

The Impact of Virtual Reality Disability Simulation on Hong Kong Teachers' Attitude and Professional Knowledge of Chinese Dyslexia

QEF Project Number 2023/0288 (Revised proposal)

Needs Assessment and Applicant's Capability

Specific learning difficulties is the primary type of special educational need worldwide, including in Hong Kong, and around 80% of them are dyslexia. Thus, it is not surprising to learn that, in most of the relevant professional development programs for teachers in Hong Kong, difficulties in reading and writing are considered an independent and critical issue when nurturing teachers' knowledge. However, the approaches currently used for teaching this issue are usually by delivering lectures and watching movies, which is less attractive and less impressive, particularly to in-service teachers. Thus, we propose to develop a VR disability simulation program to demonstrate the characteristics of Chinese dyslexia to their non-inclusive education professional teachers in the school. This VR program is believed to be more attractive and interactive. This is because VR, as an immersive learning approach, could increase learners' learning effectiveness, and gamification features added to this program could motivate the learners to keep their engagement. This project's goals also closely link to one of the Quality Education Fund's Priority Themes – Information Technology in Education, and we believe the results of this project could particularly be helpful in enhancing learning and teaching/pedagogical innovations, catering to learner diversity for those Hong Kong teachers, whose professionals are not inclusive education, in the mainstreaming schools.

All members who join this project have considerable experience in either Chinese reading/writing difficulties as well as Chinese children with dyslexia [REDACTED] who is interested in understanding the nature and heterogeneity of Chinese dyslexia and then extending to the ways to improve their academic competence as well as quality of life, will oversee the whole procedure, including developing measures, designing the intervention tools, recruiting and training research assistant and student helpers, collecting data, etc. [REDACTED] has developed a preliminary program that focuses on using VR to simulate the features of students with special education needs, financially supported by the Ministry of Education in Taiwan, and the positive effects of that program on preservice special education teachers' awareness and professional knowledge were reported. Thus, he has sufficient experience in conducting relevant projects. [REDACTED] will help to look for participants and ensure all teaching materials and measures are well-designed and age-appropriate. His research interest is in the area of literacy acquisition and cognitive development of Chinese children with and without dyslexia [REDACTED] will help mainly with the designs of measures as well as recording the participants' responses to our interventions. They have rich research experience in the gamification of computerized measures and interventions. [REDACTED] is an expert in the field of speech, language, and communication deficits. Although her specializations are not all in the domain of dyslexia, such focal issues are undoubtedly helpful for the emphasis on auditory processing deficit simulation in this project. Finally, [REDACTED] has great networks with the local schools, so his joining could largely ease the difficulties in recruiting participants from the local mainstreaming primary schools. Our team members, particularly Prof. [REDACTED], have collaborating experience for a few years in more than 10 research projects, including another QEF project, and 20 academic journal papers. The high level of professionals covers diverse aspects with long-term and successful collaboration records, making this team one of the best groups to do this project.

Goals and Objectives

We would like to develop a program, "Hong Kong Dyslexia Interactive Virtual Experience" (HK-DIVE), and this program is expected to serve as another option for the professional development programs in Hong Kong or other regions/countries that use Chinese as the primary language to give preservice teachers a more in-depth understanding of students with dyslexia. Specifically, the effectiveness of the developed HK-DIVE in improving the attitude and professional knowledge of in-service teachers in the mainstreaming primary schools in Hong Kong, in terms of their awareness, professional teaching knowledge, and capabilities to make more suitable teaching plans for students with dyslexia: (1) comparing the pre- and post-test performances in the experimental group and (2) comparing the posttest performances of the experimental and control groups.

Targets and Expected Number of Beneficiaries

There are two stages of the expected number of beneficiaries of this project.

Stage 1: two hundred non-inclusive education professional in-service teachers in the mainstreaming primary schools in Hong Kong. Among this group, half ($N = 100$) will be assigned to the experimental group, while the other half ($N = 100$) will be in the control group. Those in the control group will also receive the intervention after the experiment period that those in the experimental group received if it shows significant benefits.

Stage 2: Six sharing seminars are expected to be held to deliver the outcomes of this project to teachers and parents. It is expected that fifty participants will be involved in each seminar; thus, 300 participants will join and receive the benefits from the outcomes of this project. After the completion of all the activities of this project, the created VR program (i.e., HK-DIVE) could be used as a tool for Hong Kong in-service teachers' professional development training in the future.

Innovation

There is a growing body of information technology-relevant teaching materials and tools designed for students with dyslexia, and that has drawn so much attention from researchers and practitioners. Among the diverse tools, some of them are developed by using the approach of immersion learning, such as virtual reality (VR). However, it is rare to see the focus on how to improve in-service teachers' awareness and understanding of the symptoms of Chinese dyslexia. Even though there are some, they are usually developed in traditional, less attractive, and less immersed ways. Thus, this program is, among the first in Hong Kong, aiming to develop a VR simulation program for enhancing in-service teachers' understanding of Hong Kong students with dyslexia. As repeatedly reported by scientific studies in recent years, VR has strengths in trainee engagement and immersion learning.

