THE IMPACT OF PRECISION TEACHING ON READING COMPREHENSION IN STUDENTS WITH READING DISABILITIES

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ABSTRACT

Reading fluency is one component of reading that has recently been the focus of attention in reading curricula. It is also considered a bridge between decoding and comprehension skills. Verily, the basic goal of reading is comprehension of texts. Thus, it is essential to add comprehension skills' training to reading fluency training. The purpose of current study was to investigate the effectiveness of precision teaching method on reading fluency and reading comprehension skills in children with reading disorders. In this research, reading fluency is taught in reading words, both out of context as well as in contextual contents. Multiple-baseline across subjects was selected as a research design in recent study. Participants were three third graders: two girls and one boy. The fourth edition of Wechsler Intelligence Scale for Children (WISC-IV), Reading and Dyslexia Test, Fluency Reading Test, and Reading Comprehension Test developed by the researcher, were applied in the current study. Effect Size of intervention and visual analysis were used to analyze the data. Results indicated a considerable difference between the baseline and intervention phase of the participants and they also indicated that the training resulted in considerable improvement in the three variables of word reading fluency, text reading fluency, and comprehension. Precision Teaching Training improve the performance of participants in reading fluently and comprehension. In addition, follow up data indicated that the effects of the intervention procedures were stable across time.

Introduction

Reading is considered a key element for students' successful academic achievement, and learning this skill is highly correlated with success in the society. Reading is a basic ability that is necessary for successful performance in social sciences and math (Kauffman & Hallahan, 2011). Since majority of students find reading a challenging task, discovering effective methods that facilitate reading is one of the compelling tasks for parents and teachers as well (Frieden, 2004). Reading difficulties occur for different reasons. Some readers have difficulty in decoding. Some have weak sight word vocabulary, and some have difficulty in reading fluently. Other students decode proficiently, have adequate grade level or higher sight vocabulary, and read fluently (Buly & Valencia, 2002). However, they fail to comprehend what they read; they are poor readers (Nation, Clarke, & Snowling, 2002; Weekes, Hamilton, Oakhill, & Holiday, 2008). It is estimated that 10% of children have some difficulties in reading comprehension (Yuill & Oakhill, 1991). It is thus important to address this difficulty in remediation planning. It is reported that 47% of students who do not have apparent reading difficulties in primary years have experienced comprehension problems in intermediary levels (Pressley, 2006). Comprehension problems become evident when students start third or fourth grade, and when teacher shifts emphasis from decoding to comprehending (Pressley, 2006; Chall & Conrad, 1991).

Current studies have shown the components of effective instructional practices (Brophy & Good, 1986; Carnine et al., 2004; Gersten, 1998; Rosenshin & Stevens, 1986). Five areas have been found in effective practice: review, presentation, guided practice, feedback, and independent practice. One of the key elements in successful teaching is to have an organized plan before

instruction begins (Kame'enui & Simmons, 1990). Teachers must identify relevant pre-skills that students need to master a specific text. They need to provide enough examples and help students to solve problems related to their text.

In overall behavioral approaches in teaching reading skills to students with reading difficulties have been effective (McConnell, 2011). Behavioral approaches are based on providing an appropriate and on time feedback for students' reading performance. In addition, changing antecedent variables to enhance reading skill is crucially important (Cooper, Heward, & Heron, 2007). One of the behavioral paradigms that has been developed by Lindsley (1990) is precision teaching for slow learners. Precision teaching compared to other behavioral approaches - such as mastery reading and direct instruction - is more student-centered. It is based on students' performance level. One of the principles of precision teaching is acknowledging that students know best. This means that teacher should be a good observer of the pupil's target behavior, and get a hint about changing instructional variables: continue, step back, slice back, step forward or slice forward. Since precision teaching has become a promising practice in the field of Learning Disabilities, its application is recommended for educators and clinicians. However, due to cultural differences, its effectiveness should be tested in Iran prior to recommending its utilization by Iranian educational system. Therefore, these authors aimed to assess the effectiveness of this technique for Iranian students.

Method

Current study was an experimental research. In fact, in this study investigators used a single subject study design, multiple baseline design across subjects. In order to evaluate the effectiveness of the program, baseline condition was compared with the intervention stage. In addition to visual displays, several other methods have been used to assess the treatment effectiveness including the percentage of non-overlapping data (PND), and standardized mean differences (SMD) for each client shown in the diagrams.

