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## International Journal of Educational Research

journal homepage: [www.elsevier.com/locate/ijedures](http://www.elsevier.com/locate/ijedures)

# Development and evaluation of a WebQuest-based teaching programme: Students' use of exploratory talk to exercise critical thinking

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## ARTICLE INFO

### Keywords:

Critical thinking  
English classrooms  
Exploratory talk  
Sociocultural discourse analysis  
WebQuests

## ABSTRACT

This article reports the findings of an exploratory study involving the development and implementation of a WebQuest-based critical-thinking programme in Hong Kong primary English classrooms. Using 'design research' as its methodological framework, the study investigated the critical-thinking performance of 125 primary school students. Sociocultural discourse analysis of classroom dialogue during programme implementation revealed the participating students to have engaged in explicit reasoning and used 'exploratory talk' as a dialogic tool in exercising critical thinking. The study has profound implications for pedagogical practice with respect to the use of educational technology for critical-thinking cultivation. This article thus makes significant contributions to the WebQuest and critical-thinking literature, extending it to the Hong Kong language education context and beyond.

## 1. Introduction

The ability to think is a natural human capacity. However, our thinking can be biased or even downright prejudiced if we do not think critically but simply let shoddy thinking occupy our minds, particularly in the information era (Paul & Elder, 2019). In our current fight against the coronavirus pandemic, for instance, critical thinking is needed to set aside prejudices and concentrate on evidence in order to act rationally. Critical thinking must therefore be systematically cultivated to enable us to see through rumours and fake news. In the education arena, the teaching of critical thinking is highly valued because it can furnish students with the skills and dispositions they need to address the challenges of a globalised world (Fung & Liang, 2019; Wegerif, Li, & Kaufman, 2015).

Over the past decade, a growing body of literature has demonstrated the efficacy of group work (e.g. Fung & Howe, 2014; Kim, Sharma, Land, & Furlong, 2013) and information technology (e.g. Gokhale & Machina, 2018; Lin, Preston, Kharrufa, & Kong, 2016) in cultivating critical thinking in students. From a theoretical perspective, collaborative group work is underpinned by sociocultural theories suggesting that knowledge is constructed and acquired through interaction amongst peers in goal-oriented tasks (Lantolf & Pavlenko, 1995). Such interaction occurs during the social, cognitive and affective states of learning (Piaget, 1928, 1959; Vygotsky, 1978), and dialogic practice is considered an important means of achieving it (Wells, 2000). When it comes to higher-order thinking, it is believed that a constructivist approach to knowledge acquisition can be sustained by resolving cognitive conflicts derived from the tension amongst differing perspectives (Kramsch, 1993). In other words, during the dialogic interaction process, students achieve success and learn in a new style, with scaffolding provided by their more capable peers (Lantolf & Pavlenko, 1995).

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<https://doi.org/10.1016/j.ijer.2020.101652>

Received 17 June 2020; Received in revised form 1 August 2020; Accepted 4 August 2020

Available online 4 September 2020

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In a related vein, research suggests that the pedagogical application of information technology can enhance both classroom dialogue and peer interaction (Mercer, Hennessy, & Warwick, 2019; Wegerif, 2007). The use of digital technology in particular offers multimodal forms of classroom dialogue and plays a mediating role in the development of collaborative reasoning through idea exchange (Mercer et al., 2019). It also affords teachers and students ample opportunities to 'share, explain, justify, critique and reformulate ideas' (Mercer et al., 2019, p. 192). It is thus recommended that teachers integrate information technology into their classroom practice to engage students in thoughtful discussion (Twiner, Coffin, Littleton, & Whitelock, 2010). The adoption of a student-centred paradigm during technology implementation has also been suggested to facilitate dialogic teaching (Yoon, Ho, & Hedberg, 2005).

However, despite information technology's potential to promote dialogic interaction and critical thinking, few studies in Hong Kong (see Kong, 2014; Kong, 2015 for exceptions) have examined its use for critical-thinking cultivation, particularly in the primary language education context. To address this research gap, in the study reported herein, we developed and implemented a WebQuest-based teaching programme designed to cultivate critical-thinking skills in primary school students, and then evaluated its efficacy by gathering both quantitative and qualitative evidence of students' subsequent critical-thinking performance.

In particular, the study constitutes a pioneering attempt to design a technology-supported critical-thinking programme for application in Hong Kong primary English education. It enriches both the WebQuest and critical-thinking literature by providing empirical data demonstrating the effectiveness of WebQuests in fostering critical thinking in an Asian context. In addition, the study proposes a design framework for establishing a technology-enhanced learning environment that supports young students' cultivation of critical thinking. The WebQuest-based teaching programme designed and evaluated in this research thus has important pedagogical implications for primary school English teachers seeking to incorporate WebQuests into their classrooms.

## 2. Literature review

### 2.1. Defining critical thinking

Over the years, scholars and researchers have provided an array of definitions of critical thinking, although there is growing consensus amongst critical-thinking theoreticians that such thinking embraces both skill and disposition dimensions (Facione, Sánchez, Facione, & Gainen, 1995). According to McPeck (1981), critical thinking encompasses the 'propensity and skill to engage in an activity with reflective scepticism' (p. 8). In other words, critical thinking comprises both the willingness and the ability to challenge authoritative perspectives and consider alternative views. Such a definition embraces both the dispositional and cognitive aspects of critical thinking.

In alignment with Kuhn (1991), McPeck's view (1981) offers a more encompassing perspective, conceptualising critical thinking as a type of reasoned argumentation with a social dimension. She regards disposition as willingness to support one's opinions with evidence, and skill as the use of cognitive strategies to make a convincing argument (Kuhn, 1991). A number of other scholars (e.g. Ennis, 1987; Facione, 1990; Halpern, 2001, 2013) share this view, envisioning critical thinkers as open-minded thinkers with the flexibility and confidence to employ cognitive strategies when necessary.

According to Kuhn (1991), cognitive strategies involve five critical-thinking skills: (1) distinguishing opinions from factual evidence; (2) justifying views with substantive evidence; (3) considering alternative opinions and supporting them with good evidence; (4) providing evidence that can support one's own views and reject alternative opinions; and (5) evaluating the reliability of evidence. Given that Kuhn's (1991) long-established and comprehensive model of critical thinking has proved feasible and effective in teaching critical thinking at various school levels, including primary and tertiary education in Hong Kong and the United Kingdom (Anderson, Howe, Soden, Halliday, & Low, 2001; Fung, 2014), the study reported herein adopted her model to cultivate critical thinking in the participating students.