Conceptual Framework

Educators' perspectives can significantly shape their interactions with students, particularly those requiring special education. Social learning theory, as conceptualized by Bandura (1986), posits that an individual's perceptions directly impact their behavioral traits. In the educational context, this theory implies that teachers' attitudes towards integrating students with special needs, such as dyslexia, might influence their commitment to these students' academic success (Yildiz, 2015). Additionally, Bandura's theory highlights the

role of observing and emulating behaviors, suggesting that teachers' attitudes can shape other students' perceptions and actions towards peers with special needs in inclusive settings.

Supporting this perspective, prior research underscores the significance of educators' insights and comprehension of students' unique challenges in shaping learning experiences and outcomes (Hellendoorn & Ruijsenaars, 2000; Levine, 1998; Ryan, 1994; Wadlington & Wadlington, 2005). These perceptions are crucial in determining the extent to which students can access suitable accommodations within a nurturing academic environment (Elkins, 2000; Shevlin et al., 2004).

However, it has been observed that educators often overrate their understanding of students' reading progress and are unaware of their knowledge gaps (Cunningham et al., 2004). This overestimation is also prevalent in contexts involving students with dyslexia, potentially leading to inadequate preparation by regular education teachers for these students (Bos et al., 2001). A study by Wadlington and Wadlington (2005) revealed that educators across various levels, including primary, secondary, and university educators, as well as special education teachers, possess significant misconceptions about dyslexia. They often feel uneasy confronting or providing appropriate guidance to students with dyslexia.

Moreover, past studies indicate that merely placing children with disabilities alongside typical peers and teachers does not automatically foster positive attitudes (Silton et al., 2018). Instead, introducing well-designed interventions to educate peers and teachers about disabilities is necessary to improve cognitive attitudes, behavioral intentions, and social interactions (Vignes et al., 2009).

Overall, the perceptions and beliefs teachers hold about students with special educational needs, including dyslexia, are likely influenced by their understanding of these students' characteristics. This understanding profoundly affects the educational strategies employed for these students (Ade-Ojo, 2012). If teachers lack sufficient knowledge and understanding of dyslexia, it is predictable that adequate instructional designs and adaptations may not be implemented effectively. To address this issue, it is crucial to enhance teachers' awareness of the challenges and frustrations commonly faced by students with dyslexia (Spear-Swerling & Brucker, 2003; Wadlington & Wadlington, 2005).

Effective methods have been identified to improve individuals' awareness and understanding of specific special educational needs, such as dyslexia. The two primary approaches employed are informational presentations and experiential learning. Informational presentations, including workshops and classes, offer a direct method to educate teachers about dyslexia and the experiences of those affected by it. This approach is widespread, yet lectures lacking interaction have been found to be less engaging and effective (Nawab, 2017).

To overcome the limitations of informational presentations, innovative methods have been developed, with experiential learning emerging as a popular strategy (Kayapinar, 2016). Several studies have explored the use of dyslexia simulations for various groups. For instance, Wadlington et al. (2008) implemented a dyslexia simulation program (Experience Dyslexia®) to increase awareness and empathy among pre-service teachers, students training to become educators. Developed by the Northern California Branch of the International Dyslexia Association in 2008, the program includes six simulation stations addressing various dyslexia-related challenges. Their findings showed that a majority found the simulation beneficial, with 74% rating it as very helpful, 23% as moderately helpful, and 3% as slightly helpful.

In recent years, virtual reality (VR) has become a foundational element in simulation programs, extensively used in education to help students grasp abstract concepts and develop necessary skills (Kamińska,

2019). A systematic review by Wan and Lam (2019) identified only six well-designed studies using VR simulations to enhance understanding and attitudes towards disabilities or diseases, with most showing significant improvements. They outlined five primary benefits of VR simulations, including more ecologically valid stimulus presentation, tighter control over 3D environments, enhanced manipulation of virtual environments, and the creation of a risk-free simulated setting.

Particularly, Passig's (2011) study focused on the effectiveness of VR in simulating the experience of students with dyslexia. Their VR software, based on the Friedmann-Gvion taxonomy (Gvion & Friedmann, 2004), included ten distinct categories of dyslexia. The program was administered to 40 in-service teachers, with a control group of 40 teachers receiving a different educational intervention. The results showed significant improvements in the awareness of dyslexia's various categories and in beliefs about teachers' abilities to assist students with dyslexia in the VR group, but not in the control group.

Thus, VR-based disability simulations have proven to be effective and beneficial. Unfortunately, current educational methods primarily focus on information presentations, often combined with demonstrations or sharing sessions. This approach may not provide in-service teachers with a deep understanding of the reading and writing difficulties faced by students with dyslexia, as suggested by embodied cognition theory, which emphasizes the role of sensory and motor functions in environmental interaction (Wilson, 2002).