Instruments

Devices and measures used in the current study include: Wechsler Intelligence Scale for Children- IV. This test was used to diagnose and distinguish learning disability from mental retardation. That is to exclude individuals whose intellectual functioning is significantly below the average. WISC-IV is developed for children ages of 6-16, and is the most widely used measure of intelligence in children and youth. The fourth version of this test uses variety of verbal, visual, and spatial tasks to show the cognitive ability. This test was administered individually and took 90 minutes. It is consisted of ten core subscales. WISC-IV manual provides a description of the ten core subtests and five supplemental subtests as follows: Block Design, Similarities, Digit Span, Picture Completion, Coding, Vocabulary, Letter- Number Sequencing, Matrix Reasoning, Comprehension, Symbol Search, Picture Completion Cancellation, Information, Arithmetic, Word Reasoning. The mean for composite index scale is 100. The subtest scale scores range from 1 - 19, with most children falling within the range of 7 and 13. This scale has appropriate validity and reliability indices.

Reading Problem Scale

Test of reading problem, developed by Kormi-Nouri and Moradi (2008) is consisted of 10 subtests as the following: Reading Words, Sequences of Words, Reading Comprehension, Reading Proficiency, Rhyme, Labeling, Naming Pictures, Omission of Phonemes, Reading Meaningless Words, and Decoding. The authors intended to assess the reading ability of students in elementary school who are monolingual (i.e., native) or bilingual. This test should be administered individually, and raw scores should be converted to standardized scores before interpreting or assigning meaning to them. The mean of test is 100 and its standard deviation is 15. Internal consistency of the reading problem scale for subtests varies from 0.98 to 0.43. This test is used for normal population as well as students with reading problems. In the current study, students whose scores were 1.5 standard deviations below the mean are considered students with reading problems. Two important inventories that are used in this study were: reading fluency of words, and readings fluency of texts. These tests assessed students' speed in reading words in isolation as well as their speed in reading words in text.

Reading Comprehension Test (RCT)

This test was developed by the researchers to assess students' reading comprehension abilities. The reading comprehension passage was given to students. After reading each passage, seven multiple choice questions were asked to assess the students' level of comprehension. These passages and the multiple choice questions were tested for their suitability, reliability, and validity before application.

Intervention procedure

Intervention procedure was carried out in four stages: collecting and plotting, baseline data intervention phase, generalization, and maintenance checks. Using intervention was based on primary assessment of subjects' functional level (entry level) and functional analysis of students' reinforcing events and performance of students on the task as shown with line of celeration. Based on the performance of each student that was reflected on the celeration chart, researchers decided to continue the same pace, slice back, step back, slice forward, or step forward.

Data and Analysis

In addition to plotting data on the display graph for visual examination, several statistical methods were used to show effectiveness of intervention. Effect size of the intervention was one of indices used to evaluate the effectiveness. Two indices of Effect Size (ES) were used: Percentage of Non- Overlapping Data (PND), and Standard Mean Difference (SMD).

Results

This study was carried out by a single subject design. The mean score for Taha in reading comprehension in the base line was 8.4 (range 6-12) per minutes. After intervention his mean score accelerated and reached 32.7 (range 18-48) words per minutes. The following table shows Taha's progress in reading comprehension as measured by the number of words read per minute in isolation (flash cards).

Table (1): Mean and Effect Size for the first subject (Taha) in reading comprehension

Mean (Correct)		PND (Correct)	SMD (Correct)	Mean (Incorrect)	PND (Incorrect)	SMD (Incorrect)
Baseline	8.4	100%	11.09	4.6	100%	2.23
Intervention	32.7			0.24		

The results show that all subjects benefited from the intervention. Effect Size estimated by PND and SMD was calculated. Table (1) shows the effectiveness of intervention on the first subject, Taha.

Mahtab (Subject 2)

Mean score shows that the correct words read by Mahtab per minute increased from the baseline 1.6 to 5.86. This indicates the effectiveness of the intervention procedure. Table (2) shows significant improvement in Mahtab's reading comprehension as a result of the intervention.