### 2.2. The thinking together approach to the teaching of critical thinking

One widely used approach to the teaching of thinking is the Thinking Together approach (Mercer & Dawes, 2014), which is underpinned by Vygotsky's (1978) proposal that learning to think with others in childhood is the first step towards learning to think independently. The approach features the use of 'exploratory talk' in which learners engage in an exchange of information and ideas and think together with a view to achieving a shared understanding of the issues at hand. The concept of exploratory talk, originally proposed by Douglas Barnes (Barnes, 1976) and further developed by Neil Mercer (Wegerif, 2007), has exerted considerable influence on education in the United Kingdom since the 1970s (Barnes & Todd, 1978).

Drawing on empirical evidence from his research on collaborative learning, Mercer (1995) categorised students' talk in the classroom into three types: disputational talk, cumulative talk and exploratory talk (Wegerif & Mercer, 1997). Disputational talk is dominated by disagreement and conflict and a lack of consensus decision-making, with few attempts made to provide useful feedback on others' perspectives. The discourse characteristics of such talk include assertions and counter-assertions. Cumulative talk involves dialogue that simply builds on what one's peers have said in an uncritical way, and its discourse features include repetitions, elaborations and confirmations. In exploratory talk, in contrast, speakers consider one another's viewpoints in a critically constructive manner. If those viewpoints are challenged, justifications and alternative perspectives must be suggested. In comparison with the first two categories of talk, exploratory talk is more conducive to rendering knowledge publicly accountable and thinking more explicit (Wegerif & Mercer, 1997). It is therefore regarded as a dialogic model of higher-order thinking.

The key to promoting exploratory talk is the use of certain behavioural norms, or what Mercer (2013) calls 'ground rules'. These rules, which can be developed and agreed upon by teachers and students or negotiated by students, are then used to regulate students'

group discussions and problem-solving activities (Mercer et al., 2019). Research suggests that a lack of ground rules tends to result in unproductive group work (Littleton & Mercer, 2013). However, Wegerif (2007) goes further to claim that their use can actually promote exploratory talk, which in turn helps to develop critical thinking by highlighting the importance of reasoning in an explicit manner.

Given the significance of ground rules, the Thinking Together programme team designed a series of ‘Talk Lessons’ to support the teaching of ground rules within the school curriculum (Dawes, 2008). Such lessons are designed to prepare students for engagement with the Thinking Together approach. During Talk Lessons, teachers model dialogues and help students to use language as an instrument for reasoning and problem-solving during collaborative learning (Mercer et al., 2019). The efficacy of the Thinking Together approach has been documented in empirical studies conducted in the United Kingdom (Mercer & Littleton, 2007; Wegerif, Mercer, & Dawes, 1999) and Mexico (Rojas-Drummond & Alatorre, 1994; Rojas-Drummond & Mercer, 2003).

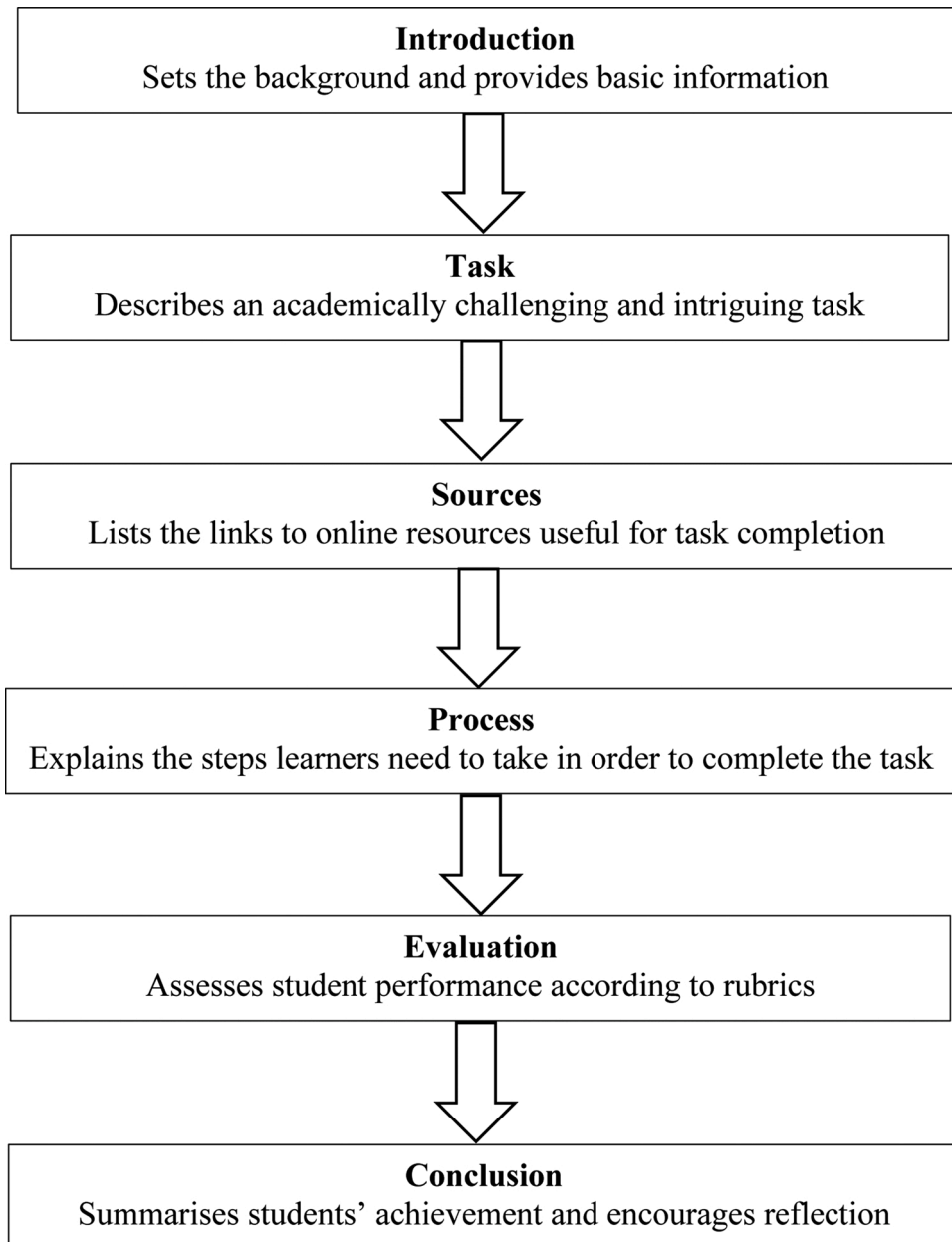


Fig. 1. WebQuest model based on Dodge (1995).

