

## NEUROLOGICAL IMPRESS METHOD PLUS

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*The purpose of these two studies was to redirect interest to the Neurological Impress Method, a multisensory approach to reading instruction that occurs between a teacher and a student, which has been largely forgotten in mainstream and special education circles over the past decades. In addition to its emphasis on oral reading, we included a comprehension component that we call the plus (+) to NIM Plus. In our first study, third through sixth-grade below-level readers in a San Diego county school participated in NIM tutoring. On each of the three measures—oral reading fluency, silent reading fluency, and comprehension—students performed statistically better after the five-week (3.3 hours) NIM training than they had at the beginning of the training. In oral reading fluency, the students' scores significantly increased from an average of 96.7 words correct per minute to 112 words correct per minute ( $p < .0001$ ). In silent reading fluency measure, students' scores increased from an average of 132 words per minute to 154 words per minute ( $p < .002$ ). On the comprehension assessment, students' scores increased from an average of 3.2 questions correct to 4.5 correct ( $p < .001$ ). In our second study, which was conducted in an urban San Diego school, similar results were found; the students scored significantly higher on all three measures. In this second study, however, we focused on “glimpses” into the reasons why NIM Plus was so effective. The tutors who provided the NIM Plus training reported that NIM Plus helped both teacher and student to focus on prior knowledge, making connections between and among texts and the world, and overall construction of comprehension. Our findings support the idea that the NIM Plus is adaptable and that it requires further investigation, in experimental settings, as well as in schools and clinics.*

The Neurological Impress Method (NIM), arguably one of the easiest and most cost-effective methods of developing children's fluency, is making a comeback after a hiatus of fifteen years. Research on the effectiveness of NIM was a staple of the research literature on fluency during the 1960s through 1980s, but it inexplicably disappeared from the literature during the past decade. Perhaps the disappearance was an artifact of the publishing world and not

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necessarily an indication that the practice had been abandoned. The evidence on this point is unclear; so we are not suggesting that NIM is not being used regularly in classrooms or in reading clinics. In our search of the literature, however, we were unable to find new research, so, hopefully, the “comeback” we describe in this paper will lead to more universal practice of this important instructional activity. Our intent was to redirect interest to a method that had been largely forgotten in mainstream and special education circles over the past decades. Our findings support the idea that the method is adaptable and that it requires further investigation, in experimental settings, as well as in schools and clinics.

NIM has a rather illustrious history dating back to the work of Heckelman (1966) who published his research with a disclaimer saying that he was not the inventor of NIM, merely a researcher who applied natural language feedback methods that had been used in speech and language interventions to students with reading difficulties. In his initial study of a ninth-grade female student with severe reading problems, Heckelman (1966) relied on methods that had been used with students with stuttering problems. In these studies, language researchers found that the redirection of the voice into the ear of the stuttering student stopped the stuttering. He explained that the young woman who he was working with read “in a stumbling, halting fashion that could hardly be identified as reading” (Heckelman, 1969, p. 278). After 12 hours of instruction using a method that he called the Neurological Impress Method (NIM), the young woman improved her reading fluency by three grade levels.

### **What is NIM?**

Heckelman (1969) described NIM as a multisensory approach to reading instruction that is “an impress, an etching in of word memories on the natural processes.” The method has been described by Heckelman, and several colleagues who followed him, as a form of unison reading between teacher and student (Arnold, 1972; Henk, 1981; Hollingsworth, 1978). The method calls for the teacher and student to hold the book or other text together with the student sitting slightly in front of the teacher. The teacher sits on the side of the student’s dominant ear. As the teacher slides her or his finger along the line under each word, he or she speaks directly into

the ear of the student, and they read the text together in a fluent manner pausing only where punctuation dictates (Arnold, 1972).

Heckelman encouraged teachers to positively reinforce their students throughout the NIM teaching episode because he believed that that “this close physical, one-to-one relationship of the teacher and the student contributes to a psychological affect component” (Heckelman, 1969, p. 415).

The steps for the NIM include:

- The teacher selects a text within the student’s reading level.
- The teacher sits at the student’s side so that he or she can speak into the student’s ear.
- The student’s finger rests on top of teacher’s finger as they read.
- The teacher moves her finger under each word as it is spoken.
- The teacher reads aloud slightly faster than the student reads aloud and models good fluency (chunking phrases and stopping where punctuation dictates).
- The teacher gives the “lead” to the student as the student becomes comfortable with the text.