The necessity of enhancing teachers' awareness and expertise early in their training has been repeatedly emphasized, especially for those yet to gain extensive experience with students (McPherson et al., 2011; Saravanabhavan & Saravanabhavan, 2010). Considering resource and time constraints, this proposal aims to benefit in-service teachers in special education training programs in Hong Kong through our dyslexia simulation program.

Despite the well-designed nature of Passig's (2011) VR dyslexia simulation and its initial success, it lacks components simulating auditory modalities. Research has shown that individuals with dyslexia exhibit significant deficits in auditory and phonological processing (Boets et al., 2007; Law et al., 2014). Passig's program, while including phonological processing elements, focused more on reading than on sound processing. Considering the theoretical link between auditory processing deficits and dyslexia's phonological processing challenges (Ramus, 2001), their program didn't fully simulate the foundational difficulties experienced by individuals with dyslexia. Therefore, we propose to develop a VR simulation specifically for Chinese students with dyslexia, incorporating both visual and auditory elements.

Additionally, previous disability simulations for dyslexia have predominantly been conducted in alphabetic languages. The unique characteristics of Chinese scripts mean that the cognitive profiles of Chinese readers with dyslexia differ significantly from those in alphabetic languages, whether in childhood (Ho et al., 2002) or adolescence (Chung et al., 2010). Previous programs, like Passig's (2011) VR software and "Experience Dyslexia®," were based on the phonological processing deficits typical of dyslexia in alphabetic languages. However, according to the Multiple-Deficit Hypothesis of Chinese dyslexia (Ho et al., 2002), these focal issues may not be as relevant for Chinese students with dyslexia (Ho et al., 2007). Thus, applying existing alphabetic language-based simulation evidence to the Hong Kong context may not be appropriate, necessitating the development and evaluation of a VR simulation program, specifically for the Chinese population. Our small-scale pilot study (N = 36 in the experimental group while N = 15 in the control group), conducted for Taiwanese pre-service teachers, created a program VR Chinese dyslexia simulation program in

which visual perception and attentional deficits of Chinese dyslexia were focused. The results showed that that program could significantly improve the slightly positive attitude and professional knowledge of pre-service teachers. However, apart from the poor quality of visual stimulations as well as the small sample size, similar to the omissions of Passig's (2011) VR dyslexia simulation, the VR program created by our pilot study did not contain the simulations of the difficulties in auditory modalities that Chinese students with dyslexia may meet. Such a lack may affect its effectiveness. Also, the focus on Taiwanese would obviously be different from what we need in the Hong Kong context.

Thus, this project seeks to create a Hong Kong Dyslexia Interactive Virtual Experience (HK-DIVE), focused on traditional Chinese scripts with Cantonese pronunciations, tailored for Chinese students with dyslexia and assess its effectiveness in enhancing the professional knowledge of mainstream primary school teachers in Hong Kong. We aim to evaluate the program's impact on teachers' attitudes, professional knowledge, and ability to devise appropriate teaching plans for students with dyslexia. The effectiveness of the HK-DIVE will be tested through pre- and post-test evaluations within an experimental group and by comparing outcomes between the experimental and control groups.

Implementation Plan with Timeline

Research Design

This project is a pretest-posttest control group designed study, and it contains one experimental group (learning with HK-DIVE) and one control group (learning with watching films). Additionally, in order to purify the validity of this project's finding, several factors will also be collected to serve as the co-variates in this project. Firstly, participants' teaching experience (in years), teaching experience with students with dyslexia (in the number of cases), and gender will be considered since these two factors have been found to affect the use of VR devices (Vergara et al., 2021). Furthermore, we will also collect participants' VR usage experience in this project since it could significantly influence the learning effect via VR devices (Chertoff et al., 2010).

Participants

In total, 200 in-service teachers aged above 18 in the mainstreaming primary schools in Hong Kong will be invited to join as participants in this project. Twenty of them will be first invited to join the HK-DIVE validation examination, while all, including those who join the validation examination, will join formal interventions. To better examine the goals of this project, those teachers with a major in inclusive/special education or who have accomplished the Thematic courses (under Cognition and Learning Needs) of Hong Kong Education Bureau's Basic, Advanced and Thematic (BAT) Courses will be excluded from this project to avoid the uncontrollable confounding factors. This is because the aforementioned teachers have accomplished 90 to 120 hours of courses that specifically targeted how to design or implement suitable teaching to those students with dyslexia (Chung et al., 2022). The participants will be equally assigned into one experimental group and one control group by matching gender and teaching experience (in years) as much as possible. Those in the experimental group ($n = 100$) will receive an intensive HK-DIVE intervention (expected to be 25 min per session, five sessions in total). In contrast, the participants in the control group ($n = 100$) will be invited to watch films that describe the reading difficulties of children with dyslexia as well as the demonstrations of these difficulties, with the same intensity of interventions in the experimental group, and this idea refers to the designs of Passig et al. (2008, 2011). More details of the two groups are provided in the Procedure section.

