

Interaction and the online distance classroom: Do instructional methods effect the quality of interaction?

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Abstract In this special issue, I bring together two studies to provide a comprehensive overview on diverse and interactive instructional methods aimed to facilitate higher levels of learning. One study explored the effects of group interaction using different instructional strategies focusing on the learning *process* using the Community of Inquiry framework. The other study investigated the effects of group interaction using different instructional strategies focusing on learning *products* using the SOLO taxonomy. The outcomes of both studies were consistent in revealing that certain kinds of instructional strategies have more effective interactions, resulting in facilitating higher levels of learning.

Keywords Online learning · Distance education · Interaction · Instructional strategies

Introduction

As a distance and online educator since the mid '90s, I have witnessed an expansion of communication technologies that I find, at times, overwhelming. As I reflect on this growth, I also find (as the French proverb goes) *plus ça change, plus c'est la même chose*. I have observed, for example, that text-based communication tools continue to be the two-way communication medium of choice—whether it is emailing, blogging, texting, twittering, or facebooking. As early forms of two-way text-based communication were emerging (e.g., asynchronous, text-based group fora) claims were being made about this new communication mode as having a significant advantage over other communication technologies in the field of distance education. It was argued that these new asynchronous net-based technologies could support

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interpersonal interaction and sustain two-way communication among two or more persons that is not time or place bound, and is cost-effective in comparison to other communication tools (Bates 1997). Today, I think an apt way to describe the kinds of two-way communication technologies available is overwhelming. And yet, with the vast array of mediated communication available, the text-based advantage observed earlier continues to hold merit—though it should also be noted that I have argued elsewhere that other forms of net-based mediated communication (e.g., audio and video) have shown to have noteworthy advantages (Kanuka 2010a). Notwithstanding there is evidence to suggest that other forms of mediated communication may be more effective as a communication medium for facilitating higher levels of learning, many distance and online educators continue to use text-based technologies as the communication medium of choice, arguing this form of communication facilitates higher levels of learning (e.g., Garrison and Anderson 2003).

Interaction, instructional strategies and higher levels of learning:
is there a connection?

In this special issue, Abrami et al. (2011) have argued that we have a lack of understanding about pedagogical effectiveness in online and distance education in various areas. In particular, this research team maintains that the absence of pedagogical understanding stems from the lack of research investigating direct comparisons of pedagogical features. Abrami et al. have identified further research practices necessary to enable consumers of research to have the ability to accurately generalize about the processes and conditions under which learning is best supported in distance education and online learning course designs. One area identified by this research group in need of further research are studies that compare an online treatment to another online treatment with emphases on learning. Expanding on this matter, Abrami et al. question whether there is empirical evidence that interaction is important and, if so, what forms of interaction are effective? Underpinning this question, is the assumption that interaction not only involves actions among (1) individuals and (2) their instructors, but also individual interaction with the (3) curricular content (Moore 1989).

Moore's (1989) framework on these three forms of interaction has served well as a conceptual framework for explaining interaction over the last few decades. Over this time, distance education has moved from a (mostly) one-way, paper-based content dissemination format whereby interaction was typically limited to student-content interaction to an interactive, collaborative, and community of learners paradigm inspired, and made possible, through the use of net-based communication technologies—which most of us now refer to as online learning. In the mid '80s, two-way communication technologies were becoming more prevalent in distance education (e.g., audio and video multi-point conferencing), Moore (1989) argued that distance educators should strive to provide three forms of interaction: learner-learner, learner-instructor and learner-content (for a full explanation of the three forms of interaction, see Abrami et al. 2011).