These steps were the original steps used by Heckelman in his intervention studies. He did not emphasize comprehension of the text; his interest was in fluency only. In our studies, which will be discussed later in the paper, we have added a PLUS to the NIM, which is a measure of comprehension. Therefore, we have one more step in the our NIM process:

- The student retells the text to the teacher at the completion of the NIM intervention and answers comprehension questions.

### **Heckelman’s NIM Studies**

After his initial success with the young woman, Heckelman tried the method with all of the struggling readers in his clinical practice and again found positive results. This led him to conduct a clinical trial experiment with 24 students in grades 7 through 10. Each of these students read at least three years below their grade level. In the study, participants received 7 1/2 hours of training directly from Heckelman for eight weeks. This study, published in *Academic Therapy* (1967) and recently cited in Rasinski and

Hoffman's (2003) Reading Research Quarterly review of oral reading practices, notes significant gains for the treatment group with a mean gain of 1.9 grade levels with a range from .8 to 5.9 grade levels.

### **Subsequent NIM Studies**

Several researchers have successfully replicated Heckelman's findings in clinical trials, but only one experimental study demonstrated the effects that Heckelman found, and this study provided an even greater amount of NIM training (15 1/2 hours) than Heckelman used (Hollingsworth, 1978). In a non-experimental replication, Lorenz and Vockell (1979) reported student gains in fluency growth as well as gains in positive attitude toward reading.

Several other researchers have also reported success in their non-experimental (no control group) studies across a variety of conditions (Cook, Nolan, & Zanotti, 1980; Eldredge, 1988; Gardner, 1988; Kann, 1983; Langford, Slade, & Barnett, 1974; Miller, 1969). However, another group of researchers reported mixed results (Arnold, 1972; Gibbs & Proctor, 1977; Hollingsworth, 1970). Henk (1981), however, in a review of the literature on NIM, noted that the method consistently produced positive attitudinal results among the students.

### **Issues in Transporting NIM Training into the Classroom**

The early studies which showed gains in fluency for students who were trained in NIM were conducted as clinical studies in which the training was supplied by researchers who were not part of the every day classroom routine; thus, questions about the transportability of NIM arose. As researchers began to think about using NIM in classrooms, they realized that issues of classroom organization and management needed to be addressed.

For example, several researchers pointed to the strain on the teacher's voice as she worked on NIM with several students per day individually as a problem for classroom implementation (Hollingsworth, 1970, 1978; Mikkelsen, 1981); and other researchers noted the problems of overall lost instructional time for the entire class when just a handful of students were receiving 1:1 NIM training (Hollingsworth, 1970).

Hollingsworth (1970) designed an approach to NIM that would potentially solve the teacher voice problem as well as the time constraint problem. He provided NIM training for a group of six fourth-grade students through taped auditory reinforcement using the EFI Multi-Channel Wireless Language System. Three of the students received the training and three students served as controls for the experiment. After 7 1/2 hours of training in which the students listened to twenty stories read by the teacher and themselves, he found that there was no difference in performance on a post fluency measure. No treatment was reported for the students in the control group. He attributed the lack of difference to the absence of the teacher–student bonds that had been carefully nurtured in the individual tutorials that were provided by Heckelman in his studies.

Several researchers believed that the cost to teacher time could be alleviated by having the instruction provided by adult volunteer tutors or trained peer-tutors. The results of these studies were also mixed (McAllister, 1989; Strong & Traynelis-Yurek, 1983), although the results tended to be positive for fluency growth and affect.

### **Our NIM Study #1**

While NIM has been demonstrated to be effective, several issues remained for us in its classroom implementation. In a recent study (Flood, Lapp, Fisher, Albert, & Flood, 2003), we argued that there were still three areas of research that needed more investigation: 1) the training of appropriate tutors (teacher substitutes) to alleviate the strain on teacher time; 2) answering the question about the effectiveness of NIM for younger students, as all of Heckelman's work had been conducted with older struggling readers; and 3) analyzing the question of how much time is needed in NIM to produce a significant effect. We wondered whether the initial results suggesting 7 1/2 to 15 1/2 hours of training could be abbreviated with some students.