The research team, comprising the PI and Co-Is, possesses extensive and deeply rooted experience in teacher education at the university level. Collectively, we have spent years nurturing and training future educators, during which time we have built a substantial and robust network of professional relationships with in-service teachers. Many of these teachers are our former students, who have now advanced into various stages of their careers and continue to maintain strong ties with us. Additionally, these former students have introduced us to their colleagues, further extending our reach within the teaching community. The trust and rapport we have cultivated with these educators over the years will serve as a critical and reliable channel for approaching and engaging potential participants for our study.

Moreover, our project has garnered the enthusiastic support of several primary school principals, including [REDACTED] [REDACTED] [REDACTED] [REDACTED] [REDACTED] as indicated in the system, who are not only aligned with the objectives of our research but have also made formal commitments to assist in its execution. These principals bring with them not only their own schools' involvement but also the influence and reach of their professional networks within the educational administrative sphere. Some of them are willing to champion our project at both the school and district levels provides a valuable opportunity to expand our recruitment efforts beyond direct contacts. By leveraging the principals' networks, we can access a broader pool of in-service teachers who might otherwise be difficult to reach.

This strategic, multi-tiered approach, which integrates both direct recruitment through our established connections and an expanded outreach facilitated by the principals' networks, positions us to effectively and efficiently recruit the 200 in-service teachers required for this study. We are confident that this combination of personal engagement and administrative support will enable us to meet our recruitment targets.

Measures

Two questionnaires and one teaching plan design exercise will be introduced before and after the intervention with the same contents but randomly arranging items, including the Cognitive Questionnaire and Capability Questionnaire, referring to the tools used by Passig et al. (2008) and Passig (2011). Also, the participants will be invited to fill out their VR usage experience, which may affect the effectiveness of our VR program.

Questionnaire of Knowledge about Reading Disabilities. The questionnaire used for testing the level of awareness of dyslexic students' difficulties was developed by Shavit (2005) and is called "The Text as Seen by the Dyslexic Child." The goal of the questionnaire was to test the knowledge of dyslexic students' ways of perceiving the world. The items on the questionnaire were composed by Passig et al. (2008), based on the taxonomy of Gvion and Friedmann (2004). The cognitive questionnaire included 10 sections, each relating to a different type of dyslexia. The questionnaire was validated by a group of researchers and teachers who specialize in learning disabilities. The questionnaire was found by Shavit to have a Cronbach's α value of 0.71.

Questionnaire of Beliefs about Reading Disabilities. Passig (2011) used the extant 23 items for the capability questionnaire adapted from Oren's questionnaire (2001) to examine the teacher's sense of capability for working with dyslexic children. The teacher was asked to what degree he or she felt capable of teaching dyslexic pupils, based on a Likert Scale ranging from 1 "definitely do not agree" to 6 "definitely agree". The response indicated the degree of agreement with each of the items on the questionnaire; the higher the score was, the higher the teacher's sense of capability for working with dyslexic children.

This measure was adapted from Oren's (2001) questionnaire testing the variable "cognitive awareness." Oren (2001) devised three subscales for her measure: a cognitive scale (eight items), an emotional scale (six items), and a social scale (nine items). According to Oren's research, the scale measuring cognitive awareness of how to work with dyslexic students has Cronbach's alpha values of .78 (Oren, 2001) and .71 (Passig, 2011).

Teaching Designing Exercise for Chinese Dyslexia. Before and after the interventions, the participants will be invited to conduct one round of teaching designing exercises for Hong Kong Chinese students with dyslexia to test how HK-DIVE may affect teachers' frontline actions towards the students. We will collect information and data about their teaching experiences. Particularly, they will be asked to design the teaching plans for one specific student with dyslexia, whose detailed information (e.g., background information and reading and writing performance) will be provided by the PI and Co-Is.

In the teaching designing exercises, based on differentiated instructions (Joseph et al., 2013), three aspects will be paid close attention to observe if the participating teachers could demonstrate to have more suitable teaching for those with dyslexia: content, process, and product (assessment). For the content, the more teachers could adjust the difficulty levels or amount of the teaching content, the better. Usually, the teachers simplify (decreasing the difficulty level), divide (decreasing the amount of teaching content for each time), reduce (decreasing the amount of teaching content in total), or substitute (removing those materials with too high difficulty level) the content of teaching materials to correspond to the student's current status. Regarding the process, teachers are expected to use more suitable teaching strategies that could facilitate the student's learning based on their strengths and weaknesses. For instance, peer instruction, role play, problem-based learning, graphic organizers constructing, or summary writing are very popular used for dyslexia. Finally, for product (assessment), teachers are expected to incorporate the proper approaches to exert their potential performance by minimizing the barriers. For instance, teachers usually use time-extension (for slower processing speed), exam paper separations (for poor working memory), text-to-speech (for deficient word/vocabulary recognition), speech-to-text (for profound writing deficits), and visual hints (for poor visual perception), etc. Each teaching designing exercise will be rated by these three aspects and a maximum of ten points for each aspect.

