubieta 2017). Instructors can download readily available videos from YouTube or use digital storytelling applications such as WordPress, Blogger, or MS. Sway to embed various content (e.g., pictures, videos, articles, polls, etc.). Blog comment postings allow both instructors and students to engage and exchange ideas with one another. Thus, through blogs and MS. Sway, instructors can share personal stories and create socially interactive environments.

In the demonstration phase, instructors show, rather than tell, students what is to be learned. Instructors can teach the attitude domain effectively by showing an appealing and credible role model through video or animation (e.g., YouTube, Pawtoon, Animoto). The most effective way to boost learning motivation is through modelling (Yang, Gamble, and Tang 2012; Clouston 2018). As such, instructors can use role-model strategies to explain and exhibit the desired options or actions for specific circumstances.

The activation phase is stimulated when students use their newly learned knowledge or skills to solve a real-world problem. For example, students can produce content in the form of vodcasts, podcasts, and blogs, which allows them to reflect on and share what they have learned. They can also publish their own writings, such as a journal, story, or class readings, to create social bonds. This engages students in creating their own content and increases their sense of ownership and responsibility over their learning (Li and Zhu 2017; Rahimi, van den Berg, and Veen 2015).

As part of assessment approaches, instructors can design learning tasks for students to produce an e-portfolio as self-reflection, which would show their actual work with personal evidence of skills or knowledge they have learned. The reflection activity enables students to share their own beliefs, perceptions, and experiences of their own learning by identifying personal

strengths and weaknesses (Chye et al. 2019; Farahian, Avarzamani, and Rajabi 2021).

Finally, in the integration phase, learning is promoted when students integrate their newfound skills or knowledge into daily life. Apart from designing and developing products, students also share them online through forums and social media. The content of the self-reflective e-portfolio, for instance, can be shared and debated among peers. Instructors can further encourage students to reveal their learning artefacts to peers for comments and feedback. Notably, the forum discussion is a great tool not only to teach factual knowledge but also to promote peer-to-peer interaction and reflection (DeWitt et al. 2014; Zion, Adler, and Mevarech 2015). This indicates that collaborative learning tools enable students to contribute to the creation of new knowledge by exchanging and debating ideas (Dewitt, Alias, and Siraj 2015). The framework for developing the attitude domain is illustrated in Figure 2.

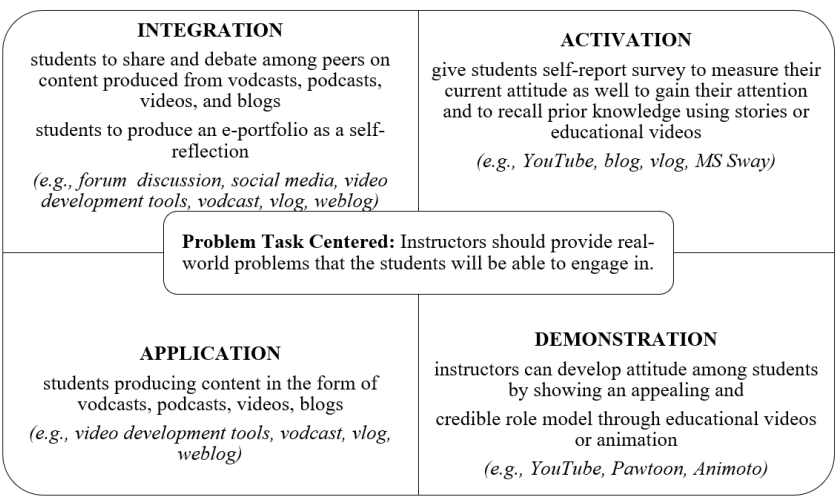

Figure 2. Framework for developing the attitude domain.

Conclusion

Collaborative learning and its tools have high potential for promoting affective skills among students, as they provide a platform for activities that create a positive attitude towards learning. In this study, different collaborative learning tools, such as forum discussion, blogging, podcasting, vodcasting,

educational videos, animation, and e-portfolios, were utilized to effectively develop the attitude domain. The resultant instructional strategy framework can be used as a guideline by HEI instructors to teach effectively with technology. However, instructors should determine their course's aims and learning objectives before adopting this framework. This process will help instructors design instructions based on real-world problems that students experience after the instruction is complete. Moreover, this is the only framework that focuses on providing problem-centered instructional solutions that show the entirety of tasks students should be exploring, discovering, and learning, from the activation phase to the integration phase.

This framework fosters a culture of innovative teaching with technology, as the framework consists of instructional strategies, collaborative learning tools, and assessment approaches. Instructors typically find difficult to evaluate a student's attitude domain due to its highly subjective nature. In addressing this issue, the framework developed from the study findings offers practical applications for instructors to demonstrate their own innovative teaching by selecting suitable collaborative learning tools to teach the attitude domain. In particular, this framework helps instructors organize their lessons using the First Principles of Instruction, which promotes students' affective domain exhibition.

The findings of this study also assist instructors in integrating technology into their pedagogical practice. Instructors need to have a good understanding of how technology can be assimilated with pedagogy as well as specific skills and knowledge. Teaching in an effective way using collaborative learning tools is not just about instructors teaching well with a technology, but also about designing instructional strategies that are linked to the type of skill or task instructors wish students to learn.

At the same time, students benefit from the framework because problem-centered instruction is more beneficial for novice learners than problem-based learning, which requires students to determine for themselves what a problem comprises, how it appears, and how to solve it. When instructors integrate this framework into their teaching of the attitude domain, they signify their shift away from teacher-centered learning to active learning, where students can work independently with confidence, collaborate in a group activity to achieve common goals, display positive ways of solving problems, value peers and others, and change their attitudes and beliefs according to new learning experiences.

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