In order to address these three areas of concern, we investigated the use of NIM with younger students in grades 3–6 for a shorter period of time (3 1/3 hours) than Heckelman had provided. In order to mitigate the problem of the teacher losing valuable classroom instructional time, we trained student teachers

in NIM so that they could provide the training instead of the classroom teacher.

We designed our study as a quasi-experimental study because school district administrators at the sites where we conducted our study were cautious about conducting clinical trials without some clear evidence that the intervention would work with their students. They wanted to be sure that the fluency instruction was not simply focused on reading faster while sacrificing understanding (e.g., Rasinski, 2003a).

Twenty (20) students, five from each grade 3–6, who read below grade level according to the state achievement tests, were randomly selected for participation. The 20 students attended 5 different suburban schools and had 9 different teachers. Of the 20 students, 14 were males (70%) and eight of the students (40%) were from traditionally under-represented ethnic groups.

Twenty student teachers who were completing their student teaching assignments in grades 3–6 served as the NIM tutors. We were not involved in the assignment of the student teachers to the students they tutored. All of the student teachers in that district participated in the study.

We measured oral fluency through the process recommended by Rasinski (2003b, 2003c)—one-minute probes—in which students are asked to read a passage from a children's book aloud to the tutor. The tutor counts the number of words the students read in one minute, then subtracts the number of errors to get the fluency rate.

We were also interested in students' ability to read fluently and silently to themselves. The tutors used timed passages that students read silently for one minute. The total numbers of words read constituted the measure.

In order to assess the PLUS of NIM PLUS we collected information about each student's comprehension. Using the Stieglitz Informal Reading Inventory (Stieglitz, 1997) as a guide, students were asked to read a passage and then respond orally to 6 comprehension questions that followed the passage. These were commercially-available graded passages. Different passages were used on the pre-test and the post-test.

Once the students were selected, the intervention tutor collected the first round of assessment data. Each tutor was observed collecting the data by one of the researchers. The tutors were also

taught to implement NIM strategy using the steps described in the first part of this paper (recall that we added two comprehension tasks to Heckelman's list of steps: a retelling and comprehension questions).

Each student received instruction for 10 minutes per day, four days per week for five weeks. The NIM intervention began with texts at each child's independent reading level and progressed to their frustrational level by the end of the intervention. Following the intervention, the tutors collected the post-assessment data using the same passages as the pretest. Again, they were observed as they collected their data. The majority of the sessions were conducted in the library/media center while the rest of the class was engaged in Silent Sustained Reading or Independent Reading.

### *Results*

On each of the three measures, oral reading fluency, silent reading fluency, and comprehension, students performed statistically better after the five weeks, 3.3 hours, of NIM training than they had at the beginning of the training. In terms of oral-reading fluency, the students' scores significantly increased from an average of 96.7 words correct per minute to 112 words correct per minute ( $p < .0001$ ). On the silent-reading fluency measure, students' scores increased from an average of 132 words per minute to 154 words per minute ( $p < .002$ ). Finally, on the comprehension assessment, students' scores increased from an average of 3.2 questions correct to 4.5 correct ( $p < .001$ ). We were pleased with these results because although some developmental growth might be expected, statistically significant gains are unlikely in that short period of time unless the intervention was effective.

The data from the observations of the tutoring sessions also indicated that the NIM sessions were consistently implemented with ease and competence on the part of the students teachers. The one-hour training session for the tutors (student teachers) resulted in their ability to deliver NIM instruction according to the model presented. During their hour long inservice, we showed a video of NIM in use, discussed the various components of NIM as presented in the methods section, and discussed the role that reading fluency plays in comprehension.

## **Our NIM Study #2**

Our second study, conducted with 20 students who attended one of two urban schools within the city of San Diego, were randomly selected from all of the students in grades 3–6 who were identified as reading below grade level according to state achievement tests. Of the 20 students, all (100%) qualified for free lunch, 11 (55%) were native Spanish speakers, 4 (20%) were African American, and the remaining students were speakers of languages other than English (including Vietnamese, Dinka, Oromo, and Hmong). Thus, all 20 students were from traditionally underrepresented groups.