Two experienced teachers will be invited to do the rating to confirm the reliability of the rating of this exercise. The raters will meet the following criteria: (1) holding a major in inclusive or special education at the undergraduate level; (2) possessing a local teaching qualification in inclusive or special education; (3) holding a postgraduate degree at a minimum of the master's level in the field of education; and (4) having at least ten years of frontline experience teaching students with special educational needs, with a focus on dyslexia. At least two rounds of inter-rater reliabilities confirmation process will be conducted before this project, and this process will not be terminated and head to the official rating until the consistency of rating (the difference in each aspect is not bigger than two points) reaches .80.

VR Usage Experience Scale. The study employs a modified "Virtual Environment Assessment Questionnaire," originally based on Chertoff et al.'s (2010) "Virtual Experience Test." This tool evaluates user experiences in virtual environments across five key dimensions: sensory, cognitive, emotional, behavioral, and relational. The questionnaire consists of 14 items, with three questions allocated to each dimension except for the sensory, which has two. The sensory dimension assesses the quality of sensory feedback, while the cognitive dimension focuses on task-related content and user interface. Emotional aspects are gauged through

the user's emotional reactions to virtual events. The behavioral dimension examines the user's sense of agency and skill transferability. Lastly, the relational dimension evaluates the effectiveness of interactions with Non-Player Characters. The scale's validity and reliability have been confirmed, evidenced by a Cronbach's alpha of .908. A Likert 5-point scale will be used for scoring, where higher scores indicate a more positive user experience.

Expected Hong Kong Dyslexia Interactive Virtual Experience

In this project, a key product will be developed via both theoretical and practical approaches, that is, the Hong Kong Dyslexia Interactive Virtual Experience (HK-DIVE). The basic idea of the HK-DIVE is similar to previous products, such as Passig's (2011) VR software and Experience Dyslexia® (Northern California Branch of the International Dyslexia Association in 2008), in which different types of dyslexic students' reading and writing difficulties are separately implemented. However, it is worth noting that the different types of dyslexic students' performances in these relevant products are basically based on the theoretical considerations of various types of performance, but it is highly possible to miss or misunderstand the detailed performance of different types if the classifications are purely based on reviewing the literature without digging into the difficulties students face. Thus, we plan to take both theoretical and practical aspects into consideration. The details of identifying the performance types of Chinese students with dyslexia are introduced in the Procedure section below.

Next, in terms of the identified various types, we expect to set a series of scenarios ($n = 5$) for each type in the HK-DIVE. Thus, there are expected to be, in total, 35 scenarios in this program. All the scenarios will be based on our pilot study, which included three different scenarios led by visual perception and attentional deficits. And more others which be expanded from visual perception and attentional deficits as well as other deficits (Wang* et al., 2019, 2020) and error types (Ho et al., 2004) will be added. The details are listed below.

- Attentional deficit: The participants will read the text guided by a spotlight, and the movements of the spotlight will not go smoothly. To simulate Chinese dyslexia's attention deficit during their reading, it could be line or word escapement. That is, the spotlight will go from the first character to the last one with skipping characters or lines, and its movements may also be reversed and randomly throughout the text.
- Visual perception deficit: One is to simulate the situation that students with Chinese dyslexia would face difficulties in distinguishing two or three Chinese character-like figures or counting the number of strokes contained in one Chinese character-like figure presented in a tiny size, which makes it very difficult for the participants to see clearly. Another scenario of this deficit will be the presentation of fuzzy Chinese character recognition; some specific characters shown in the text will be visually vague to the participants. The last scenario for this deficit is the crowded texts during a sentence or a text. This could happen on several Chinese characters in a line or a couple of lines in a text during reading.
- Orthographic knowledge errors: In this scenario, the participants will watch the simulation that the comprising of compound Chinese characters, which are combined by two radicals, would mess up. Particularly, the radicals may reverse (i.e., 諷 becomes 風言) or put-side down.
- Morphological awareness errors: Chinese dyslexia's difficulties in processing homophones will be shown in this scenario. The participants will see the text that some characters are replaced by characters with the same pronunciations. For instance, 天真的孩子 will show as 天珍的孩子.
- Semantic processing errors: In this scenario, the retrieval of Chinese vocabulary with similar meanings

would be presented. For instance, 我馬上就去吃飯 will present as 我連忙就去吃飯.

- Auditory discrimination errors: One is to simulate their difficulties in discriminating similar compound sounds for each Chinese character (e.g., /suo1/ and /shuo1/) by fuzzing the sounds. The participants will then be asked to indicate the target characters.
- Auditory processing speed deficit: Another scenario will target simulating their slower auditory processing speed. The participants will experience two- to three-times of speedy speaking information from the instructors' oral expressions in this VR program and then be asked to accomplish the following actions correspondingly.