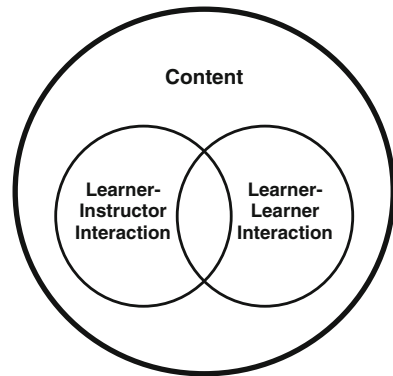
Since the time Moore (1989) distinguished among these three forms of interactions, the communication tools we use in our distance learning have become more sophisticated, allowing students and instructors to seamlessly interact with each other. However, it continues to be important for the students' to interact with the content—irrespective of whether they are interacting with other learners or the instructor—interacting with the content underpins the learner–learner and learner–instructor interactions. On this basis I have argued that the content interaction aspect of Moore's theory is deserving of re-examination (e.g., Kanuka 2000). Specifically, while it is essential that distance and online educators attend to the design and development of course content, it is also important to do so in ways that facilitate interaction for not only independent learner interaction, but also learner–learner and learner–instructor interaction. Thus, the design, development and delivery of the course content are key considerations in not only planning learner–content interaction, but also in directing and fostering learner–learner and learner–instructor interactions with the course content.

In this paper, I begin with a framework on learner–content interaction adapted from Moore's interaction theory that I use to frame prior investigations on effective text-based interactions in online and distance learning. I provide an overview of two studies I conducted that explored the kinds of interactions that are effective at facilitating higher levels of learning (Kanuka 2005; Kanuka et al. 2007). Six diverse and interactive instructional methods aimed to facilitate higher levels of learning in text-based group forums were used to investigate the effects of different kinds of interactions. One study explored the effects of group interaction using different instructional strategies focusing on the learning *process* using the Community of Inquiry framework to assess higher levels of learning (Kanuka et al. 2007). The other study investigated the effects of group interaction using different instructional strategies focusing on learning *products* using the SOLO taxonomy to assess higher levels of learning (Kanuka 2005). In this paper, I bring together both studies to illustrate the consistency of outcomes. Specifically, using text-based, asynchronous group forums both studies revealed that instructional strategies that are effective at facilitating higher levels of learning are (1) well structured with clearly defined student roles and responsibilities and (2) provoke students to explicitly confront others' opinions.

Underpinning theoretical framework: learner–content interaction

Most forms of learning, distance or otherwise, have some form of content as the basic teaching material. Additionally, good pedagogical practice typically includes instructional strategies that support learner interaction with the content. As mentioned earlier, Moore (1989) asserts that three kinds of interaction should be facilitated by online and distance educators (learner–learner, learner–instructor, and learner–content). When considering how to facilitate these three kinds of interaction, many of us tend to think of each independently. However, this independent view of interaction does not acknowledge that when students interact with other students and their instructors, they are interacting about the content; some form of content is

Fig. 1 Interactions in any learning environment are not independent of each other



always present in interactive learning processes. Although conceptually we can deal with each kind of interaction independently, in reality the three are interrelated, as Fig. 1 illustrates.

It may well be, in agreement with Juler (1990), that reviews of the literature comparing face-to-face learning to distance and online learning (e.g., Russell 2001), which reveals that there is no significant difference between distance and online learning and face-to-face learning, could be attributed to the powerful impact of the content in the learning process, rather than delivery methods. Irrespective of whether or not we can make this claim about delivery methods, one conclusion we can make is that some form of content is basic to learning and the interactions learners have with the content are as important as the interactions with their instructors and co-learners. Hence, an assumption framing the overview of the studies presented in this article is that the interactions between and among students and instructors investigated relate to how the students are developing understandings (process) and applying (product) the course content.

Overview of two studies

Empirical research in education typically involves exploring the effects of interventions in one of two ways: (1) during the learning *process* (e.g., the effects on learning development and/or growth during the learning transactions); (2) the students' *products* (e.g., the effects on student performance at the conclusion of the learning transactions). Following is an overview of two studies (Kanuka 2005; Kanuka et al. 2007) that explored diverse and interactive instructional methods aimed to facilitate higher levels of learning by examining the effects on the learning process and student products.

