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Si Raca App in Quantum Learning, Is It Effective to be Implemented in Early Reading Material for Primary School?

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Abstract

There are various learning applications on the Play Store to facilitate students' learning process. The application can contain learning materials of making alphabets sounds, alphabet tracing, and reading. One of it which can be utilized to teach early reading skill is Si Raca app. This study aims to investigate the integration of Si Raca app in quantum learning and its effectiveness in early reading materials for primary school. This study is quantitative research in form of quasi-experimental study that implements non-equivalent control group design. The participants are first grade students of primary schools. Test is utilized as research instrument. This study involves experimental and control groups. The experimental group utilizes Si Raca App in quantum learning which implements TANDUR technique. It stands for Tanamkan, Alami, Namai, Demonstrasikan, Ulangi, and Rayakan (Instilling, Experiencing, Labeling, Demonstrating, Repeating, and Celebrating). The control group does not utilize Si Raca App in quantum learning. Results of this study show that Si Raca app can be integrate into quantum learning because it can be collaborated with educational technology. Moreover, Si Raca app is effective to be implemented in quantum learning for early reading materials. It can be concluded that the integration of Si Raca app into quantum learning creates new learning syntax.

Keywords: Early Reading, Primary School, Quantum Learning, Si Raca App.

Introduction

Self-development process in primary school will be determined by the class level and learning activities provided. Primary school is further education level after the students have studied in kindergarten which develops their personalities, abilities, academic achievements (1). During primary school level, students are aged 5 – 12 years old (2). This middle childhood make them more able to develop their physics, emotion, social, and cognitive (3). Therefore, primary school level is an important level for students to obtain self-development before coming to higher level. Learning activities in primary school drive students to be more active and interested rather than learning at home (4). Therefore, it is important for teachers to ensure that school learning is compatible with students' development especially in the first year of school (5). In the first year, learning process has to develop students' critical thinking skill (6) and literacy skill as in learning to read (7). Early reading is an activity which is closely related to reading skill in the first year of primary school. In line with past study (8), reading skill is greatly influenced by cognitive factors and early reading activities provided. Furthermore, several researchers state that early reading materials provide general knowledge as basic of education for students (9) including phonology in distinguishing sounds, vowels, consonants, and words (10). Early reading is the first stage in formal education to detect intellectual development, cognitive correlation (11), and the ability to create narrative text (12) which is important to increase the quality of education (13). The activities of early reading become a basis of developing students' memories and understanding of all subjects (14) that can increase their cognitive and spiritual intelligences (15). This can be a part of language learning (16). The students are able to avoid difficulties in future learning (17). This makes early reading becomes the main material to be intensively taught in primary school rather

