Research Framework of the Impact of Online Dynamic Assessment on Science Reading Comprehension of Students in a Remote Mountain Region

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Abstract: The purpose of this study was to discuss the impact of online dynamic assessment of reading comprehension on science (DARCS) on fifth and sixth grade elementary school students in a remote mountain region, and to analyze the students' reading performance and reading awareness. The quasi-experimental design method was employed in this research. The subjects were divided into two experimental groups, the online dynamic assessment groups (reading-while-listening group and silent reading group) and a control group using traditional paper assessment. Research results provided useful insight to the reading comprehension effectiveness for socially disadvantaged school children living in mountain regions, in hopes that these children may benefit from research conclusions and that teachers may adjust teaching and instruction methods accordingly.

Keywords: Science reading awareness, dynamic assessment, science reading comprehension

Introduction

Newton once said, "If I have seen further, it is only by standing on the shoulders of giants." Reading opens up one's view of the world, and is the means by which students in remote mountain regions see the world beyond their daily lives. Effective reading is also an important channel for students to communicate and exchange experiences with others. With proper guidance and instruction from teachers, students' reading effectiveness may be vastly improved. In the 21st century, where knowledge has become increasingly digitalized, online reading has become the most convenient and effective way of acquiring information.

The school at which the researcher serves is situated in the remote mountain regions of southern Taiwan, where distance and inaccessibility has obstructed students from receiving outside information. The disastrous aftermath of the 88 Typhoon in 2009 and 314 Earthquake in 2010 have robbed locals of their livelihoods. Younger generations have been obliged to make their livings away from home, resulting in many issues regarding student families such as single-parent homes, grand parenting, and students with parents who are new immigrants. The students in these mountain regions lack cultural stimulation and adequate resources for home learning. School teachers often neglect the importance of reading, causing students to lose interest in reading and unable to learn outside of school,

and thus resulting in a complete lack of motivation and willingness to learn from extracurricular reading.

After the natural disasters affected the region, the media conducted many in-depth reports on local conditions, thereby providing increasing visibility. Government assistance and private donations surged in, helping to reconstruct school buildings and local structures destroyed in the disasters. Students and locals received second-hand computers, as well as the care and concern from around the island. Unfortunately, students were unable to fully utilize the donated computers, or to gain interest in reading and improve their reading comprehension, because teachers were unable to provide assistance and effective instruction in this aspect.

Science texts are structurally different from language and descriptive texts in that science text structures often include description, questions, chronology, comparisons, causal relations, procedures, and theorizations. Science texts employ a specific vocabulary, grammatical language and semantics [1] that is less familiar to school children in the remote mountain regions. Science experts employ previous knowledge to grasp and acquire information contained therein, and they use charts and graphs to clarify concepts, rationalize, and analyze the causal relations in this information to construct concepts and achieve understanding of the topics discussed. According to the theory of interactive construction, reading comprehension requires that the readers interact and exchange with the text at hand. When students read science texts, they interact with their peers through ordinary conversation, and that is the way they learn to construct meaning out of the text, thereby improving their reading comprehension, metacognitive skills, and reading effectiveness to become a good skillful reader.

Dynamic assessment was innovated to complement the limitations of static paper tests in traditional evaluations. Feuerstein [2] suggested that dynamic assessment not only serves to evaluate previous knowledge, skills, or experiences, but to evaluate growth process, changes, and learning readiness. Its purpose is to evaluate children's developmental potential, to understand how their difficulties while solving the problems, so as to provide effective instructions. Dynamic assessment provides real-time feedback according to students' response, and teachers may adjust their teaching strategies according to students' problem-solving process. Online dynamic assessment may also be used to provide one-on-one instruction, which differs from classroom courses where students must pay more attention to the tasks at hand. The application of dynamic assessment on reading learning may help to improve student comprehension of science information.

Language learning is a transitional process from the external to the internal, changing the operational qualities of the human mind by internalizing the structure of language, thereby causing human thought to evolve from a biological level to a higher intellectual level. Reading-while-listening helps students to recognize words, and for them to associate meaning with words, helping them to better understand the texts they are given. Online reading activities enhanced with reading-while-listening may help to improve students' reading comprehension as well as their understanding of the content of science texts.

According the issues mentioned above, the following specific research questions may be posed with regard to the contributions of online dynamic assessment on the reading learning effectiveness (reading comprehension, reading awareness, and processes of reading) of elementary school students located in a remote mountain region.

1. What are differences in science reading comprehension, science reading awareness between the students from the traditional paper reading group and online dynamic assessment reading groups (reading-while-listening group and silent reading group)?
2. What patterns of reading processes could be found by the students of online dynamic assessment reading groups (reading-while-listening group and silent reading group)?