### 2.3. Key attributes of WebQuests

WebQuests were originally developed by Bernie Dodge of San Diego State University in 1995. According to Dodge (1995), WebQuests constitute ‘an inquiry-oriented activity in which some or all of the information that learners interact with comes from resources on the Internet, optionally supplemented with video conferencing’ (p. 10). He envisioned this Internet-based technological application as a viable tool for prompting students to actively analyse, synthesise and evaluate online information for problem-solving purposes (Dodge, 1995). A typical WebQuest model (see Fig. 1) comprises six modules: Introduction, Task, Sources, Process, Evaluation and Conclusion (Dodge, 1995; March, 1998). The Introduction module provides intriguing background information on the quest topic, whilst the Task module presents details of the classroom tasks and activities that students need to accomplish. The Sources module then gives students access to links to reliable online resources that have been reviewed and filtered by teachers in advance, the Process module outlines the specific steps they need to take to complete the given tasks, and the Evaluation module provides rubrics for an evaluation of students’ learning performance. Finally, the Conclusion module requires teachers to summarise students’ learning outcomes and encourages students to reflect on their learning.

Research has demonstrated that web-based technology such as WebQuests can enhance collaborative learning and social interaction because of its task-based, inquiry-oriented nature (Yang, Tzuo, & Komara, 2011). In completing a WebQuest, students need to collaborate and interact with one another to solve a problem through group discussions, thereby promoting dialogical development. In the group process created by a WebQuest, learners also engage in a dynamic exchange of ideas and the co-construction of meaning and knowledge while making a joint effort to achieve success (March, 2003). It is therefore argued that the theory and practice of WebQuests embody the tenets of constructivism, which suggests that ‘people create their own unique meaning based on their sensory-based experiences and the subsequent integration of and reflection on those experiences’ (Dennen, Burner, & Cates, 2018, p. 10).

### 2.4. Linking WebQuests to critical thinking

A number of scholars have conceptualised the potential effects of WebQuests on critical-thinking development in theoretical terms. For instance, based on their comparison of the WebQuest model and Weinstein’s (2000) critical-thinking framework, Vidoni and Maddux (2002) conclude that the former requires students to evaluate Internet information and consider a multitude of viewpoints and ideologies, thereby potentially fostering critical thinking. In a similar vein, Wegerif’s (2007) dialogic perspective on the Internet posits that it ‘is not so much a “tool of tools” [as] a cacophony of voices offering countless opportunities for dialogic engagement with multiple perspectives on every topic’ (p. 181), which suggests that teachers should expose students to a variety of online resources to stimulate thinking about varying perspectives. One way of broadening the dialogic space in the classroom is to conduct structured WebQuest activities in which students are assigned a range of websites to explore in investigating an ill-defined problem and are required to engage with multiple perspectives (Wegerif, 2007). More recently, Kachina’s (2012) meta-analysis of the literature on the impact of WebQuests suggests that they constitute a potentially effective tool for cultivating critical-thinking skills.

The critical-thinking effects of WebQuests are not only theoretically founded, but are also consistently supported by empirical research using a variety of research methods. For example, in Kanuka’s (2005) action research, WebQuests were found to be the most effective of the tools examined for developing critical thinking in adult students in Canada. Similarly, the results of a quasi-experimental study conducted in North China by Zhou et al. (2012) revealed that integrating WebQuests into science teaching can exert positive effects on critical thinking amongst high school students. More recently, the empirical results of Ebadi and Rahimi’s (2018) mixed-methods study in Iran indicate that WebQuest-based instruction can enhance critical thinking in the English classroom.

## 3. Knowledge gaps, research questions and conceptual framework

On the basis of the foregoing literature review, a further review of the empirical research on critical thinking and WebQuests (e.g. Al-Shamisi, 2016; Chang, Chen, & Hsu, 2011; Lim & Hernández, 2007; Puthikanon, 2009; Sung, Hwang, & Chang, 2015) reveals two major knowledge gaps. First, previous studies have suffered from a restricted range of methodological approaches, with most adopting conventional experimental research designs (e.g. Al-Shamisi, 2016; Chang et al., 2011; Sung et al., 2015) to explore the effectiveness of WebQuests in critical-thinking cultivation; limited research has employed an emerging research approach of ‘design research’ to design and evaluate a WebQuest-based critical-thinking programme. Compared with traditional experimental research, design research offers the advantage of not only testing theory but also developing it (Bakker, 2018). Moreover, design research can provide insights into the mechanism by which something works in addition to revealing what works (Bakker, 2018). Second, whilst research has been conducted to examine the critical-thinking effects of WebQuests on students at different levels of education worldwide (e.g. Lim & Hernández, 2007; Puthikanon, 2009; Zhou et al., 2012), little research attention has been paid to primary school students, particularly those in Hong Kong language classrooms. To fill these knowledge gaps, the study reported herein employed design research (please refer to the Methods of Data Collection section for details) to examine how educational technology can be used to develop critical thinking in Hong Kong primary English classrooms. Accordingly, the overarching research question guiding this design research project was: ‘How can a WebQuest-based teaching programme support students’ critical-thinking development in the context of Hong Kong primary English classrooms?’ However, owing to space constraints, this article concentrates on the project’s findings on students’ classroom dialogues. The specific research question addressed herein is thus: ‘To what extent did students exercise critical thinking during the WebQuest-based teaching programme?’