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than another academic subject (18). Therefore, early reading materials have to be well mastered by students to ensure them having basic literacy and understanding of all academic subjects. However, early reading is more difficult to be taught and understood by students. Several researchers in past study (19) explain that in almost all countries including Indonesia, the reading skill is low and becomes an educational or social problem. This is closely related to external factors such as reading materials (20), parental support (21), and teachers' roles in teaching early reading (22). Therefore, teachers have to organize learning activities using the most appropriate learning model or approach (23). Learning model or approach is indirectly referred to the success of teaching early reading. Learning model is stated as teacher's strategy to improve students' reading skill (24). Teachers can choose quantum learning that solves early reading problems in the classroom (25). In addition, this quantum learning can improve students' early reading skill (26). Quantum learning is considered as an innovation that can change learning direction through various classroom interactions, so it enables students to present learning independences (27). In other words, quantum learning is said as a process to accelerate students' learning process (28) by giving chances for them to learn, access various learning sources, communicate, and interact (29). It makes this learning model has mostly implemented internationally and obtained a lot of recognition from academic experts (30). It can be stated that quantum learning is a learning model that is recognized by many academic experts because it facilitates students by providing freedom to learn. Quantum learning has many benefits and advantages as a basis of teaching and learning process. It provides freedom for students to obtain learning knowledge, train, and get more impressive learning results (31). It is also able to create fun and effective interaction because students are active in classroom learning (32). Moreover, it requires group works that build comfortable learning circumstances, so students' abilities can be developed (33). The advantages of quantum learning in improving students' skills have been proven by several researchers. In past study (34), the researcher utilizes quantum learning with TANDUR technique which stands for Tanamkan, Alami, Namai, Demonstrasikan, Ulangi, and Rayakan (Instilling, Experiencing, Labeling, Demonstrating, Repeating, and Celebrating) to improve students' writing skill in primary school. However, quantum learning model in previous research does not provide much progress because teacher's media is stated to be boring. So, the researcher presents serial images as media in implementing quantum learning. It makes students' writing skill on simple essay to be improved. Unfortunately, the previous research only focuses on learning activities and writing result of simple essay. It is different with this study which focuses on the improvement of students' early reading skill. Furthermore, the previous research has not explained the types of serial pictures used. Quantum learning is also discussed in previous research (35) that is implemented to train students' speaking skill in primary school. The researcher utilizes BUPETIK media from book publishing of Erlangga Group. Result of previous research focuses on the learning process, so the researcher has not explained the detail improvement of students' speaking skill in quantum learning. Its results show that quantum learning using book media has problems such as students are less active and the materials cannot be quickly understood. Quantum learning has also been discussed in past study (36). The researcher compares Quantum-Learning Methodology (QLM) to conventional learning method using whiteboard and Microsoft PowerPoint in teaching students at nursing department. Its results show that QLM improves learning process, students' motivation and retention. The combination of motivation and better learning process can lead to more and longer retention. The QLM is implemented using the stages of experience, label, demonstrate, review, and celebrate (EEL DR. C). Moreover, research in the past (37) discusses the implementation of quantum learning in teaching listening skill at primary school. In the learning process, teacher utilizes audiovisual media in form of children videos. Its results are quite satisfactory because students' listening skill is improved. However, focus of that previous study is on result of listening skill. So, the researcher suggests developing more discussion on reading skill after conducting listening. Furthermore, it has not explained more about the audiovisual media used in quantum learning. Based on background of study and recommendations previous research,

research gab in this study is related to the use of mobile application named Si Raca app in quantum learning. Si Raca App stands for Aplikasi Terampil Membaca (Reading Skill Application). This application can be downloaded inhttps://play.google.com/store/apps/details?id =air.Siraca. The icon of Si Raca app can be viewed in Figure 1.

This application contains the materials of reading alphabets, reading vowels, reading consonants, reading syllables, reading words, reading sentences, and reading narrative texts. In addition, this application has games and exercises. The main menu of Si Raca app can be viewed in Figure 2.

Figure 1: Icon of Si Raca App

Figure 2: The View of Main Menu

Si Raca app is also equipped with musical instrument which is automatically turned on or off using the button provided. This application can be used by students, teachers, parents in kindergarten and primary school levels. The menus can be explained as follows. A number of studies related to the use of application in learning process have been conducted. However, each application has its own materials that are implemented in various learning model to assess different skills. A previous study (38) was conducted to combine learning and playing. The researcher created android application in form of educational game containing the names of things surrounding. Moreover, another study (39) was carried out to create an application about the legend of villages in Madura. This application contained stories of Jokotole as the main figure to reveal those legends in his journey. A research (40) related to application had been conducted which revealed that sevima edlink app was able to increase lecturers' and students' performances in flipped classroom learning. In line with another study (41) who implemented construct 2 applications in the quantum teaching of geometric material. It resulted on the improvement of students' mathematical understanding. Different research (42) had been conducted in which Chinese Skill application was utilized to facilitate students in listening appropriate pronunciation, so they could increase their pronunciation skill by paying attention to intonation and punctuation in speaking Mandarin. Recent study showed that DORA (dongeng nusantara) application significantly improved students' listening skill to fairy tales (43). Furthermore, a study (44) revealed that the developed Android-based application could be utilized in teaching early reading or as a