Table (2): Comparison of Means and Effect Sizes of intervention phase for Mahtab's reading comprehension

	Mean (Correct)	PND (Correct)	SMD (Correct)	Mean (Incorrect)	PND (Incorrect)	SMD (Incorrect)
Baseline	1.6	100%	5.75	4.5	100%	4.42
Intervention	5.86			0.43		

Nazanin (Subject 3)

Mean score of correct responses in reading comprehension for Nazanin was 2.4 WPM, while mean of the incorrect response was 3.7 WPM during the intervention. As indicated in Table (3) mean score of correct responding changed from 2.4 to 6.18, whereas mean score of incorrect responses changed from 3.7 to 0.17.

Table (3): Comparison of correct and incorrect responding in reading comprehension in baseline and intervention phases for Nazanin

	Mean (Correct)	PND (Correct)	SMD (Correct)	Mean (Incorrect)	PND (Incorrect)	SMD (Incorrect)
Baseline	2.4	100%	5.46	3.7	100%	3.75

Intervention	6.17			0.17		

As indicated in table (3), precision teaching had a significant effect on increasing Nazanin's performance.

Comparison of the three subjects' performance in reading comprehension

Precision teaching was effective in increasing correct responses and reducing incorrect responses in all three subjects. Table (4) shows the dramatic changes in the rate of students' correct responses as a result of the intervention.

Table (4): Comparison of Means and Effect Sizes during the baseline and intervention phases in reading comprehension

	Baseline	Intervention	PND	SMD
Taha	1.8	5.67	100%	3.42
Mahtab	1.6	5.86	100%	5.75
Nazanin	2.4	6.18	100%	5.46

As indicated in the table (4), all three students have had significant improvements in their grades due to the intervention. As students' correct responses to reading comprehension questions increased, their incorrect responses decreased. Table (5) shows the reduction in student's erratic responses.

Table (5): Comparison of Effect Size of intervention across subjects

	Baseline	Intervention	PND	SMD
Taha	4.4	0.67	85%	2.48
Mahtab	4.5	0.43	100%	4.42
Nazanin	3.7	0.16	100%	3.75

As indicated in the table (5), PND of Taha's scores is 85%. This means that only 15% of data points in baseline and treatment level overlap, while 85% do not. The other two participants don't have any overlapping data points.

Please insert diagram (1) here.

Researchers were interested in examining the effects of precision teaching on fluency building in reading. To this end, they used multiple baseline across subjects. Analysis of data reveled that in all three subjects level of fluency increased. For example, Taha was the first subject whose correct responses increased dramatically (from 8.4 to 32.7). The following table shows this data.

Table (6): Mean and Effect Size of correct responses in the first subject (Taha)

	Mean	PND	SMD
Baseline	8.4	100%	11.9
Intervention	32.7		

In addition to visual analysis of graph, Effect Size indices were also very high.

Mahtab (the 2nd subject) also improved her level of mastery in fluency building as a result of the precision teaching procedure. Mean of her correct responses in the baseline condition was (9.13) WPM, however, this amount increased to 40.1 in the baseline. This means that Mahtab's speed and accuracy improved dramatically in the intervention phase. Table (7) shows Mahtab's results.

Table (7): Comparison of Means and Effect Size for the correct responses in fluency building for the second subject (Mahtab)

	Mean (correct)	PND	SMD
Baseline	9.13	100%	48.4
Intervention	40.1		

Table shows that overlapping data does not exist for the second subject, Mahtab. Therefore, intervention phase is simply a separate graph. Percentile of non-overlapping data showed that one hundred percent of data points in intervention phase were separated from baseline data points.

Nazanin (the 3rd subject)

Analysis of data indicated that Nazanin's progress was significant. Mean of correct number of word uttered by this student during one minute was 100; however it accelerated and reached 40.3 words per minute during the baseline. Results are presented in Table (8).

Table (8): Comparison of Means and Effect Size of correct responses in reading fluency (words) for Nazanin

Statistics	Mean (Correct Responses)	PND	SMD
Baseline	10	100%	19.42
Intervention	40.3		

Table shows Nazanin's progress from the baseline to the intervention phase.

Please insert Diagram (2) here.

In addition to using words (separately) in fluency building, using words in text was also examined.

Text reading (application)

To test the speed of reading words (fluency) in real texts (application), three short stories were selected from the books written for children within 9 - 10 age groups. The pretest- post in single subject design was given prior to each trial. Results showed that the speed of reading words in real text also increased as a result of precision teaching.