Programme design was guided by a conceptual framework (see Fig. 2) derived from a synthesis of the literature reviewed above. More specifically, it began with an adapted version of the Thinking Together programme and a series of Talk Lessons. During the Talk

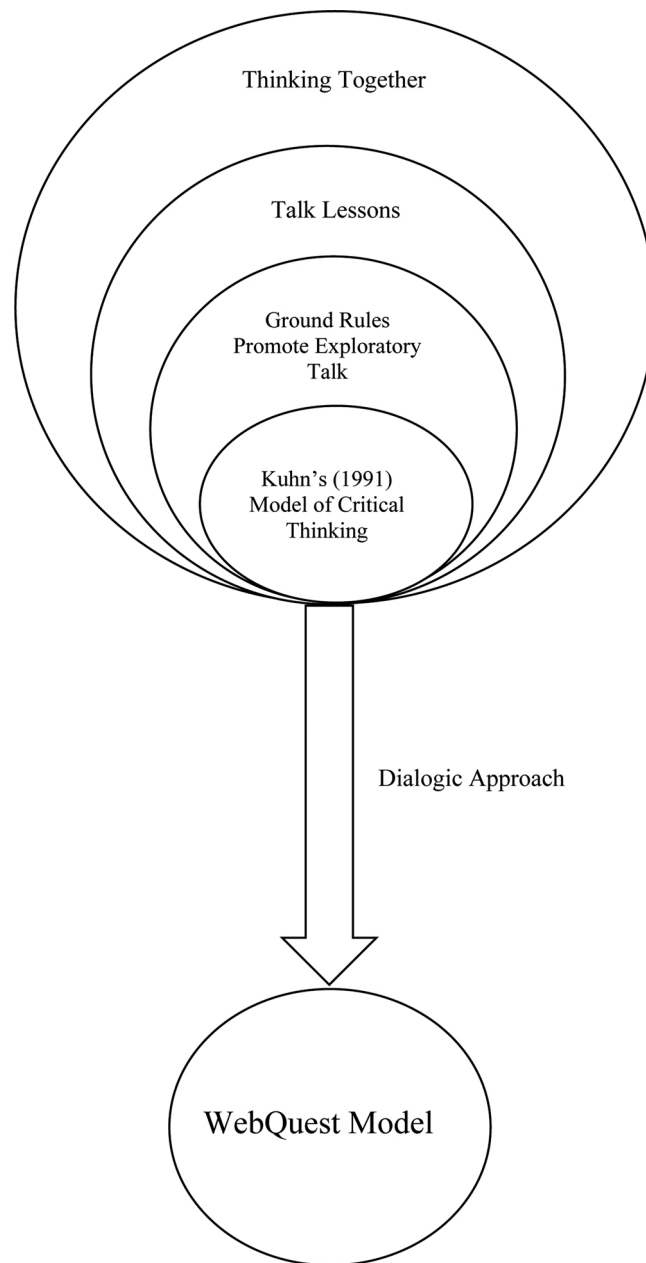


Fig. 2. Design framework for the WebQuest-based teaching programme.

Lessons, students learnt the importance of ground rules for classroom discussions and the five critical-thinking skills outlined in [Kuhn's \(1991\)](#) model in the form of ground rules. For instance, the skill of 'justifying views with substantive evidence' was translated into the rule 'We will support our ideas with good evidence', which was expected to help students to understand that the use of such a rule would promote critical thinking in their classroom discussions. After completing the Talk Lessons, students began to learn using the WebQuest model. To assist them in opening up a dialogic space, the WebQuest posed ill-defined problems to explore. Moreover, it assigned students a range of websites containing multiple perspectives on a given topic to force them to consider alternative perspectives, thereby further broadening the dialogic space in the classroom.

#### 4. The design of the teaching programme

Informed by the conceptual/design framework outlined above, the WebQuest-based teaching programme comprised a series of eight one-hour lessons delivered over six weeks. The lesson plans for the eight lessons were jointly developed and agreed upon by the

participating teachers and researchers (see the Participants and Research Site section for details). The general purpose of the first three lessons was to teach students how to be good speakers and listeners and how to establish ground rules for group work and critical thinking. They were also introduced to Kuhn's (1991) model of critical thinking.

In the remaining lessons, the students then engaged in learning facilitated by the WebQuest model. Specifically, in the fourth lesson, students were officially introduced to the WebQuest model (<http://zunal.com/webquest.php?w=390626>), which was designed in accordance with the school curriculum and English textbook to embed the teaching programme in the school's daily teaching regime. As Fig. 3 shows, the WebQuest model used in this research comprised five of the six main modules outlined above, namely, Introduction, Tasks, Process, Evaluation and Conclusion. Students were first guided through the Introduction, Tasks and Process modules, and then, in the fifth to seventh lessons, engaged specifically in the Process component of the WebQuest, working in groups of four to complete two group activities. The first activity involved exploration of various versions of the Cinderella story from around the world and an appreciation of Hong Kong culture, whereas the second required them to write scripts for a Hong Kong-based Cinderella play and to write an essay justifying why their play would be attractive to Hong Kong audiences. Students were expected to use the five critical-thinking skills explicated in Kuhn's (1991) model in completing the WebQuest through group discussion, script-writing and justification. Finally, in the eighth lesson, teachers evaluated students' performance in accordance with assessment rubrics, asked them to reflect on what they had learnt and encouraged them to further explore the topic of Cinderella.

## 5. Participants and research site

The current exploratory study involved teacher and student participants from five senior primary classrooms in one representative school selected from a pool of 40 schools participating in a Hong Kong Education Bureau-funded professional development programme<sup>1</sup> led by the researchers. One school was selected for this research, as the aim was to conduct an in-depth investigation involving the engagement of both teacher and student participants, as well as the researchers' observations of real-life classroom scenarios, with particular attention paid to students' classroom interactions. Given the considerable degree of research endeavour required, targeting just one school seemed a manageable way of yielding a microscopic understanding of students' critical-thinking performance in class.

Five whole classes of Primary Five students (aged 11–12) in the focal school participated in the research, for a total of 125 student participants. Primary Five students were selected for two reasons. First, compared with their Primary One to Primary Four counterparts, Primary Five students have accumulated more English thinking and writing experience, which was seen as likely to facilitate their learning with English WebQuests. Second, the teaching schedule of Primary Five teachers is more flexible than that of their Primary Six counterparts, who are under pressure to prepare students for the pre-Secondary One examination. Therefore, it is more feasible for Primary Five teachers to integrate WebQuests into their classrooms. A total of five teachers with at least four years of teaching experience each participated in the research.