media in autonomous learning. In addition, a research (45) showed that BATAKU as Android-based digital media could increase students' skills to write explanation texts in sixth grade of primary school. When Si Raca app is implemented in quantum learning to teach early reading at primary school, it requires careful adjustment to ensure that the approach is appropriate for students' understanding and development. However, the proper plannings make this application to be effective in improving students' understanding in reading activities. Therefore, a study is needed to investigate the ways to integrate and evaluate the effectiveness of its implementation in quantum learning. It is conducted to measure students' reading skill in primary school. In this case, this study has not been conducted by previous researchers. Si Raca app will be included in the syntax of quantum learning to teach early reading at primary school. The objective of this study is to investigate the integration of Si Raca app into quantum learning and the effectiveness of Si Raca app when it is implemented in early reading materials at primary schools. Si Raca App has been integrated into quantum learning in early reading materials. In other words, students learn to read using Si Raca App as a form of digital literacy. Moreover, the researchers investigate students' cognitive development to reveal that their early reading skill is better when Si Raca App is implemented.

Methodology

This study was quantitative research in form of quasi-experimental study that implemented non-equivalent control group design. This research design was utilized because of the limitation of randomization in schools or classes environments that were naturally divided. This research design tended to be more efficient in terms of time and energy without needed random formation of experimental and control groups. This design can be viewed in Figure 3.

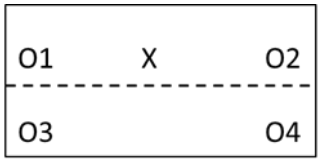

Figure 3: Research Design

notes:
O1 = Experimental group before giving treatment
O2 = Experimental group after giving treatment
O3 = Control group before giving treatment
O4 = Control group that was not given any treatment
X = Treatment (The use of Si Raca app in quantum learning)

Participants of this study were divided into two groups. The first participants were in experimental group consisting of 87 students in the first grade of primary school at Sugihwaras District. The second participants were in control class consisting of 76 students in the first grade of primary school at Sukosewu District. This sample size was adjusted to the available population, so the number of participants in each group could not be changed. By selecting students in one place, the researchers could manage them easier. Although the number of each group was different, this sample size was considered to be sufficient for analyzing the treatment effects statistically. Research instrument of this study was test. It was adopted from past study (19) that covered reading syllables, words, sentences, and narrative texts. The instrument of reading skill can be viewed in Table 1.

Table 1: Instrument of Reading Test

No.	Type of Questions	Assessment Indicators				Total Score
		Fluency	Accuracy	Pronunciation	Intonation	
1.	Reading syllables					
2.	Reading words					
3.	Reading sentences					
4.	Reading narrative texts					
					Score	

Table 1 was filled using Likert scale from 1 to 5 (Score 1 = very bad, score 2 = bad, score 3 = quite good, score 4 = good, and score 5 = very good). Metrics for this Likert scale was from 1 to 5. The researchers chose to use it to conduct structured and quantitative evaluation on various aspects easier. Moreover, this metrics was effective to measure student's skill in primary school level. This Likert scale provided appropriate range of ratings to reflect variance of effectiveness. It was started from "very bad" to "very good" level without losing data interpretation. The choice of this scale was because it was relevant to create consistent evaluation standards, enable statistical analysis, and reduce subjective bias measurement. Furthermore, score 5 was considered to be optimal for maintaining data sensitivity in the population of primary school students by keeping its practicality and accuracy. Likert-based evaluation was used to assess the effectiveness holistically through quantified indicators. The use of reading syllables, words, sentences, and narrative texts in reading test was important to evaluate students' reading skill comprehensively. Test in reading syllables was utilized to measure student's basic skill in recognizing language sounds. Test in reading words was utilized to evaluate student's visual recognition and understanding its definitions. Test in reading sentences was utilized to measure student's understanding about the syntactic structures and simple contexts. Test in narrative texts was utilized to measure student's reading skill in finding main ideas, important details, and making conclusions. This gradual test reflected the process to read naturally from basic to advanced level. It provided complete description about student's reading skill and facilitated to identify the developed area. Procedure of this study involved experimental group which implemented Si Raca app in quantum learning (TANDUR) and control group which implemented quantum learning (TANDUR) without Si Raca App. In this stage, the differences between both groups were analyzed to investigate the effectiveness of Si Raca app.