Additionally, to increase the participants' motivations, we will add more gaming features into this program, such as scoring, health points, and experience points, or even allow participants to use their scores to buy tools to help them make the challenges easier. Such features of gamification have been well demonstrated to increase learners' motivations as well as their learning effectiveness (for a review, see Dicheva et al., 2015).

Finally, although the simulation for dyslexia is believed to be a key experience that facilitates awareness of dyslexia, with hopes of positively impacting disposition and pedagogical approaches (Wadlington et al., 2008), the previous evidence showed that the simulation alone may not reach the ideal outcomes. That is, Steltenkamp (2016) proved that simulation plus lecture is the most effective approach to enhance teachers' awareness and professional teaching knowledge toward dyslexia; that combination outperformed either simulation alone or lecture alone. Thus, after all the scenarios of one type, there will be a small section of knowledge delivery charts that contain the basic knowledge of this specific type of Chinese dyslexia as well as the information regarding educational implications.

Procedure

There are four stages in this project, and the details are introduced below.

Year/Month	2025												2026												2027														
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12			
1. Preparation phase	█																																						
2. Data collection of pre-test performance						█																																	
3. Creation of HK-DIVE				█																																			
4. Implementation of HK-DIVE												█																											
5. Data collection of post-test performance																							█																
6. Dissemination of the project's findings																																		█					

1. Preparation phase:

Recruiting staff, including the research assistant and student helpers, approaching potential participants and recruiting participants. Furthermore, we will also confirm inter-rater reliability of teaching plans.

2. Data collection of pre-test performance

The participants in two groups will be requested to fill out both the Questionnaire of Knowledge about Reading Disabilities and Questionnaire of Beliefs about Reading Disabilities to collect the pretest performance.

Also, the participants will be invited to write a teaching plan for a specific case of Chinese children with dyslexia provided by the investigators.

3. Creation of Hong Kong Dyslexia Interactive Virtual Experience

In this stage, the key product of this project, i.e., HK-DIVE, will be created based on the aforementioned summary of reading and writing difficulties of Hong Kong students with dyslexia. Afterward, the validity of the HK-DIVE will be tested by inviting a group of in-service teachers ($n = 20$) to experience the HK-DIVE for three sessions that contain 20 minutes per session; meanwhile, they will be allowed to refer to the summary of reading difficulties of Hong Kong students with dyslexia. They will then be requested to finish the investigation on the consistency between the HK-DIVE and the aforementioned summary. Any significant inconsistent or missing parts found in the investigations will be brought to the PI and scholars in the relevant field, and there will be a comprehensive review before decisions to add or modify the contents in the HK-DIVE. The revised version of the HK-DIVE will undergo the same procedure of testing validity until there is no significant inconsistent or missing part, or there are some PI and scholars in the relevant field who have a consensus that these parts are either not that critical or unable to be mimicked in the VR environment.

4. Implementation of Interventions HK-DIVE

In this stage, two groups of participants will take different intervention materials with the same duration (20 minutes per session) and intensity (five sessions in three weeks). The final version of the HK-DIVE will be applied to our participants in the experimental group. On the contrary, the participants in the control group will be asked to watch videos that contain the same reading difficulties as what is demonstrated in the HK-DIVE. The reason for separating the activities in the HK-DIVE into five sessions is to avoid the side effects caused by watching VR for too long, such as eye strain, fatigue, and dizziness. Each participant in either the experimental or control group is expected to receive a 35-session intervention, which, based on the expected intensity, will consume 21 weeks. Considering the size of the target sample, a duration of 13 months is proposed for this purpose.

Regarding the risk of participant drop-out, we have put in place several strategies to mitigate this. Firstly, the relatively short and intensive 21-week intervention period is designed to maintain participant engagement and minimize the likelihood of attrition. Additionally, once participants are confirmed, we will establish and maintain regular communication with them through WhatsApp or other messenger software. This ongoing contact will ensure that participants remain connected to the project, are informed about their progress, and feel supported throughout the intervention period. By fostering a strong sense of involvement and providing consistent updates, we aim to reduce the risk of drop-out and ensure high retention rates.

5. Data collection of post-test performance

Afterward, the participants in the experimental and control groups will be requested to fill out the Questionnaire of Knowledge about Reading Disabilities and Questionnaire of Beliefs about Reading Disabilities again as well as VR Usage Experience Scale for the data collection of the posttest performance. Finally, the participants will be invited to write a teaching plan for a specific student with dyslexia who is different from the one they wrote for the pre-test performance. Those participating in-service teachers' change in the attitude, knowledge, and, the most important, the capability of making a suitable teaching plan for Chinese students with dyslexia. Participants in the experimental group is expected to be able to immersively experience the reading difficulties of Chinese dyslexia, comparing to those in the control group. The

immersive nature of the VR experience is expected to profoundly impact participants' attitudes toward integrating students with dyslexia into their teaching plans and bridge the gap by providing an embodied learning experience that enhances the retention and application of knowledge.