## 6. Methods of data collection

The study reported herein constitutes the exploratory cycle of a design research project that involves iterative cycles of the refinement of research problems, solutions, methods and design principles. The emerging research approach of 'design research' is defined as

the systematic analysis, design and evaluation of educational interventions with the dual aim of generating research-based solutions for complex problems in educational practice, and advancing our knowledge about the characteristics of these interventions and the processes of designing and developing them. (Plomp, 2013, p. 16)

The data collected for the current design research project include: (a) pre- and post-tests of critical-thinking skills and dispositions, (b) audio-recordings of classroom dialogue, (c) students' written work, (d) classroom observations, and (e) semi-structured interviews with the teacher participants. Because space limitations make it impractical to present all of the project data, this article focuses on the classroom dialogue audio-recordings, which provide the most robust and conclusive evidence of students' use of critical thinking during the learning process. More specifically, the classroom interactions of six groups of students while they engaged with the WebQuest task were audio-recorded on two occasions, for a total of 12 group discussions amounting to 2 h and 10 min of classroom talk. The six groups were selected because the teachers deemed them to be the most representative of the classes as a whole. To ensure that audio-recording proceeded smoothly, one researcher was present in the classrooms during the recordings, which took place during the fifth and sixth lessons of the teaching programme.

## 7. Methods of data analysis

All of the audio-recordings were transcribed, with the transcripts then checked against the original recordings for accuracy. All transcripts were subjected to sociocultural discourse analysis, a methodology proposed by Mercer (2004) for analysing classroom talk as a social mode of thinking, for example, using language as a tool for collaborative reasoning and problem-solving. According to Mercer (2004), sociocultural discourse analysis helps researchers to engage with the contextualised, dynamic nature of dialogue. It

<sup>1</sup> The funded programme aimed to foster communities of practice to enhance small class teaching and was delivered by the researchers.

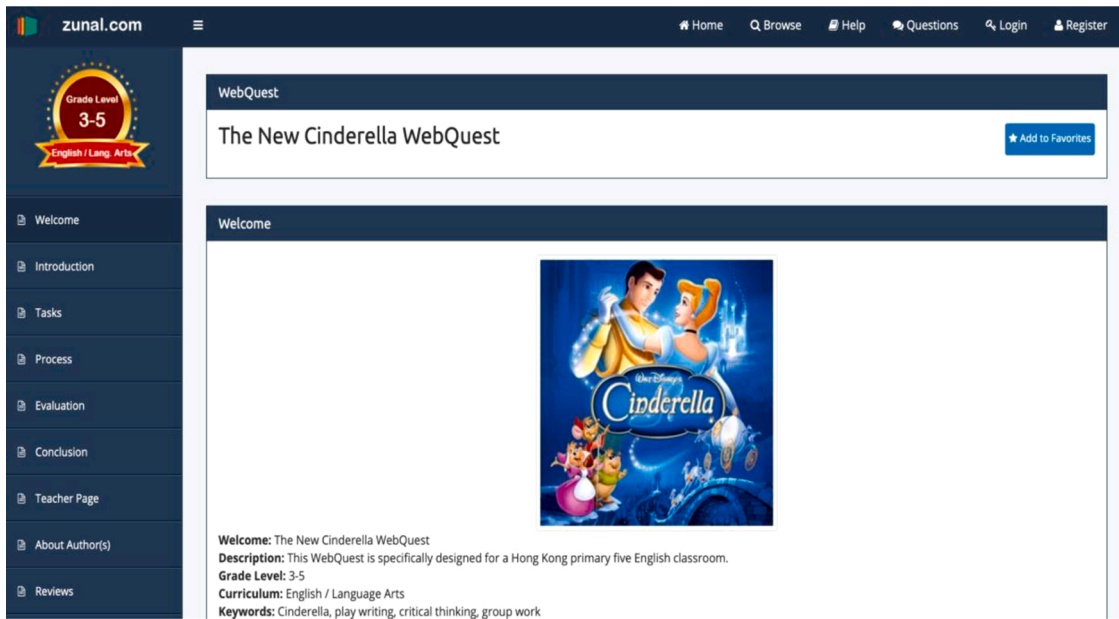


Fig. 3. Interface of WebQuest designed by the researchers (<http://zunal.com/webquest.php?w=390626>).

takes advantages of the affordances of both quantitative and qualitative methods.

At the macro level, the quantitative component of such analysis involves counting the occurrence of particular words or collocations of words in language use. In the current research, such key linguistic/discourse features as the incidence of ‘because’, ‘so’, ‘agree’, ‘disagree’, ‘if’, ‘think’, ‘how/why’, ‘would’, ‘should’, ‘could’, ‘might/maybe/may be’ and ‘but’ – markers or proximal indicators of exploratory talk and reasoning identified in established classroom research (e.g. [Boyd & Kong, 2017](#); [Soter et al., 2008](#); [Wegerif et al., 1999](#)) – were counted using concordance software (i.e. Antconc). After the initial identification of these key words, they were further coded as reasoning words if they were used in an appropriate context and signalled reasoning ([Soter et al., 2008](#)). According to [Boyd and Kong \(2017, p. 68\)](#) and [Soter et al. \(2008, p. 388\)](#), reasoning words can be grouped by function and definition (see [Table 1](#)). They have been found to offer the language of conjecture, as well as to prompt reasoning, elicit elaboration, provide reasons for claims and demonstrate a willingness to consider others’ viewpoints ([Boyd & Kong, 2017](#); [Wegerif et al., 1999](#)). Accordingly, to ascertain the extent to which the classroom dialogue was exploratory in nature, it was critical to investigate the degree to which the students used reasoning words indicative of exploratory talk. To that end, after obtaining a thorough understanding of the data through transcription and the reading and re-reading of the transcripts, the first author coded the reasoning words using the framework illustrated in [Table 1](#). A second rater, who was blind to the research purpose, was invited to code 20 % of the data independently using the same framework. The inter-rater agreement rate was 91 %. In the case of any coding discrepancies, the two raters discussed them until consensus was reached. It should be noted that throughout the coding process, the context of language use was considered to determine the functions of the reasoning words. Such consideration was facilitated by the concordance software, which enabled the researchers to retrieve the context of a given key word. Descriptive statistics of the reasoning words were then generated to obtain a holistic understanding of students’ talk behaviour in relation to exploratory talk.