Technique in analyzing data was started by calculating the total score of students' reading skill using a formula:

$$Total\ Score\ = \frac{Total\ score\ of\ each\ indicator}{20\ (maximum\ score)}\ x\ 100$$ [1]

Furthermore, student's reading skill was calculated using a formula:

$$Score\ = \frac{Total\ Score}{4\ (assessment\ indicators)}$$ [2]

After obtaining students' scores in control and experimental groups, it had to test its normality, homogeneity, balance, and hypothesis testing. These four tests are described as follows.

Before testing balance and hypothesis, it is needed to ensure that the data was normal. The normality test in this study was used Lilliefors method. The formula used was as follows

$L = \text{Mak}|F(z_i) - S(z_i)|$ [3]

The critical area was calculated using the following formula.

$DK = \{ L \mid L > L_{\alpha;n} \}$ [4]

The value of $L > L_{\alpha;n}$ which was obtained from Lilliefors table with significance level or α = 5% and degree of freedom n (sampel size). Data is stated to be normal when the value of $L_{Max} < L_{table}$ (46).

The next step was to test homogeneity. The data had to test its balance and hypothesis. The result had to be homogeneous. In this homogeneity test, the researcher used Bartlett test with the following formula.

$$\chi^2 = \frac{2{,}303}{c}\left[f\ log\ log\ R\ KG - \sum_{j=1}^{k} \quad f_j\ log\ log\ s_j^2\right]$$ [5]

with: $\chi^2 \sim \chi^2_{\alpha,k-1}$

The critical area was measured using the following formula.

$DK = \{\chi^2 | \chi^2 > \chi^2{}_{\alpha;k-1}\}$ [6]

When the value of α = 5% and (k-1), the value of $\chi^2_{\alpha,k-1}$could be viewed in table of chi-square with the degree of freedom (k-1). Data was stated to be homogeneous when the value of χ^2 count < χ^2 table (46).

Balance test was conducted to ensure that experimental and control groups had the same skill level. Balance test of this study was measured using t-test.

$$t = \frac{\left(\underline{X}_1 - \underline{X}_1\right)}{S_p\sqrt{\frac{s_1{}^2}{n_1}+\frac{s_2{}^2}{n_2}}}$$ [7]

The critical area was measured using the following formula.

DK = $\left\{t \mid t < t_{\frac{\alpha}{2},v}\ atau\ t > -t_{\frac{\alpha}{2},v}\right\}$ [8],

with a= 5%

Data was stated to be balance when the value of t count < t table.

Hypothesis testing of this study was used t-test.

$$t = \frac{\left(\underline{X}_1 - \underline{X}_1\right)}{\sqrt{\frac{s_1{}^2}{n_1}+\frac{s_2{}^2}{n_2}}}$$ [9]

The critical area was measured using the following formula.

DK = $\left\{t \mid t < t_{\frac{\alpha}{2},v}\ atau\ t > -t_{\frac{\alpha}{2},v}\right\}$ [10],

with a = 5%

Hypothesis was accepted (H_1 was accepted) when the value of t count > t table (46).

Results

In digital era, the integration of Si Raca app in quantum learning provides more competitive learning experiences. Utilizing technology enables students to obtain more material understanding and improves their early reading skill. This integration creates new learning approach, encourages the collaboration and appreciation of holistic and inclusive education. The integration of Si Raca app in quantum learning produces a new learning syntax starting from T (Tanamkan/Instilling), A (Alami/Experiencing), N (Namai/Labelling),D(Demonstrasikan/Demonstrating),U(Ulangi/Repeating),R(Rayakan/Celebrating). Each stage of TANDUR is integrated in Si Raca app. This new learning syntax can be implemented in teaching early reading. The syntax can be viewed in Table 2.