1. Methods

The current study used quasi-experimental approach and pretest-training-posttest experiment to explore the effects of on-line dynamic assessment on students' science reading comprehension and reading awareness. Students were randomly assigned to three groups: two experimental groups and one control group. Among the two experimental groups, one group will be administered the "reading-while-listening" version of the DARCS (RL-DARCS group), and another group will be administered the original version of the DARCS without "reading –while –listening" (DARCS group). The control group will be administered using traditional paper reading tests.

1.1 Student Samples

Research samples comprised of fifth and sixth grade students from two schools located in a remote mountain regions of southern Taiwan, with 87 students in the experimental groups (47 male students, 40 female students), and 43 students in the control group (22 male students, 21 female students). Among the treatment groups, 44 students were assigned to the RL-DARCS group (22 male, 22 female); 43 students were in DARCS group (25 male, 18 female); the remaining 43 students were in the control group. The students' mother languages comprised of Mandarin Chinese and Minnan. School courses were taught in Mandarin Chinese. Student backgrounds comprised mainly of new immigrant descendents (Indonesian and Vietnamese), and children were raised by grandparents and single parents. Most families made livings out of farming and agriculture, and occupied the mid to lower strata in socioeconomic status.

1.2 Research Tools

In this research, the dynamic assessment for reading comprehension materials was set up on a digital assessment platform system for online science texts, and included three research tools for the analysis of reading comprehension materials: Dynamic Assessment for Reading Comprehension on Science (DARCS), Reading Comprehension on Science Test (RCST), and Inventory of Science Reading Awareness (ISRA).

1.2.1 Dynamic Assessment for Reading Comprehension on Science (DARCS)

Dynamic Assessment for Reading Comprehension on Science includes four major dimensions: identification of scientific vocabulary, reasoning, making inference, and identification of main idea. There were 14 science reading texts, each text included 4~7 diagnostic questions, a total of 69 questions. The DARCS program was stable with internal consistency 0.84 for grade 5 students and 0.85 for grade six students. IRT discrimination (value a) of the total test was 1.11, difficulty (value b) was 0.52, and guess rate (value c) was 0.23. The tool was appropriate for this group of students.

1.2.2 Reading Comprehension on Science Texts (RCST)

Similar to the components of DARCS, RCST includes four major dimensions: identification of scientific vocabulary, reasoning, making inference, and identification of main idea. There were 12 science reading texts, each text included 3~5 diagnostic questions, a total of 52 questions. The internal consistency of RCST was 0.74 (grade 4version) and 0.80 (grade 6). IRT discrimination (value a) of total test was 0.63, difficulty

(value b) of was 0.76, guess rate (value c) was 0.20. This tool was used to explore the students' comprehension of science information.

1.2.3 Inventory of Science Reading Awareness (ISRA)

Inventory of Science Reading Awareness was developed by Yore, et al. [3] and translated into Chinese by Wang, et al. [4]. ISRA aims to examine students' metacognitive awareness of science reading across three dimensions: science reading, science text and science reading strategies, and there were 63 items in total. Reliability value α of each dimensions fell between 0.37~0.66. The total reliability was 0.75.

1.3 Research procedure and Administration

This research was conducted in the 2012 school year for a total of four months. Implementation procedure was as follows: pre-test, first stage of reading training with DARCS, mid-test, second stage of reading training with DARCS, post-test, and three weeks delayed test. The pre-test consisted of administering the RCST, ISRA and memory capacity tests on all three groups with the same textual content. In the first stage teaching experiment, the two experimental groups underwent reading training with online DARCS on eight textual instruction sessions; the control group underwent paper reading tests on the same eight texts. The midway test consisted of RCST on all three groups on the same textual content. In the second stage reading training, the two experimental groups were administered simultaneously with online DARCS on six textual instruction sessions; the control group underwent paper reading tests on the same six texts. The post-test consisted of RCST and ISRA tests on all the three groups at the same time. Three weeks later, RCST delayed tests were administered to all three groups.

1.4 Data Analysis

To answer the first research question, ANCOVA analysis was conducted to differentiate the treatment results of the three groups. For the second research question, the students' responses to the treatment on the online DARCS were collected including reading time, item-answering time, number of prompts used, and number of re-readings for each unit of reading. The longitudinal analysis was conducted to understand the changing patterns of students' reading processes.

2. Discussion

In this study, comparisons were made among traditional paper assessments, online RL-DARCS, and online DARCS in order to explore the effects of dynamic assessment on students' science reading awareness and comprehension in a remote mountain region. The results of this research will provide insight to raising students' science reading comprehension that will benefit socially disadvantaged school children in mountain regions, in hopes that teachers may adjust teaching and instruction methods accordingly.

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