At the micro level, the qualitative component of the methodology involved detailed analysis of the transcribed episodes of dialogue. The aforementioned three-item typology of talk, namely, disputational talk, cumulative talk and exploratory talk, was used as the frame of reference and guiding framework in conducting fine-grained analysis of the student dialogues. It should be noted that this framework is not intended to be applied at the word or utterance level. Instead, it should be applied at a higher level, namely, the level of intersubjective orientation ([Wegerif, 2007](#)). For instance, an exploratory orientation is a speech situation in which speakers strive to understand one another and are willing to change their stance when a good argument emerges. Informed by this analytic framework, the researchers sought to understand the extent to which the interlocutors were collaborating and critically reflecting on one another’s ideas. Particular examples from the transcripts were selected for presentation here based on the criteria that they are easily understood and illustrate the given point well. Whilst the quantitative analysis afforded a holistic picture of the level of criticality in students’

**Table 1**  
Reasoning words grouped by their definitions and functions.

Reasoning words	Definition (as suggested by <a href="#">Soter et al., 2008, p. 388</a> )	Function (as suggested by <a href="#">Boyd &amp; Kong, 2017, p. 68</a> )
would, should, could, maybe/might/may be think, agree/disagree because, so, but, if, how/why	Speculating/proposing Positioning/claiming Linking a reason to a claim; Analysing/generalising	<ul style="list-style-type: none"> <li>• Introduce/provide a link to reasoning</li> <li>• Prompt reasoning</li> </ul>



dialogue, the qualitative analysis allowed a nuanced and contextualised understanding of their classroom interactions.

### 8. Results of students' classroom dialogue

#### 8.1. Quantitative component

Table 2 shows the total number of occurrences of the key words and their functions, accompanied by examples of students' utterances. In general, the reasoning words were used more frequently to introduce or provide a link to reasoning (154 times) than to prompt it (90 times). Of the words denoting speculation, 'should' was the most frequently used (58 times), being used 48 times to introduce or provide a link to reasoning and 10 times to prompt reasoning. Of those used for positioning or claiming, 'think' appeared most often (35 times), 15 times to introduce or provide a link to reasoning and 20 times to prompt it. Of the words for linking a reason to a claim or analysing and generalising, 'because' was the most frequently used (54 times), in all cases to introduce or provide a link to reasoning. This language use pattern suggests that the students engaged in explicit reasoning by using 'because' to explain the reasons for their opinions. They were also found in the dialogic interactions to be capable of seeking justifications from their peers, generally by

**Table 2**  
Total number of occurrences of key words related to exploratory talk.

Reasoning words	Definition	Introduce/provide a link to reasoning	Prompt reasoning	Total
would		5 times e.g. No, it would be better if you acted the part of Cinderella's father because both of you are from a poor family, while her father has passed away.	3 times e.g. Oh, I have an idea. Would it be good if the name of Cinderella were Sun Yat-sen?	8 times
should		48 times e.g. He acts the part of Cinderella's dad, and you should act as Cinderella.	10 times e.g. What should Cinderella's name be?	58 times
could	Speculating/proposing	0 times	1 time i.e. Could you please stop talking nonsense?	1 time
maybe		0 times	1 time i.e. Then maybe we can set the background.	1 time
might		1 time i.e. It might be better if our Kung Fu competition were at the Great Wall.	0 times	1 time
may be		0 times	0 times	0 times
think		15 times e.g. Hong Kong culture. I think culture is like history, which is limited by many things.	20 times e.g. What do you think about adding some more characters?	35 times
Agree	Positioning/claiming	0 times	4 times e.g. Why don't you agree with that? The teacher said a reason must be provided.	4 times
disagree		1 time i.e. I disagree, I disagree; well you provide the aside, you act the part of mother, I act the part of fairy, you act the part of princess, and you act the part of prince.	0 times	1 time
Because		54 times e.g. No, it would be better if you acted the part of Cinderella's father because both of you are from a poor family, while her father has passed away.	0 times	54 times
so		6 times e.g. We can say that both of your fathers died, and later, you, the father, wanted money, so you forced your daughter to work.	0 times	6 times
but	Linking a reason to a claim; Analysing/generalising	12 times e.g. Why don't we make a story like this: Cinderella was very rich before, but after her father died, she became very poor.	0 times	12 times
if		12 times e.g. It might be better if our Kung Fu competition were at the Great Wall.	5 times e.g. Would it be okay if Cinderella acts the part of prince and soldier?	17 times
how		0 times	3 times e.g. Let's talk about the plot first. How should the story begin?	3 times
why		0 times	43 times e.g. Who will act the part of the mother, and why?	43 times
Total		154 times	90 times	244 times

asking 'why' (43 times). Their use of 'if' (12 times) was also indicative of their ability to reason in an explicit manner by making clear the assumptions and reasons they had in mind. Moreover, the students on occasion used 'but' (12 times) to introduce or provide a link to reasoning. Taken together, these descriptive statistics offer a holistic view of students' exploratory talk-related behaviour. The next section will provide a more contextualised, microscopic understanding of their use of such talk.

## 8.2. Qualitative component

To illustrate the extent to which the participating students made use of critical thinking in the group discussions while learning via the WebQuest-based programme, the two following dialogue excerpts were subjected to sociocultural discourse analysis. The two excerpts and corresponding commentary offer supportive evidence of the students' use of critical thinking in their joint effort to complete the WebQuest task of producing a Cinderella play for a Hong Kong audience.

### 8.2.1. Excerpt 1

The first excerpt comes from the classroom discussion of a group of students during the fifth lesson of the teaching programme. S1, S2, S3 and S4 represent Students 1, 2, 3 and 4, respectively, whilst T represents the teacher.