Contextualizing the studies

The literature on using diverse instructional strategies in the distance and online classroom has maintained that many instructional strategies effectively translate to

Table 1 Principles of teaching and learning

Principle	Instructional strategies
1. Engagement with abstracted phenomena. Higher levels of learning involve active and purposeful engagement with complex abstracted phenomena	Case study Role plays Semantic webbing Concept webbing
2. Multiplicity of perspectives. Higher levels of learning include diverse and/or multiple perspectives about the issues(s) or problems(s) presented	Debates Guided hypertext with annotations Multiple information sources Sequenced content databases
3. Relatedness. Higher levels of learning involve phenomena that have relevance to the learners.	Press conference/debate with invited expert Online case histories with raw data
4. Learning methods. Higher levels of learning include diverse ways of knowing	Open-ended questioning WebQuest Problem-based learning Delphi or nominal group technique
5. Responsibility. Higher levels of learning require learners to assume greater responsibility in the learning process	Group cooperative projects Presentations Active self-assessment rubrics
6. Meaning making. Higher levels of learning require learners to build meaning into the issues and problems presented	Antithetical questions Scaffold discussion Reflective question posing/deliberation
7. Reconstruction. Higher levels of learning require learners to understand that their own world view is not the only one (or necessarily the correct one)	Role reversal questions Brainstorming Heterogeneous groupings

Adapted from Kanuka (2002)

text-based distance and online environments (e.g., Collett et al. 1999), and in some cases, are even more effective online than face-to-face (Heckman and Annabi 2005; Garrison and Anderson 2003; McKnight 2001). Building on the outcomes of an empirically validated framework (Kanuka 2002), further research was then conducted on the effectiveness of the instructional strategies. Table 1 provides an overview of the framework used for selecting the instructional strategies investigated.

One instructional strategy was selected from each of the principles: Case study, role play, webquest, reflective question posing, nominal group technique, invited expert and debate. (For a detailed overview of each instructional strategy, refer to Kanuka 2005.)

Study 1: Effects of interaction on the learning 'Process'

The overarching purpose of study 1 was to explore the effects of instructional strategies on levels of cognitive presence during the learning process (Kanuka et al.

2007) using the Practical Inquiry Model of Cognitive Presence (Garrison et al. 2001). The objective was to determine if there was a difference between levels of cognitive presence and instructional methods. Interactions with text-based group forums and different instructional strategies were used to determine the effects of interaction on higher levels of learning. Instructional strategies were defined as deliberate and planned goal oriented pedagogical activities where the learning outcomes, the teacher's and the students' roles and activities are clearly defined, and described.

The instructional strategies used in this study were designed to provide the students with some dilemma or perplexity as a result of an authentic problem (based on an actual event or events) and included the following components identified by Tenenbaum et al. (2001, p. 87) as necessary to achieve higher thinking patterns: (1) arguments, discussions, debates, (2) conceptual conflicts and dilemmas, (3) sharing ideas with others, (4) materials and measures targeted toward solutions, (5) reflections and concept investigation, (6) meeting student needs, and (7) making meaning, real-life examples.

Garrison et al.'s (2001) theoretical model of practical inquiry was used as a framework to guide the study and assess patterns of cognitive presence. As Table 2 shows, the practical inquiry model asserts that there are five phases of critical thinking and cognitive presence.

Cognitive presence is understood by Garrison et al. (2001) as occurring within a critical community of inquiry in which participants "(re)construct experience and knowledge through the critical analysis of subject matter, questioning and challenging assumptions" (p. 7).

Garrison et al. (2000) also developed a research technique—quantitative content analysis (QCA)—for assessing the processes and outcomes of online discussion, which was used in this study. The results of this first study revealed that across instructional methods, the WebQuest and Debate activities were the most effective at facilitating higher levels of cognitive presence (for a full description of data collection and analysis, see Kanuka et al. 2007).

Study 2: Effects of interaction on the learning products

The overarching purpose of study 2 was to explore the effects of instructional methods on levels of complexity by which students show competency in their learning products using the SOLO Taxonomy (Biggs 1999). For this study, a rubric was designed using the SOLO taxonomy (an orderly way of describing a hierarchy of complexity by which learners show mastery of academic work). Instructional strategies were used as a means of providing distance and online learning interactions with the aim of moving the students to higher levels of learning using the SOLO taxonomy as a guide for assessment.