Table 2: Integration of Si Raca App in Quantum Learning

Concept of Quantum Learning	Integration of Si Raca App in Quantum Learning Method
T	Teacher provides information about Si Raca app in front of the class and asks to download it on https://play.google.com/store/apps/details?id=air.Siraca. Teacher introduces Si Raca app to students, explains its features and benefits in improving reading skill Teacher instills knowledge about the important of critical and creative reading for self-development and solving problems using exercises and games. **Purpose:** To motivate students and encourages their motivation
A	Teacher facilitates direct learning in reading 1) alphabets, 2) vowels, 3) consonants, 4) syllables, 5) words, 6) sentences, and 7) narrative texts in Si Raca App. Students reading various texts in Si Raca app. Teacher asks students to enlarge their knowledge and learning experiences by playing games and doing exercises in Si Raca app. Teacher investigates the reasons of students' answers. **Purpose:** To facilitate students in direct learning
N	Students utilize Si Raca app to identify and label the concepts of reading texts such as themes, arguments, and important facts. Students learn to define the new words and relate it to a broader context. Teacher asks students to make conclusion of their reading texts. **Purpose:**

	To label relevant terms and define important concepts
D	. Teacher asks students to have critical, creative, and cooperative reading in front of the class using Si Raca app . Teacher asks students to raise a critical question, make a summary, and present it orally . Teacher asks students to work in pairs to continue the simple stories provided **Purpose:** Students show their understanding by demonstrating or presenting.
U	. Students are given additional assignment to repeat and enrich their understanding of texts in Si Raca app. . Teacher provides quiz and additional exercise on matching texts with appropriate pictures to measure students' understanding **Purpose:** To repeat materials in order to strengthen students' understanding and skill.
R	. Teacher provides awards for students' achievements by giving compliment or simple prize. . Teacher and students conducts reflection by sharing their experiences and achievements. **Purpose:** To celebrate success and give reward for students' achievements.

Quantum learning emphasizes on interactive and fun learning which is in line with features of Si Raca app. This application utilizes technology to provide learning materials in form of sounds, animations, and simulations. It makes the materials to be easily understood. Games in this application motivate students because of its challenges. Si Raca app builds individual and adaptive learning which adjusts to the materials and students' abilities. This integration is able to improve teacher and students engagement. Teacher can create more personal and effective learning. Therefore, Si Raca app enriches students' learning experiences and supports quantum learning in creating holistic, dynamic, and innovative learning. It is in line with a concept that quantum learning gives positive influence on students' academic achievement and self-confidence (31). To investigate whether Si Raca app is effective or not when it is implemented in early reading materials at primary school, it requires balance test and hypothesis testing. The test results can be explained as follows. Normality test in this study uses Lilliefors method. The significance level is 5%. Analysis result of normality data can be viewed in Table 3.

Table 3: Normality Test of Daily Test

Group	Experimental	Control
n	87	76
Total	7148	6277
Mean	82,16091954	82,59211
Deviation Standard	5,609115428	5,654916
L Max	0,087730547	0,09262
L Table	0,094989171	0,101631
Conclusion	Normal	Normal

In Table 3, it can be viewed that the value of L_{Max} in experimental class is 0,087730547 and the value of L_{table} is 0,094989171. Because the value of $L_{Max} < L_{table}$, it can be concluded that the data of experimental group is normal. The maximum score or L_{Max} in control class is 0,09262 and the value of L_{table} is 0,101631. Because the value of $L_{Max} < L_{table}$, it can be concluded that the data of control class is normal. In this study, Bartlett method is utilized to test homogeneity. The calculation result in experimental and control groups can be viewed in Table 4.

Table 4: Homogeneity test of daily test scores

Variance	**31,46217589**	**31,97807018**
n	87	76
k	2	
db	86	75
log Var	1,497788755	1,504852251
log var. db	128,8098329	112,8639188
db.var	2705,747126	2398,355263
Var combination	31,70249931	—
B		—
	241,6760538	
χ^2 Count	0,005301626	—
χ^2 Table	3,841458821	—
Conclusion	Homogeneous	—

In Table 4, the value of χ^2_{count} is 0,0053, and the value of χ^2_{table} is 3,841. Because the value of $\chi^2_{count} < \chi^2_{table}$ it can be concluded that the data of daily test in experimental and control groups is homogeneous.

To obtain valid result, balance test has to be conducted before giving treatment. It aims to ensure that both groups have the same abilities. Balance test is conducted using t-test. Its results can be viewed in Table 5.