S2	I need to say 'You can't go out, and you need to come back'; then, I need to beat Cinderella, see how busy I will be in the play.	1
S1	But we really, we have Cinderella's stepsister, namely, the fairy, so why not have Cinderella's stepsister appear twice because Cinderella's stepsister has little to say?	2
S4	I also have a lot to say; can I say nothing?	3
S1	What part do you play? You should act the part of Cinderella's stepsister.	4
S2	Yes; then, we need to deal with the fairy.	5
S1	Fairy, it is you. You act the part of fairy. You act the part of fairy, S4.	6
S4	What? Does that mean that I need to say a lot?	7
S2	Does that also mean that I need to say a lot? I need to act the part of Cinderella's father.	8
S3	Then what other characters do we have?	9
S1	None.	10
S4	None.	11
S1	After that, there is an aside.	12
S4	Who will be in charge of the aside?	13
S2	You should be in charge of that, too.	14
S4	No, that won't work. Does the prince need to do the aside?	15
S3	If the prince also needs to do the aside, he can't do both well.	16
S2	That's not the case. He can walk while he is doing the aside.	17
S1	Why not have S4 do the aside because she only acts the part of fairy?	18
S4	What? No way.	19
S1	You are the fairy; then, who else will be the fairy? It will be you.	20
S4	Me? No way.	21
S1	You do the aside.	22
S4	Does the one who provides the aside need to say a lot? Forget about it; I don't know how to speak.	23
S1	Okay, I will act the part of fairy, and you will be in charge of the aside.	24
S4	I don't want that.	25
S1	You do the aside.	26
S4	No, I won't do that; it means too much to say. What other characters do we have?	27

In this extract, the group members are discussing which characters they should enact and their respective workloads and responsibilities. It seems that they misunderstand the discussion task because they are supposed to be discussing how they will write a play based on the different versions of the Cinderella story they have read and their understanding of Hong Kong culture. However, they concern themselves with sorting out who plays what role.

Despite the group's misunderstanding of the task, their talk is exploratory in nature. At the beginning of the excerpt, S2 takes up the role of Cinderella's father. It is worth noting that he is capable of using examples as supporting evidence for his viewpoint that his role entails many responsibilities (i.e. 'I need to say "You can't go out, and you need to come back"; then, I need to beat Cinderella' [line 1]). S1 also provides justifications when he proposes that Cinderella's stepsister should appear in the play twice (i.e. 'Why not have Cinderella's stepsister appear twice because Cinderella's stepsister has little to say' [line 2]). Then S4 seems to be rather concerned about the number of lines she has in the play (e.g. 'I also have a lot to say; can I say nothing?' [line 3]). When S1 suggests that S4 should act the part of fairy, S4 challenges this idea by saying 'What? Does that mean that I need to say a lot?' [line 7]. The students then pursue a discussion of who should be in charge of the aside. It is noteworthy that S3 uses the discourse pattern 'If...' to explain why the prince should not be in charge of the aside (i.e. 'If the prince also needs to do the aside, he can't do both well.' [line 16]). S2 then disagrees with S3 and justifies his view (i.e. 'That's not the case. He can walk while he is doing the aside.' [line 17]). Using 'because' in her explicit reasoning, S1 also justifies her opinion that S4 should provide the aside (i.e. 'Why not [have] S4 do the aside because she only acts the part of fairy?' [line 18]). S4 repeatedly rejects the proposal that she deliver the aside (lines 19, 21, 25) and provides a reason: She does not know how to speak and dislikes speaking too much (lines 23, 27).

It is apparent from the foregoing analysis that all the students in the group actively participate in the discussion by offering differing ideas and opinions supported by some explicit reasoning. They pose questions to one another to elicit opinions and attempt to resolve differences and reach a consensus. They challenge one another about the number of lines each role entails whilst seeking a joint

understanding of their roles and responsibilities in the play. It is therefore argued that the above transcribed episode of talk has many of the characteristics of exploratory talk.

### 8.2.2. Excerpt 2

The second excerpt captures the classroom discussion of another group of students during the fifth lesson of the teaching programme, with the same designations for the participating students and teacher.

S1	I have a good idea. The good idea is that there is a prom; that means there is a scene for a wedding, that means, a scene for a wedding.	1
S3	There is a prom.	2
S3	[unintelligible] It's not good to have a scene for a wedding.	3
S2	We need it.	4
S4	That's very important. That's a very important thing.	5
S3	It's not good to have a scene for a wedding.	6
S1	We need to include all of those in our play.	7
S3	It's not good to have a scene for a wedding.	8
S2	Well, a scene for a wedding.	9
S1	But the plot can be like this, generally like this, you and I get married there, then, at the prince's house, then at the prince's house, perhaps at that place.	10
S3	What? Isn't it too fast?	11
S1	A very small house, a very small one.	12
S3	Isn't it too fast for them to get married? They haven't known each other long.	13
S1	No.	14
S2	Why is the prince's house so small?	15
S1	It is located downtown.	16
S3	But they get married too quickly.	17
S1	Before they get married, the prince expresses his love to Cinderella, after that they go downtown and express their love to each other, after that they go to prince's home.	18
S2	Good point.	19
S3	Why is there a scene for a wedding? They don't even know each other.	20
S1	They know each other downtown.	21
S2	Do they get married as soon as they know each other?	22
S1	They need to express their love first.	23
S3	Express love.	24
S1	Yes, express love.	25
S2	Expressing love means giving a love letter.	26

This excerpt records the students' discussion on whether a wedding scene for the prince and Cinderella is needed. The discussion starts with S1's view that the wedding should take place during a prom (line 1). However, S3 disagrees with the idea of having a wedding scene at all, but does not explain why initially (i.e. 'It's not good to have a scene for a wedding' [line 3]), followed by S2's and S4's rebuttal that such a scene is indeed necessary (e.g. 'We need it' [line 4]). S3 again repeats her assertion that there should be no wedding scene (e.g. 'It's not good to have a scene for a wedding' [line 6]), but only later provides justification for her view, that is, that it is much too soon for Cinderella and the prince to get married because they barely know each other (see lines 11 and 13, e.g. 'Isn't it too fast for them to get married? They haven't known each other long' [line 13]). It is interesting to note that when S2 asks why the prince's house is small (line 15), S1 explains that it is because the house is located downtown (line 16), reflecting his awareness that the play is set in Hong Kong, where living area per capita is rather small. As the discussion continues, S1 seems to reformulate his ideas and adds several plot details before the proposed wedding scene (i.e. 'Before they get married, the prince expresses his love to Cinderella, after that they go downtown and express their love to each other' [line 18]). S3 still disagrees with creating a wedding scene, again giving the reason that Cinderella and the prince do not know each other (i.e. 'Why is there a scene for a wedding? They don't even know each other' [line 20]). Expressing a contrasting opinion, S1 argues that Cinderella and the prince got to know each other downtown before deciding to get married (line 21) and, further, that in the play they need to express their love for each other before the wedding (line 23). These views are followed by agreement and clarification from S3 and S2 (lines 24 and 26).