6. Dissemination of the project's findings

In an effort to disseminate the research findings of this project, a series of six sharing seminars will be planned. These seminars aim to engage both educators and parents, serving as a platform for knowledge transfer and collaborative dialogue. By sharing the outcomes as well as let the participants of those seminars experience the HK-DIVE, the project's findings are expected to aspire to influence educational practices and parental involvement in a meaningful way. Each seminar is anticipated to host approximately fifty participants, culminating in an estimated total of 300 attendees across all sessions. This substantial participation is expected to amplify the impact of the project, ensuring that its benefits are widely received and implemented. Therefore, these seminars are not merely informational events, but rather integral components of the project's broader dissemination and impact strategy. Also, once this current project approves the effectiveness of HK-DIVE, it would be recommended to the course coordinators and instructors of the in-service teachers' professional development in special education and inclusive education, such as the Certificate in PDP for Teachers (Catering for Diverse Learning Needs) or Advanced level or Thematic level of the Basic, Advanced and Thematic Courses.

Data Analysis

There are two research aims in this project, and to examine these research aims, various statistical methods will be used. ANCOVAs will be used for the intergroup comparison of the posttest performances of the experimental and control groups while controlling their pretest performances. In terms of G*power, a moderate effect size (i.e., 0.30) could be obtained with the context of a statistical power of 0.95, an α error probability of 0.05, total sample size of 200, number of groups as two, and numbers of co-variates as three (required sample size: 15 for each group).

Teachers' and Principals' Involvement in the Project

The teachers will be invited to join to use the HK-DIVE to enhance their awareness and professional knowledge of Chinese dyslexia. Their views on this product will also be welcomed to make it better. Also, they will be encouraged to spread this product to peers and parents of children with dyslexia because these two populations are the main stakeholders. In addition, the role of principals is expected to provide support for recruiting the participants as well as relieving the teachers to join this project.

Budgets

(HKD1,656,100)

Staff (HKD747,500)

1. Research Assistant: We request a full-time research assistant for three years to help PI and Co-Is to train necessary research manpower, communicate with potential participants and schools, discuss details with the VR program creation company, and initially analyze data. This item is expected to cost HKD702,000 [36 (months) * HKD19,500 (including MPF)].
2. Student Helpers: We request several numbers of student helpers to facilitate the process of this project.

Firstly, 200 hours of student helpers are expected to help us in preparing all the necessary materials. Furthermore, during the experimental implementations, we request two student helpers for four participants (expected number of participants per school) for each intervention session. Thus, the total budget for this item is $\text{HKD}45,500 = \text{HKD}13,000 [\text{HKD}65 \text{ (including MPF)} * 200 \text{ (hours)}] + \text{HKD}32,500 [\text{HKD}65 * 200 \text{ (number of participants)/4 (expected number of participants per school)} * 2 \text{ (two SHs per participant)} * 5 \text{ (sessions of the created VR program)}]$.

Equipment (HKD140,000)

3. VR devices: To make the experiments more smoothly, we request 20 sets of VR devices, which are expected to cost HKD7,000. We are allowed to implement the interventions parallelly. So, this item is expected to cost $\text{HKD}140,000 [\text{HKD}7,000 \text{ (per VR device)} * 20 \text{ (number of VR devices)}]$.

Services (HKD445,280)

4. VR program creation service: Since this project aims to create a VR program and test its effectiveness, a one-off $\text{HKD}400,000$ is requested to purchase a VR program creation service.
5. Consultancy fee for teachers: A budget for this item is needed to invite experienced teachers to rate the participants' teaching plans (one of the indicators of the VR program's effect). Considering the number of teaching plans they will need to rate (200 per round), it would be a massive burden for the raters. Thus, considering the expected time spent for rating each teaching plan (~20 minutes), we expect eight sets of teaching plans to be rated per day on the basis of daily pay for supply teachers for primary schools (graduate) (HKD1,415). Thus, this item is expected to cost $\text{HKD}45,280 [8 * \text{HKD}1,415 * 2 \text{ (two rounds of review)} * 2 \text{ (number of teachers)}]$.

General Expenses (HKD90,000)

6. Local transportation: Since the student helpers will be asked to assist in implementing the interventions, the local transportation of a research assistant/PI or Co-I is requested. This item is expected to cost $\text{HK}45,000 [\text{HKD}60 \text{ (round trip fee)} * 200 \text{ (number of participants)/4 (expected number of participants per school)} * 3 \text{ (two student helpers + one research assistant or investigator per participant)} * 5 \text{ (sessions of the created VR program)}]$.
7. General expenses: Several items under general expense are likely to be needed in this project, such as stationary fees, mail fees, printing, telephone fees, storage fees, etc., so we request $\text{HKD}30,000$ to cover all these items.
8. Audit fee: We request a one-off HKD15,000 for this project's audit fee since the amount of budget exceeds one million HKD.

Overhead (HKD213,417)

9. Overheads for University and Faculty: A 15% of the total amount of budget items 1 to 8 (i.e., HKD1,422,780) is requested to be the overhead for University and Faculty, so it would be HKD213,417.