The SOLO taxonomy (SOLO stands for structure of the observed learning outcome) is a system for classifying student work according to its quality (Biggs and Collis 1982). It is an orderly way of describing a hierarchy of complexity which learners show competency of academic work. Unlike other taxonomies, the SOLO taxonomy is not content dependent, making it useable across a number of subject

Table 2 Adapted from the practical inquiry model (Garrison et al. 2000)

Phases of cognitive presence	Description and evidence of process
Phase I&II: triggering event and problem definition	<p>Student activities begin with a triggering event (phase 1) followed by problem definition (phase 2)</p> <p>There is evidence of directed and purposeful thinking, with a focus on the problem that is introduced as the triggering event</p> <p>There is evidence of learners defining and redefining the problem presented</p> <p>A critical spirit and intellectual autonomy is present, whereby learners critically assess the issues explored and are open to alternative explanations</p>
Phase III: exploration	<p>There is evidence that learners are searching for explanations of the problem presented and exploration of relevant ideas</p> <p>In addition to a critical attitude and expansive thinking, learners are divergently seeking for solutions; this is important in the development of critical thinking and problem solving, as ideas organize and make sense of contingent facts</p>
Phase IV: integration	<p>There is evidence of a conceptualization of the problem presented</p> <p>Thinking is reflective and private, although reflection is socially shared with evidence of the individual tentatively making sense of the information that emerged during the exploratory phase</p> <p>There is evidence of judgments and decisions being made and focused on an idea or emerging hypothesis</p>
Phase V: resolution	<p>The idea or hypothesis is tested. The testing begins with an initial process of sharing the idea or hypothesis with peers who, in turn, provide insights</p> <p>Learners become ready to act upon their understanding; if there is confirmation of the problem solution for resolution, understanding will result</p> <p>An unsatisfactory resolution will trigger a renewed search and the process will begin anew</p>

areas. The SOLO taxonomy has five levels of sophistication that can be encountered in learners' responses to academic tasks (Biggs 1999):

1. Prestructural—the task is not attacked appropriately, the student hasn't understood the point
2. Unistructural—one or a few aspects of the task are picked up and used (understanding as nominal);
3. Multi-structural—several aspects of the task are learned but are treated separately (understanding as knowing about)
4. Relational—the components are integrated into a coherent whole, with each part contributing to the overall meaning (understanding as appreciating relationships)
5. Extended abstract—the integrated whole at the relational level is reconceptualized at a higher level of abstraction, which enables generalization to a new topic or area, or is turned reflexively on oneself (understanding as far as transfer and as involving metacognition)

Table 3 Assessment guide for levels of understanding displayed (SOLO taxonomy)

Levels of learning	Key features of written work
Pre-structural responses	<p>Little or no understanding has been demonstrated</p> <p>Does not address the question</p> <p>Restates the question</p> <p>Makes personally based associations with the unit or course text</p> <p>Does not relate various concepts covered in the unit to each other</p> <p>States a series of unrelated facts</p> <p>Uses a small amount of information available</p> <p>Does not reach a supported conclusion</p>
Uni-structural responses	<p>Addresses the question, but in a limited manner</p> <p>Defines and accurately describes problems/issues</p> <p>Selects one or two main concepts from the unit notes and/or course text</p> <p>Does not adequately link the information selected</p> <p>If a conclusion is reached, it is based on limited information</p>
Multi-structural responses	<p>Uses two or more data/information sources but fails to explain the links/relationships between the data sources</p> <p>Begins to provide explanations about problems and issues—but is inconsistent with other information and misses important information available</p> <p>Does not notice inconsistencies in argument formation</p> <p>Mainly descriptive style writing—but there is evidence of basic cause and effect links</p>
Relational responses	<p>There are multiple information sources with coherent links made</p> <p>Substantiated positions are reached that are consistent with the information provided</p> <p>Begins to provide explanations or theories resulting from the linking of information</p> <p>Evidence of cause and effect judgments</p> <p>Movement from descriptive to explanative</p>
Extended abstract responses	<p>Information is used to support positions from resources provided in the course (e.g., text; course notes) as well as outside resources (e.g., prior course information; journal articles; books)</p> <p>Possible explanations, theories and hypotheses have been generated and substantiated using resources cited and reflections</p> <p>Conceptualizations are at a level extending beyond what has been provided in the course content</p> <p>Recognition of the multiplicity of perspectives given the complexity of the problem resulting in a number of possible positions on the issue</p>

Levels and key features, adapted from Biggs (1995, 1999)

The following Table 3 provides an abbreviated overview of the rubric used in this study to assess the students' position papers. The key features provided for each level of the SOLO taxonomy are cues for assessing student's written work.