Table 5: Balance Test of Daily Test Scores

Mean	82,16091954	82,59210526
Deviation standard	5,609115428	5,654915576
variance	31,46217589	31,97807018
n	87	76
t count	-0,487472844	—
t table	2,262558579	—
Conclusion	Balance	—

In Table 5, the value of t_{count} is -0,4875, and the value of t_{table} is 2,2626. Because the value of $t_{count} < t_{table}$, it can be concluded that experimental and control groups have balance abilities. Normality test needs to be conducted before testing hypothesis. It is conducted using Lilliefors method. The results can be viewed in Table 6.

Table 6: Normality Test of Students' Reading Scores

Group	**Experimental**	**Control**
N	87	76
Total	7248,75	5367,5
Mean	83,31896552	70,625
Deviation Standard	5,718148593	5,800503
Lo Max	0,075508352	0,096938
L Table	0,094989171	0,101631
Conclusion	Normal	Normal

In table 6, it can be viewed that the value of L_{Max} in experimental group is 0,07551 and the value of L_{table} is 0,09499. Because the value of $L_{Max} < L_{table}$, it can be concluded that the scores of experimental group are normal. Meanwhile, the value of L_{Max} in control group is 0,09694 and the value of L_{table} is 0,10163. Because the value of $L_{Max} < L_{table}$, it can be concluded that the scores of control group are normal. Homogeneity test is pre-requisite before conducting hypothesis testing. It was tested using Bartlett method. Its results can be viewed in table 7.

Table 7: Homogeneity Test of Students' Reading Scores

Variance	32,69722334	33,64583333
n	87	76
k	2	
db	86	75
log Var	1,514510874	1,526931289
log var. db	130,2479351	114,5198467
db.var	2811,961207	2523,4375
Var combination	33,1391224	—
B	244,7749015	—
χ^2 Count	0,016396603	—
χ^2 Table	3,841458821	—
Conclusion	Homogeneous	—

In table 7, it can be viewed that the value of χ^2_{count} is 0,0164, and the value of χ^2_{table} is 3,8415. Because the value of $\chi^2_{count} < \chi^2_{table}$, it can be concluded that students' scores in experimental and control groups are homogeneous. The results of t-test in hypothesis testing can be viewed in Table 8.

Table 8: Hypothesis Testing Using T-Test of Students' Reading Scores

Mean	83,31896552	70,625
Deviation standard	5,718148593	5,800502852
variance	32,69722334	33,64583333
n	87	76
t count	14,03064906	—
t table	2,262558579	—
Conclusion	Ho is rejected	—

In table 8, it can be viewed that the value of t_{count} is 14,0306, and the value of t_{table} is 2,2626. Because the value of $t_{count} > t_{table}$, so H_0 is rejected and H_1 is accepted. It can be concluded that the use of Si Raca app in quantum learning is effective for teaching early reading.

Discussion

Si Raca App can be integrated in quantum learning because this learning method can utilize technology. Therefore, Si Raca app can be used to enrich students' learning experiences in quantum learning. On the other hand, parents' educational backgrounds and student's habit in using application are not mentioned in this study to avoid confounding variables. It does not influence students' early reading skill. Moreover, technology-based quantum learning is able to optimize students' learning activities and outcomes (47). Quantum learning can be combined with learning media (48). Result of a research shows that it can be implemented to all fields of study using interactive media (49), so it influences students' academic achievements, retention, and positive attitudes (50). Si Raca app in quantum learning is designed to facilitate students in improving their reading skill interactively. It is able to provide more effective learning experiences. In reading context, Si Raca app contains elements of stories, interesting animations, and clear sounds to create more interesting learning which can be easily remembered. Children are able to read in natural and fun ways because they are actively involved in the stories to solve challenges in this application. Furthermore, this application supports teachers and parents in monitoring children's development, providing quick feedback, and adjusting to materials based on children's needs. In other words, Si Raca app not only improves children motivation to read, it also ensures that they obtain needed skill for higher learning level. Results of this study are in line with previous study (44) in which android-based application can be utilized in teaching to read. However, the study (44) only up to developmental stage because of time limitation. Therefore, it focuses to describe validation value or feasibility of Alpabenta application.