The mean of correct responses for Taha (the first subject) in the baseline phase was 24. However, in the intervention phase it increased to 56.5. Table (9) shows the results.

Table (9): Comparison of Means of correct responses and Effect Size for Taha in fluency building (reading the text)

Conditions	Mean (Correct)	PND	SMD
Baseline	24	100%	7.06
Intervention	56.5		

The second subject (Mahtab) was another student who found reading a challenge. She was tested prior to intervention (baseline condition) and after intervention (treatment condition). In reading fluency of the real text, the speed of her correctly read words in baseline was 20.8 WPM. However, that figure dramatically increased in treatment condition to 57.7. Table (10) shows Mahtab's performance.

Table (10): Comparison of Mean score of correctly read words and Effect Size (fluency in text) for Mahtab

Condition	Mean score correctly read	PND	SMD
Baseline	20. 8	95%	10.7
Intervention	57.7		

As evident in the table, PND shows that 95 % of data points are non-overlapping.

Nazanin (the third subject)

The mean of correct responses for Nazanin in the baseline was about 24.4; whereas the mean of correct responses in the intervention phase was 62.4. Table (11) shows the intervention effectiveness.

Table (11): Comparison of mean scores of correctly read words (fluency in text)

Condition	Mean of correct response	PND	SMD
Baseline	24.4	100%	11.76
Intervention	62.4		

Table (11) shows the effectiveness of the intervention. None of the data points in the baseline overlap with the intervention baseline phase.

Please insert Diagram (3) here.

Discussions

The current research aimed at studying the effects of precision teaching on reading comprehension. In this respect, students' understanding of the proposed prose and their ability to correctly answer the questions were assessed. Although some students can read text correctly and fluently, they cannot understand the meaning of what they read. To improve the students' understanding of the text some strategies are needed (William & Atkins, 2004). Stevens and Slavin (1992) showed that children with difficulties in reading comprehension also have difficulties in using cognitive strategies. They don't know how to monitor and after monitoring how to change the problems (Roberts et al., 2008). Difficulty in reading comprehension is observed in majority of students with learning disabilities. Some of these students are competent in reading text fluently; however, they do not grasp the meanings of what they read. When teachers ask them questions about the text they've just read, they can't answer correctly (Kubina & Yurich, 2012).

In the current study, researcher examined the effectiveness of precision teaching on reading comprehension. They concluded that precision teaching was an effective method in increasing reading comprehension with all subjects. The findings revealed that students who were taught basic educational skills with direct instruction and precision teaching showed significantly higher levels of reading comprehension. In another study, Nitti (1990) studied the effectiveness of precision teaching in reading comprehension in five students. Results indicated that precision teaching was effective in increasing their level of reading comprehension. This study was compatible with the findings of the authors. In addition, Selfridge and Kostewicz (2011), who worked with four children with learning disabilities, discovered that precision teaching increased their reading abilities and reduced their mistakes. Students who have difficulties in fluency pay so much attention to decoding and blending that they don't find appropriate time to spend on reading comprehension. Their major concern is to enhance accurate reading and fluency building. Therefore, with gradual enhancement of fluency, they exercise their own mastery level on reading materials and start to spend time on comprehension.

Teachers also played an important role in teaching children strategies that enhance comprehension of the text. Precision teaching has some virtues in terms of education and learning. These include frequent testing and decision making in class in accordance with student's capacity. Moreover, the principle of 'student knows the best' makes teachers conscious about the fact that blaming students for slow patterns of learning will not take the responsibility a way from teachers. Current study showed that changes in the magnitude of reading comprehension will not disappear after termination of treatment. In addition to maintenance, results also revealed that generalization to other appropriate situations is possible. In this study transfer of learning from the taught words in context was also examined. Data indicated that precision teaching is not only a good strategy for learning it is also an appropriate method for generalization and maintenance purposes.