The results of this second study reveal, consistent with the first study, that certain instructional strategies (e.g., WebQuest and Debate) are more effective than others (e.g., reflective discussions) at creating the conditions necessary to facilitate higher levels of learning.

Discussion and conclusions

For this special issue on online and distance learning, I provide an overview of two prior studies I conducted that explored diverse and interactive instructional methods aimed to facilitate higher levels of learning. One study explored the effects of group interaction using different instructional strategies focusing on the learning *process* using the Community of Inquiry framework. The other study investigated the effects of group interaction using different instructional strategies focusing on learning *products* using the SOLO taxonomy. I have brought both studies together for this special issue to illustrate that the results reveal that specific kinds of instructional strategies (debates and WebQuests) have more effective interactions, resulting in facilitating higher levels of learning. The results also illustrate that some forms of interaction contribute to higher levels of learning. In particular, given that the highest levels of cognitive presence were in the WebQuest and Debate activities, and the highest levels of student products based on the SOLO taxonomy were also the WebQuest and Debate, a conclusion can be drawn that there are three advantageous qualities that are more apparent with these instructional methods than the other instructional methods investigated: (1) they are well-structured, (2) they provided clearly defined roles and responsibilities for the students and (3) they provoked the students to explicitly confront others' opinions.

The following Table 4 provides an overview of each instructional method, describing the structure, role of the student, role of the instructor and the benefits and limitations of each instructional method.

A wider review of the research reveals that these findings are not unique. In this special issue, Abrami et al. (2011) also observe,

[J]ust because opportunities for interactions were offered to students does not mean that students availed themselves of them, or if they did interact, that they did so effectively. The latter case is the more likely event, so the achievement effects resulting from well-implemented interaction conditions may be underestimated in our review.

Abrami et al. (2011) note further, “guided, focused and purposeful interaction goes beyond whether opportunities for interaction exist to consider especially why and how interaction occurs.” There are several reasons cited by these authors that explain why students do not utilize knowledge tools more effectively. Two of these reasons are directly supported by the findings of the research I have cited in this paper: (1) the principle of least effort and (2) active collaboration among learners requires external structures. Hence, prior research, as well as the findings of the studies described in this paper, reveal that structured, planned, confrontational and demanding interactions that include directed roles and responsibilities for the

Table 4 Overview of instructional methods

Structure	Debate			Invited expert			Nominal group technique			Reflective deliberation		WebQuest	
	Highly structured	Highly structured	Highly structured	Minimally structured	Minimally structured	Highly structured	Highly structured	Highly structured	Highly structured	Minimally structured	Highly structured	Highly structured	Case study
Role of student	Students have a dominant role, which is demanding and aggressively challenges theirs, and others, under-standings	Students are required to search new information from not only their own perspective but also conflicting perspectives	Students are required to actively participate with the invited expert, but have minimal responsibility for the quality of their participation	Students have moderate responsibility in that they are expected to make contributions (e.g., recommendation)	Students have a moderate responsibility to explore diverse perspectives or actively explore new information	Students have a moderate responsibility to explore diverse perspectives but not to actively explore new information	Students have a dominant role in that they must be able to generalize the course content, act on it, and then reflect on their actions	Students are expected to explore new information but are not expected to actively explore other perspectives	Students have a dominant role and are responsible for providing well informed and well researched perspectives based on their assigned role	Students are expected to explore diverse solutions to the problem presented	Students have a dominant role and are required to search for new information to justify plausible solutions to the case presented	Students are expected to explore diverse solutions to the problem presented	Moderately structured
Role of teacher	The teacher has a dominant role in the careful planning and advanced preparation, including group formations—but is minimally involved in the activity	The teacher has a dominant role in the minimal planning by the teacher is required in terms of disseminating background information about the invited expert; however, the teacher has a dominant role in moderating the discussion	Minimal planning by the teacher is required in terms of disseminating background information about the invited expert; however, the teacher has a dominant role in moderating the discussion	The teacher has a dominant role in the planning and preparation; she also has a dominant role in moving the activities through a series of steps	The teacher has a dominant role in the planning and preparation; she also has a dominant role in moving the activities through a series of steps	The teacher has a minimal role in planning and preparation; however, she has a dominant role in the discussion	The teacher has a dominant role in planning and preparation—but is minimally involved in the activity.	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity	The teacher has a dominant role in the preparation of writing the case study and guiding questions—but is minimally involved in the activity