The above analysis of the student discussion highlights many of the characteristics of exploratory talk. It is evident from the transcribed episode that the group members ask each other questions and offer various opinions for joint consideration (e.g. whether a wedding scene is needed). They critically challenge one another's views and provide justifications, suggestions and clarification. They seem to reason together, co-constructing a shared understanding of the choice of a wedding scene in the play, which represents a shared thought process that is characteristic of exploratory talk.

## 9. Discussion and implications for pedagogical practice

With respect to the research question addressed in this article (i.e. To what extent did students exercise critical thinking in the WebQuest-based teaching programme?), the results of both quantitative and qualitative analysis of the participating students' classroom dialogue demonstrate that they used exploratory talk as a dialogic tool to exercise critical thinking when discussing how to create a Hong Kong version of a Cinderella play. More specifically, descriptive statistics of the reasoning words indicative of exploratory talk indicate that the students used such words more frequently to introduce or provide a link to reasoning than to prompt reasoning, providing evidence of their competence to reason explicitly and offer justifications for their opinions, skills related to

supporting opinions with non-spurious evidence and providing evidence to substantiate one's arguments in Kuhn's (1991) model. In particular, the students can be seen in the excerpts engaging in explicit reasoning by using 'because' to explain the reasons for their opinions, asking 'why' in their dialogic interactions to seek justifications from their peers, using 'if' to make transparent their assumptions and reasons, and using 'but' to introduce reasoning or provide a link to it. These results resonate with those of Boyd and Kong (2017) revealing that reasoning words characterising exploratory classroom talk function to either introduce or elicit reasoning. They also lend credence to the contention of Soter et al. (2008) that the density of reasoning words is an important measure of both the quality of classroom discussions and students' critical-thinking ability.

In addition, the qualitative analysis results also offer supportive evidence of the students' use of critical thinking in their collaborative efforts to solve the problem of creating a Cinderella play for a Hong Kong audience. They demonstrate the majority of the classroom discussion in the two excerpts to reflect the hallmarks of exploratory talk, which in turn promoted critical thinking, thus broadly supporting the classroom dialogue research linking exploratory talk to critical thinking (e.g. Chen, Tolmie, & Wang, 2017; Rojas-Drummond & Zapata, 2004; Webb, Whitlow, & Venter, 2017). For instance, Chen et al. (2017) found the use of dialogic teaching to significantly improve schoolchildren's critical thinking. As mentioned previously in the discussion of the current study's conceptual framework, both the Thinking Together approach and the dialogic framework of teaching thinking foreground the use of dialogue to promote thinking. The findings presented herein provide empirical evidence to support the adoption of the dialogic approach to critical-thinking cultivation.

Whilst the quantitative and qualitative findings respond to the research question by suggesting that the participating students exercised critical thinking to a large extent in the WebQuest-based programme used in the current study, they also yield important implications for the design of similar programmes. For example, as the findings highlight the pivotal role of exploratory talk in promoting critical thinking, one preliminary design principle for any WebQuest-based critical thinking programme would be the incorporation of the explicit teaching and modelling of reasoning words and sentence patterns indicative of exploratory talk. Such teaching/modelling is believed to boost students' ability to think critically in dialogic interactions with peers and teachers because reasoning both underpins and bolsters critical thinking (Davies & Esling, 2020; Pifarré & Kleine Staarman, 2011). Another rudimentary design principle suggested by this study's results is the provision of online resources containing multiple perspectives that either complement or contradict one another in the given WebQuest, which echoes the design principles for argumentative activities proposed by Schwarz (2003) and Schwarz and Shahar (2017). The rationale is that exposure to a broad spectrum of opinions and information (e.g. the different versions of the Cinderella story provided by the WebQuest in this study) may enable students to consider and offer a variety of ideas for joint consideration during classroom discussions, a major finding of the excerpt analysis herein. It is also noteworthy that a consideration of alternative views is also advocated by Kuhn's (1991) model of critical thinking.

The present findings have profound implications for pedagogical practice with respect to technology-supported critical-thinking cultivation. First, because the study found students able to exercise critical thinking in the WebQuest-based programme adopted, educational practitioners may wish to consider tailoring the programme to the nature of their courses and needs of their students to foster critical thinking in their classrooms. Operationally, such adaptation should contemplate the availability of educational technology, students' digital literacy, and the degree of alignment between the respective goals of the programme and school curriculum, as these are important conditions for the success of a technology-supported teaching programme aimed at critical-thinking development (e.g. Kong, 2014; Yang & Wu, 2012). In addition, the use of WebQuests should incorporate the social aspects of dialogical development, which, as indicated in the Literature Review, can be achieved by engaging students in problem-solving collaboration and interaction during group discussions. Students' exchange of ideas and discussion of online information can promote such development. Second, given that critical-thinking cultivation in Hong Kong primary schools is gaining increasing attention in both practice and research (e.g. Fung, 2014; Fung & Liang, 2019), it is hoped that this pioneering research will promote the use of educational technology such as WebQuests and similar tools to support critical-thinking advancement. In particular, its findings shed light on the design of critical-thinking programmes featuring the use of information technology. The proposed design framework therefore has significant implications for curriculum designers and instructional material designers, offering them insight into the use of educational technology for critical-thinking cultivation. Finally, the constructive effects of exploratory talk demonstrated in this study suggest that this type of talk is worthy of promotion in local English classrooms and beyond, with the results of classroom discourse analysis revealing the student participants to have used it as a dialogic tool to exercise critical thinking. It is therefore recommended that teachers give full play to the role of exploratory talk in teaching students group discussion strategies. They can do so by following the ground rules presented in Wegerif (2007), as social ground rules are an integral part of such talk. In teaching ground rules, it is recommended that teachers adapt Talk Lessons (Dawes, 2008) to their own school curricula, thereby preparing students for engagement in Thinking Together practices.

## 10. Limitation and conclusion

In conclusion, the aims of the exploratory cycle of the present design research project were to design a WebQuest-based teaching programme and evaluate its impact on the exercise of critical thinking in Hong Kong primary English classrooms. Sociocultural discourse analysis of the participating students' classroom dialogue indicates that they used exploratory talk as a dialogic tool to exercise critical thinking. However, this conclusion may be tempered by the study's limitations. In particular, its findings relate only to one specific teaching programme in the context of one Hong Kong primary school. It cannot be concluded with certainty that the findings are generalisable to other contexts and students. Notwithstanding its limitations and exploratory nature, the study offers important insights on the cultivation of critical thinking with the support of education technology.

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