Based on the weaknesses in past study (44), this study has to involve experimental and control

groups to investigate the effectiveness of Si Raca app when it is implemented in quantum learning. The novelty of this study is on the use of Si Raca app in quantum learning to improve students' early reading skill. This novelty has not been conducted in previous research. It can be described in Figure 4.

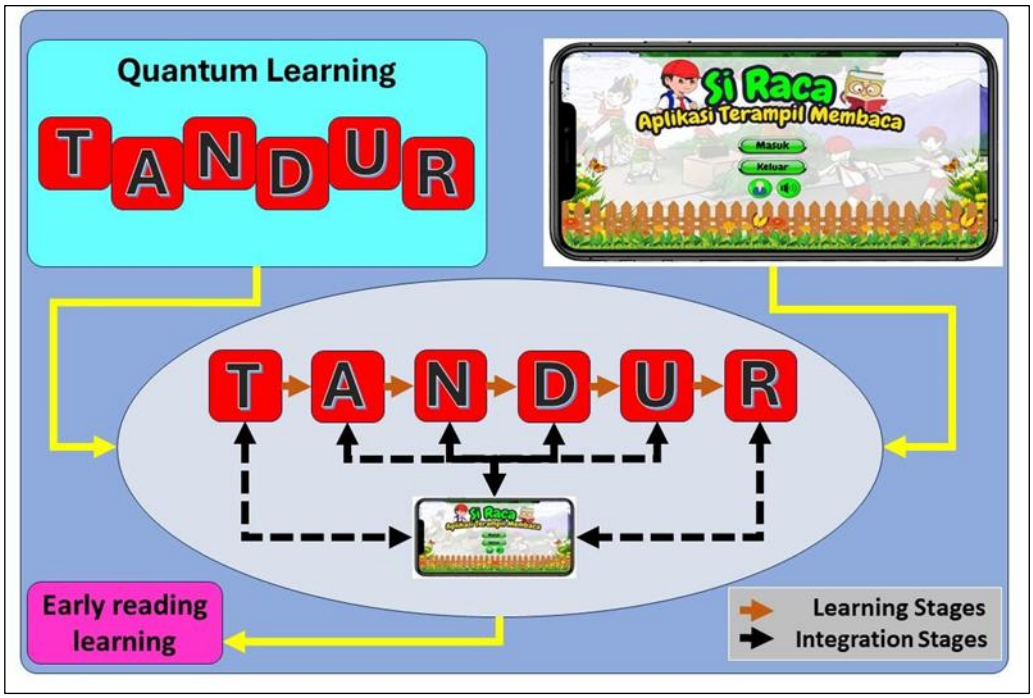

Figure 4: Novelty of This Study

Results of this study have implications for improving learning method because Si Raca app is integrated into quantum learning. It creates effective method to increase students' early reading skill. It can encourage teachers and educational institutions to adopt and develop similar technology in learning process. Moreover, findings of this study show the importance of training and professional development for teachers in utilizing educational technology. Teachers have to obtain specific trainings to optimize the use of Si Raca app and quantum learning in the teaching and learning process.

Conclusion

Conclusions of this study are first, integration of Si Raca app in quantum learning method creates a new learning syntax in early reading. This syntax requires the stages of T, A, N, D, U, R using Si Raca app. It becomes the novelty of this study. Second, Si Raca app in quantum learning is effectively implemented to teach early reading. This effectiveness is based on the results of trials in experimental group compared to control group. This study recommends that Si Raca app is implemented in different learning method such as flipped classroom or hybrid learning. Furthermore, this study provides opportunities for further research in various aspects of educational technology, for example the investigation on long-term effect of using Si Raca app, or the evaluation of its effectiveness in different learning contexts.

Abbreviations

Si Raca: Aplikasi Terampil Membaca, TANDUR: Tanamkan, Alami, Namai, Demonstrasikan, Ulangi, and Rayakan.

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Author Contributions

C. Hasanudin: Making concept, writing article, making figure design; A. Fitrianingsih: Translating the article, analyzing the data; I. Zulaeha: Evaluating article, finding references; N. Fitriyana: Field officer, conducting investigation; K. Saddhono: Reviewing article, conducting validation.

Conflict of Interest

The authors have no conflicts of interest to declare.

Ethics Approval

Not applicable.

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