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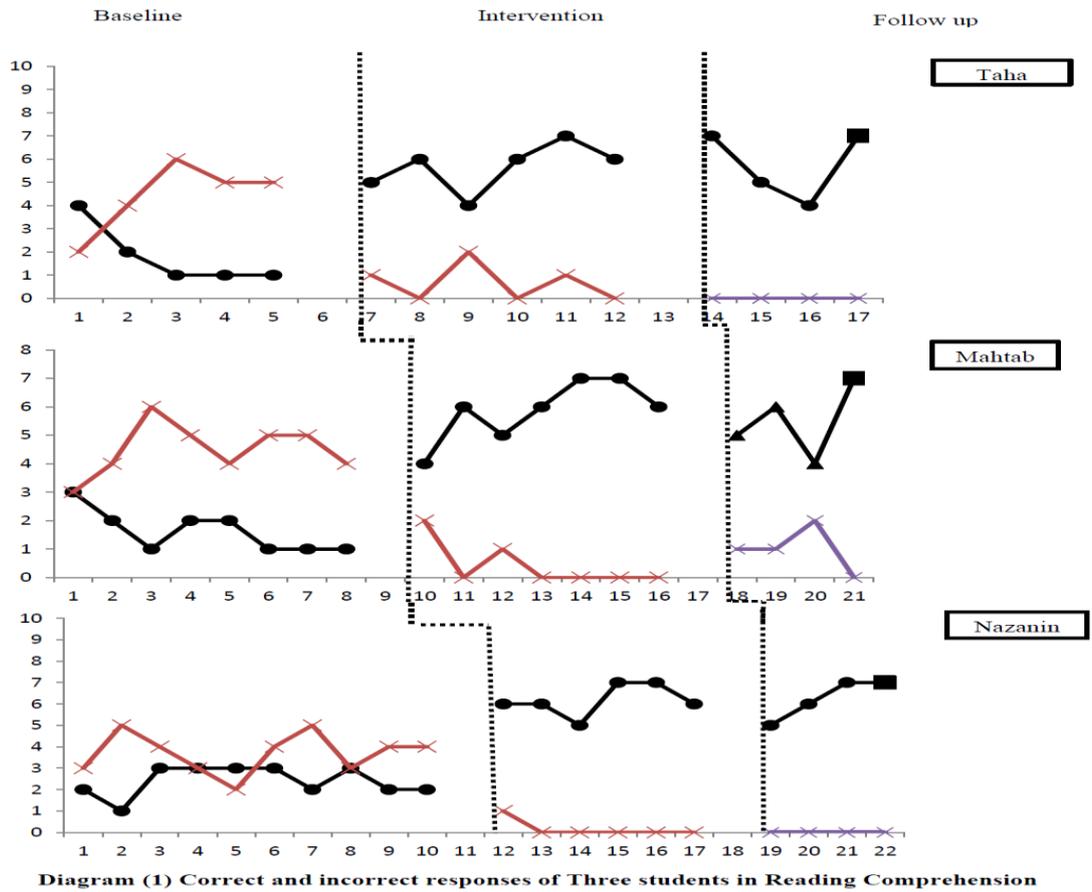
Diagram (1) Correct and incorrect responses of Three students in Reading Comprehension

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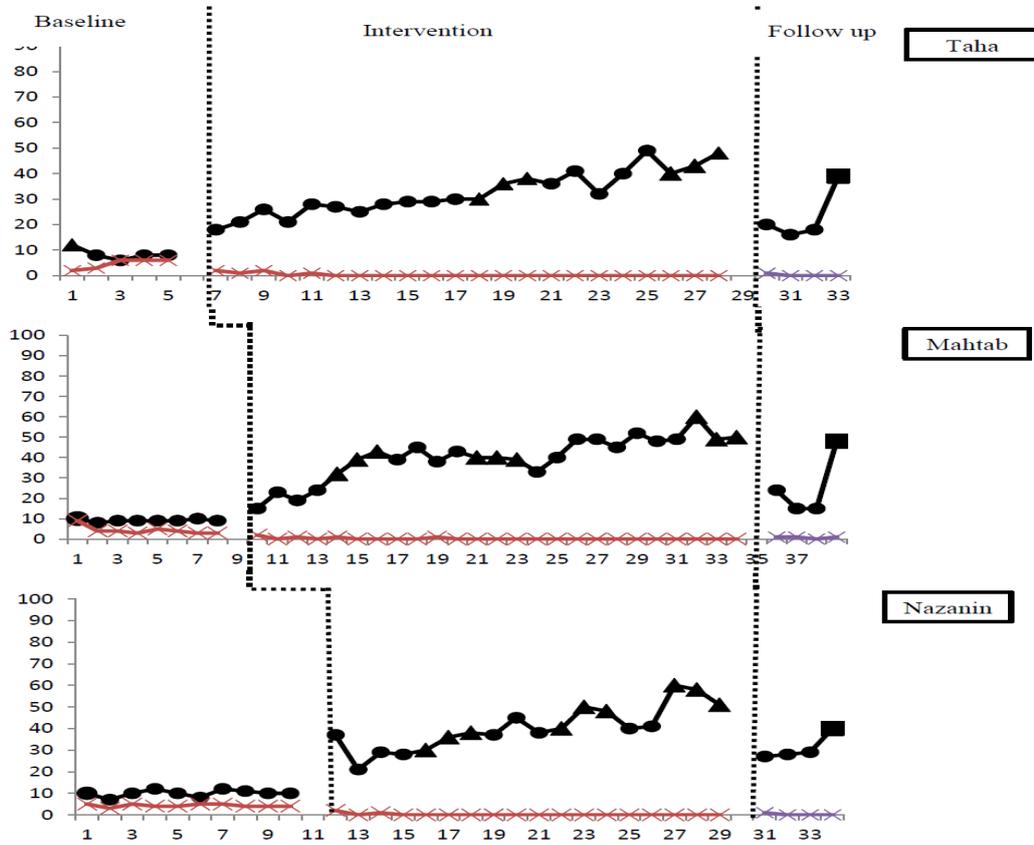*Diagram (1): Correct and incorrect responses of three students in reading comprehension*