Similar to Study #1, we provided NIM instruction via an instructor other than the teacher. Both of these schools hired reading intervention tutors who had completed at least 6 units of coursework in reading language arts methods to provide instruction to students who were identified as significantly below grade level. These tutors were paid with funds from the Title 1 and supplemental instructional budgets. We provided training to the tutors in the same way as was described in study 1. We also collected data in the same way as presented in Study 1. The tutors collected pre-intervention data including oral reading fluency, silent reading fluency, and comprehension information.

Again, students received 10 minutes per day of NIM instruction four days per week. In addition to the demographic differences between Study 1 and Study 2, we systematically observed NIM sessions at these two schools. We observed just over 100 sessions. Like Study 1, we found statistically significant gains on all three measures—oral-reading fluency increased from a pre-assessment average of 62.4 words correct per minute to 87.3 words correct per minute ( $p < .001$ ); silent-reading fluency increased from a pre-assessment average of 88.6 words correct per minute to 114 words correct per minute ( $p < .01$ ), and comprehension increased from a pre-assessment average of 2.5 questions correct to 4.2 ( $p < .001$ ). Perhaps more interesting, however, were the glimpses into the reasons why NIM was so effective. The tutors who provided NIM training ensured that students were being provided with fluency instruction and also focused on prior knowledge, making connections between and among texts and the world, and constructing comprehension.



For example, we observed several sessions in which Randall Jimenez (a tutor) read the book *The Rifle* (Paulsen, 1995) with a sixth-grade student named Jesse. Mr. Jimenez implemented NIM flawlessly with this student reading just a bit faster than Jesse, keeping the pace quick enough to ensure understanding. As he read, he also emphasized different words with his voice (the bold indicates added vocal emphasis):

He just **knew** it was old and might have some **value**, so he thought he would keep it, at least for a while. So he sprayed it lightly with preservative oil, including a squirt down the bore, wrapped it in a moisture-absorbent cloth, taped it together, and **popped** it in the back closet of his motor home, and by the time he'd gone a hundred miles down the road heading west his thoughts were off the rifle and on to the day's news, where he heard that a large religious encampment in Texas had been **raided** and **burned** and all the people **killed** in the action. (p. 59)

The follow-up conversation was very interesting as Mr. Jimenez confessed to Jesse that he really didn't know the parts of a rifle, that he wanted to know where the bore was, and that he didn't really understand how to take care of a rifle. Jesse responded, "Yeah, well it's not like I have a gun or nothin,' but the bore is the barrel part, you know where the bullet comes out. But the barrel is on more like a regular gun; a bore is the rifle. [Pause] But, you don't want to go spraying nothin' down the bore or you'll gum up the pin. He should did it with a cloth."

In a third-grade classroom, the reading-intervention tutor selected the book *Stranger in the Woods* (Sims & Stick, 2000) to complement the shared reading lesson that the teacher had done the day before that focused on dialogue. Before Nina Pham began reading with her student Lasiandra, they looked through the book and talked about the pictures. At one point, Lasiandra said, "Ohh, it looks so cold. I feel bad for all those animals in the cold." As they began to read together, Ms. Pham modeled fluent reading, comprehensible pronunciation, and changed her voice for each of the different characters. Early in the book, the owl says, "Who-hoo's in the woods? Why is he here? When? When did the stranger come?" (n. p.). Ms. Pham used her voice to imitate an owl as she said "who-hoo" which Lasiandra replicated a few pages later when the owl says, "Who-hoo-hoo will go? Who-hoo-hoo will go see?" (n. p.).

Following their reading, Ms. Pham asked Lisiandra to retell the story. Lisiandra explained how the animals found a snowman and wanted to know what it was. At the end of the book, she said, “And then these kids came and gave the animals more food. I think those kids will give the animals food so that they can live in the cold.”

In another classroom, the reading intervention tutor Kari Sullivan had assembled a collection of books that were within De’Angelo’s reading level. As they began their session, De’Angelo looked through the box of books and said, “I do’ know—they all look a’ right” to which Ms. Sullivan responded, “Hey, I’ve read them all. This is about you—you get to pick any one that *you* want.”