Contingency provision (HKD19,808)

10. Contingency provision: A 3% of the total amount of budget items 3 to 7 (i.e., HKD660,280), with the exclusion of Staff expenses (items 1 and 2) and audit fee (item 8), is requested to be the contingency provision, so it would be HKD19,808.

The total amount of budget is HKD1,656,005 (rounded to the nearest hundred to \$1,656,100), the difference of \$95 is allocated to General expenses.

Expected Project Outcomes

1. **Enhanced Professional Knowledge and Awareness**: The HK-DIVE aims to significantly improve in-service teachers' understanding of dyslexia, particularly in reading and writing difficulties faced by Chinese students. This is expected to be evident through improved pre- and post-test performances in the experimental group and in comparisons with the control group.
2. **Improved Teaching Plans for Dyslexia**: The project anticipates that teachers, post-intervention, will be better equipped to design suitable teaching plans for students with dyslexia, demonstrating adaptability in content, process, and product (assessment) aspects of teaching.
3. **Increased Engagement and Interaction**: By incorporating VR and gamification elements, the program aims to foster higher engagement and interactive learning experiences for teachers, enhancing their motivation and involvement in the learning process.

Project Evaluation

1. **Attitude and Knowledge of Teaching Dyslexia**: The effectiveness of HK-DIVE will be evaluated using a rigorous research design, Pretest-Posttest Control Group Design, to quantitatively assess the improvements in attitude and knowledge by administering structured questionnaires for Chinese students with dyslexia.
2. **Creations of Teaching Plans**: The same research design will be used to examine the participants' capabilities to create suitable teaching plans for this type of SEN.

Sustainability of Project Outcomes

1. **Integration into Professional Development Programs**: The HK-DIVE, upon proving effective, could become a standard tool in Hong Kong for in-service teacher training programs, ensuring long-term benefits in enhancing teaching quality for students with dyslexia.
2. **Ongoing Use and Adaptation**: The VR program's design allows for updates and adaptations, making it a sustainable resource that can evolve with emerging educational needs and technological advancements.
3. **Spreading Awareness and Knowledge**: By involving teachers and principals in the project and encouraging them to share their experiences, the project aims to create a ripple effect, leading to broader awareness and understanding of dyslexia in the educational community.

Dissemination/Promotion of Project Outcomes

1. **Sharing Seminars**: The project plans to conduct a series of seminars to disseminate its findings to a broader audience ($N = \sim 300$), including educators and parents. This approach will facilitate knowledge transfer and collaborative dialogue.
2. **Engaging Educational Stakeholders**: The project outcomes will be shared with course coordinators and instructors involved in professional development in special and inclusive education, fostering wider adoption and implementation.
3. **Publication and Outreach**: The findings and experiences from the project will be documented and possibly

published in relevant educational journals or platforms, ensuring that the knowledge and insights gained reach a wider audience beyond the immediate participants of the study.

Report Submission Schedule

Our organisation commits to submit proper reports in strict accordance with the following schedule:

Project Management (Should be submitted via the “Electronic Project Management System” (EPMS))		Financial Management (Hard copy together with supporting documents should be submitted to the QEF Secretariat by mail or in person)	
Type of report and reporting period	Report due on	Type of report and reporting period	Report due on
Progress Report 01/01/2025 - 31/12/2025	31/01/2026	Interim Financial Report 01/01/2025 - 31/12/2025	31/01/2026
Progress Report 01/01/2026 - 31/12/2026	31/01/2027	Interim Financial Report 01/01/2026 - 31/12/2026	31/01/2027
Final Report 01/01/2025 - 31/12/2027	31/03/2028	Final Financial Report 01/01/2027 - 31/12/2027	31/03/2028

Asset Usage Plan

<u>Category</u>	<u>Item/Description</u>	<u>No. of units</u>	<u>Total cost</u>	<u>Proposed plan for deployment</u>
Equipment	VR devices	20	140,000	After the completion of the project, our organisation will continue to make good use of the equipment to organise teacher training programs.

Declaration

- (1) Our organisation confirms that the copyrights of the deliverables/materials should be owned by the QEF and accepts the QEF Intellectual Property Rights Policy and ensures that the deliverables shall not infringe any copyright or other intellectual property rights of any third party.
- (2) The expenditure items funded by the QEF are one-off. Our organisation would bear the recurrent expenditure incurred, including maintenance costs, daily operating costs, etc. and the possible consequences that may arise.
- (3) Our organisation would ensure that all procurement of goods and services is conducted on an open, fair and competitive basis with measures taken to avoid conflict of interests in the procurement process.
- (4) In order to ensure the openness, fairness and competitiveness of the procurement of goods (including equipment) and services as well as appointment of project staff, our organisation would conduct quotation/tendering exercise and open recruitment exercise in accordance with the QEF General Guidelines on Staff Administration and Procurement Matter.

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