Diagram (2) Correct and incorrect responses of three students in fluency building of words

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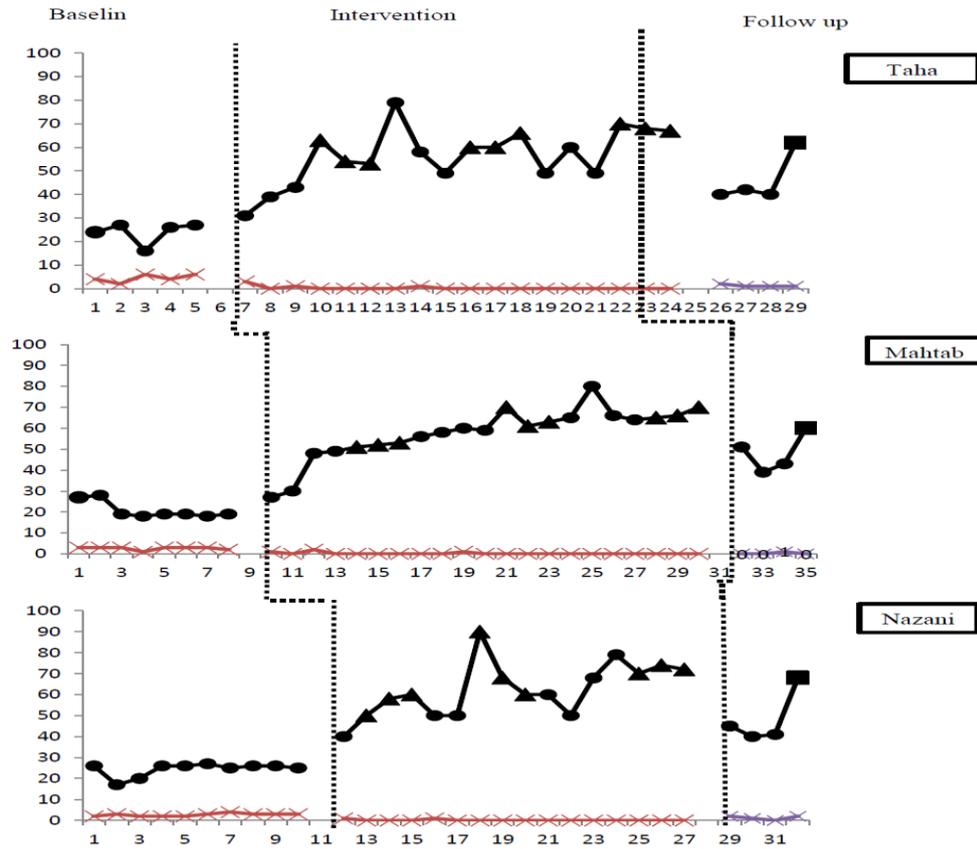
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Diagram (3) Correct and incorrect responses of three students in Fluency Building of text reading (words in text)

Diagram (3): Correct and incorrect responses of three students in fluency building of text reading (words in text)