Table 4 continued

	Debate	Invited expert	Nominal group technique	Reflective deliberation	WebQuest	Case study
Benefits	Provides students with the opportunity to improve analytical communication skills through the need to formulate arguments, defend positions and critique counter arguments	The ability to pose probing questions, confront opinions, and evaluate responses that contribute the learners' own perspectives Minimal time required in terms of preparation	Prevents domination by a single perspective Forces passive group members to participate Results in a set of ranked solutions to a well-formed problem	Provides opportunities for students to clearly articulate their position, arguments, and interpretation on abstracted and complex phenomena Minimal time required in terms of preparation	Provides an opportunity to expose students to a variety of perspectives by asking them to assume the role of others with diverse view points	Facilitates the acquisition of analytical skills and the ability to think clearly in ambiguous situations
Limitations	Time consuming to facilitate online Student resistance due to time-consuming group co-ordination and the need to research the topic (some team members may not assume their required responsibility)	The invited expert may not have moderating and/or teaching skills and/or be comfortable in an online discussion forum, which may leave learners to gain little benefit from the expert's experience(s)	Beginning with a well-formed problem eliminates the need for the students to discover for themselves the issues involved and, hence, removing the need to search for deeper understandings	Because roles and activities are not clearly specified, some students can dominate the discussion while others may choose not to participate Time consuming to moderate (without an active moderator discussions often get off topic)	Clear and articulate instructions are required for students to understand the purpose of role playing; without an understanding of the purpose students will not actively participate due to self-conciseness	Time consuming and difficult to write authentic case studies; if the students do not view the case as authentic and relevant it will not support lively discussions or generate plausible solutions

Kanuka (2010b)

students' contributions in distance and online education when using text-based, asynchronous group forums are important elements in facilitating students to engage at higher levels of understanding and critical discourse.

These findings also provide further support for Moore's theory of transactional distance (1973, 1990).

Theory of transactional distance

The theory of transactional distance seeks to isolate those elements of educational transactions that have the greatest influence on learners in distance education. Moore (1973, 1990) argued that much of what we know about teaching and learning can be applied to both the theory and the practice of distance education and, more recently, online learning. However, even though we can apply much of what we know, if the degree of separation is great, it can transform traditional expository teaching so significantly that alternative ways of teaching are needed.

Moore's theory includes three variables and two dimensions. On the teaching dimension are two variables, dialogue and structure. Dialogue is the interaction between the instructor and the learners, while structure is concerned with the elements of the course design. In learning environments where the learner receives directions and guidance through both a high degree of structure of the course and a high degree of interactive dialogue, then there is a low level of transactional distance. Alternatively, where learners make their own decisions about strategies and have little if any dialogue, there is a high level of transactional distance.

According to Moore (1973, 1990), the learning dimension must also be considered in distance education, and the amount of learner autonomy exercised is the third variable. Moore recognized that theories of distance education that only considered the variables of teaching (i.e., dialogue and structure) would be incomplete (Moore and Kearsley 1996). For example, even where a course is highly structured, the learners may decide for themselves whether the guidance and directions will be used and, if so, when, where, in what ways, and to what extent. The praxis of this theory, then, involves determining the right mix of structure, dialogue, and autonomy for achieving successful distance learning transactions.

The findings of the studies cited in this paper support the theory of transactional distance. Specifically, while structured learning is a relatively straightforward concept (e.g., guided, focused, purposeful) that tends not to be in need of further clarification, self-regulated learning, on the other hand, is a complex and multifaceted construct.

Conclusion

Good teaching in higher education includes an ability to make the content being taught stimulating and interesting, presented at the right level of understanding that is also engaging, the use of valid assessment methods, and the provision of the highest quality of feedback on the learners' work (Ramsden 1992). In the end, however, it is the level of the interaction that will determine the quality of a

learner's educational experience, whether it is face-to-face or distance and online education.

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