De’Angelo selected *A Child’s Glacier Bay* (Corral & Corral, 1998). As they read in unison, it was clear from De’Angelo’s face that the book had either not captured his interest or was too difficult for him. Ms. Sullivan seemed surprised by this and said, “Hey, D, I thought you liked adventure books. This is a cool adventure book, but if you want to pick another one, that’s okay too. You don’t have to finish every book you start.” De’Angelo looked up at her and said “Yeah, this could be for a dif day” and selected *Harvesting Hope: The Story of Cesar Chavez* (Krull, 2003).

As they begin reading together from this new book, De’Angelo began reading as fast as Ms. Sullivan. She quickened her pace a bit to maintain the challenge. A few pages into the book, they read “Cesar was so happy at home that he was a little afraid when school started” (n. p.). At this point, De’Angelo stopped reading the text and said “Hey, no need for fear, school ain’t bad” while Ms. Sullivan continued to read. She noticed this and said “You’re right. . .let’s start this page again” and they read the entire page together without pausing.

### **Lessons Learned and Questions that Remain**

The data from our recent studies on NIM PLUS suggest that this is an effective method for increasing fluency without sacrificing comprehension. Students in this study across grades 3–6 exhibited statistically significant gains in oral reading fluency, silent reading fluency, and comprehension as a result of NIM PLUS. Our work with NIM PLUS confirms Heckelman’s (1966) notion that NIM is a cost-effective and easy-to-use instructional strategy.

The data from our studies also suggest a number of lessons learned. They include the following:

- Some students (especially those who are reading significantly below grade level) need short, focused, and individualized lessons to improve their fluency and comprehension.
- People other than the teacher can be taught how to implement NIM PLUS effectively.
- NIM is an effective approach with younger students. Our data suggests that it is effective down to at least the third grade.
- Authentic children's literature can be used in NIM PLUS intervention sessions. These authentic pieces of literature capture students' interest and motivate them to read more.
- The addition of comprehension activities to the NIM protocol is important to ensure that students understand what they read and not that they simply read faster.

Several questions remain regarding the use of NIM PLUS. First, we would like to know the relative value of NIM PLUS. It is clear to us that these significant gains in oral reading fluency, silent reading fluency, and comprehension were unlikely the result of normal instruction and development. After all, data were collected over a very short period of time. Having said that, we still do not know the relative value of NIM PLUS. How much of the observed growth can be attributed to NIM PLUS? To find this out, a clinical trial needs to be conducted. We hope to engage other researchers in a large clinical trial with over 1,000 readers receiving intervention. This will allow us to determine the added value that NIM PLUS provides for students as they become fluent readers.

Second, our data suggest that NIM PLUS is effective in time segments shorter than those originally proposed by Heckelman. We do not yet know, however, the hour-by-hour benefit of NIM PLUS. Is there a specific minimum number of hours of NIM PLUS instruction required before there is a detectable effect? Is there a plateau or ceiling after which no further increases are seen? To find this out, we need to assign large numbers of students to the intervention with different amounts of time. From that data, we can begin to plot the time investment versus outcome to determine the recommended intervention.

Third, and finally, we need to determine the range of school personnel who are capable of delivering NIM PLUS instruction. In our studies, we have used student teachers and reading intervention tutors. In both cases, these people held bachelor's degrees and had formal training in reading methods. It seems reasonable to suggest that school-based reading specialists could also implement NIM PLUS instruction. The question remains about the use of other adults, including partents, to provide this level of support for our most struggling readers. For example, could each clerical staff member and/or custodian be taught to use NIM PLUS and then be asked to provide this type of instruction to a few students over the course of five or six weeks? Alternatively, could community volunteers, parents, and business partners be provided with instruction from a reading specialist and then read with students using NIM PLUS? In other words, what skills and prerequisite knowledge are required to be effective in the delivery of NIM PLUS?

NIM PLUS, based on the work Heckelman (1969) and other researchers who followed in his footsteps, works effectively as a means for increasing fluency for children who struggle with reading in grades 3–6 (as well as with older readers as demonstrated through the original Heckelman studies). NIM and NIM PLUS have a positive effect on children's affect including attitude toward reading and motivation to read. It seems to work as well with second language students as it does with native English speakers, and it can be used with many different types of texts.

The future for more NIM studies is bright; there is still a need for clinical trials to determine the differential effects as well as the exact length of time that is needed for individual students to profit from NIM instruction. NIM is a promising, easy-to-use method that should find its way into every child's reading life.

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