

Academic and Behavioral Improvements in 2nd- Through 8th-Grade Students in the Hardy Brain Camp Program

Report on the Hardy Brain Camp Pilot Study of the Boys & Girls Clubs of Greater Oxnard and Port Hueneme and the United Boys & Girls Clubs of Santa Barbara County

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Executive Summary

The academic and behavioral performance of 54 students (grades 2-8) was studied before and after participation in the Hardy Brain Camp program. The students, who belonged to the Boys and Girls Club of Greater Oxnard and Port Hueneme and attended school in the Rio School District along with students who belonged to the United Boys & Girls Clubs of Santa Barbara, were selected by Boys and Girls Club Staff and Rio School District School Psychologists as those needing academic, attention, and behavior improvements.

The students in both groups were selected because of observed difficulties with learning, attention, organization, behavior, poor grades, listening, following directions, completing schoolwork, reading and/or math weaknesses. Some of the students were struggling in regular classrooms, some in Special-Education pull-out programs, some with Special Education one-to-one aides, some in full-day Special Education programs and some in programs for emotionally disturbed children. Some had no diagnosis and some had diagnoses of Learning Disabilities, ADD, ADHD, dyslexia, Central Auditory Processing Disorder, speech and language delay, dysgraphia, dyscalculia, Asperger's Syndrome and autism. They all had severe difficulties that negatively impacted their ability to do well in school.

The students went through the Hardy Brain Camp program, which consisted of 20 sessions of 45 minutes using a proprietary training program designed by Sherrie Hardy to improve the millisecond timing of the brain. Improved millisecond timing has been shown to improve reading, math, thinking speed, attention, communication, and coordination.

Before and after training, teachers, parents, and Boys and Girls Club counselors rated the students on eleven traits that influence academic success and behavior.

Two standardized testing measurements were used to evaluate the students along with a Mathematics Performance Inventory. Twenty-two students were tested using the Woodcock-Johnson for Reading Fluency, Math, and Processing Speed. Thirty-two students were given the WISC Coding and Symbol Search to measure processing speed along with the Mathematics Performance Inventory.

The twenty-two students tested with the Woodcock-Johnson gained an average of:

- **9.1 months improvement in reading.**
- **3.9 months improvement in math.**
- **16 months (1.6 years) improvement in processing speed. This was the most significant outcome.** Processing speed is the combination of thinking speed and decision-making speed. As students improve their processing speed they are able to think faster and absorb information more easily.

The thirty-two students who were tested with the WISC showed an average of:

- **10.9% improvement in processing speed** in the WISC Coding measurement.

- **31.2% improvement in processing speed** in the WISC Symbol Search.

The thirty-two students who were tested on the Mathematics Performance Inventory showed an average of:

- **2.9 months improvement in math.**

The students also showed dramatic improvement in ratings from teachers, parents, and Boys and Girls Club counselors on the 11 academic and behavior traits for which they were rated. Remarkable improvements were made in academic performance, attitude, ability to process information, and ability to deal with the surrounding environment

Students showed an average of:

- Ability to pay attention: **35.2%** improvement
- Reading, math, spelling, and writing: **32.1%** improvement
- Ability to organize and communicate ideas: **26.7%** improvement
- Focus: **35.1%** improvement
- Ability to finish work on time: **30.4%** improvement
- Listening skills: **32.1%** improvement
- Ability to manage frustration: **27.5%** improvement
- Ability to finish work independently: **31.3%** improvement
- Coordination and motor skills: **20.8%** improvement
- Ability to work well with others: **25.4%** improvement
- Self confidence: **30.5%** improvement

For the 11 traits rated, teachers reported an average of 21.9% improvement, parents reported an average of 32.8% improvement and Boys and Girls Club counselors reported an average of 34.4% improvement.

Rio School District School Psychologist, William MacDonald, summed up the progress students made as “remarkable.” He said he has never seen this much progress so quickly with this population of students.

Principal of Rio Real Elementary School, Maria Hernandez, said the program “takes away the barriers and allows our students to experience academic success.”

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Introduction

Children struggle in school for many reasons. Two of the most important are slow thinking skills and weak processing skills. Students with these two weaknesses have problems completing school work, paying attention, reading, and doing math. Often, these students receive tutoring or extra help for these visible symptoms - but not for the underlying weak processing and thinking skills that create these problems.

A *learning disability* (LD) is usually defined as *unexpected underachievement*—specifically, students who do not listen, speak, read, write, or develop mathematics skills commensurate with their potential, even though there has been adequate opportunity to learn. Historically, unexpected underachievement has been attributed to intrinsic neurobiological factors that indicate that students with LD will require specialized instruction to achieve at expected levels based upon some index of aptitude, usually an IQ test score.¹ The concept of unexpected underachievement has been reported in medical and psychological literature since the mid-19th century under the rubrics of dyslexia, word blindness, dysgraphia, dyscalculia, and other terms.² However, it has only been since 1962, when Samuel Kirk, a psychologist at the University of Illinois, coined the term *learning disabilities*, that the concept of unexpected underachievement attained formal recognition in the education community.

The concept of *learning disabilities* and the need for different specialized educational services also made intuitive sense to parents, teachers, and policymakers. The term did not stigmatize children. Specifically, the learning difficulties displayed by youngsters with LD were not due to mental retardation, poor parenting, or psychopathology. The term likewise reflected optimism. Students with LD had not yet reached their potential: Their difficulties in learning to read, write, and/or calculate occurred despite adequate intelligence, sensory integrity, healthy emotional development, and cultural and environmental advantage. Education programs were needed that recognized differences among children with LD, those who learned “normally,” and those who manifested physical, sensory, and intellectual handicaps that affected academic achievement.

The field of LD was founded on the assumption that neurobiological factors are the basis of these disabilities. As the field progressed, definitions of LD continued to attribute disabilities in learning to intrinsic (neurobiological) rather than extrinsic (for example, environmental or instructional) causes, even though there was initially no objective way to assess the presence of recognized brain dysfunction.³

New scientific studies proved that a large number of children need support in a timely manner to overcome their existing biological and neurological impediments to learning. It became clear that failure

¹ See K. Kavale and S. Forness, *The Nature of Learning Disabilities* (Hillsdale, NJ: Erlbaum, 1995); and J.L. Wiederholt, “Historical Perspectives on the Education of the Learning Disabled,” in *The Second Review of Special Education*, eds. L. Mann and D. Sabatino, (Austin, TX: PRO-ED, 1974), 103-152.

² See G. Reid Lyon, Jack M. Fletcher, et al (2001), *Rethinking Learning Disabilities*, Progressive Policy Institute, Thomas B. Fordham Foundation.

³ Ibid.

to act in the early years of a child's development may create an irreversible condition. The importance of a timely intervention became more obvious in the minds of parents, community leaders and policy makers.

The No Child Left Behind Act of 2001 (NCLB) includes benefits to students with learning disabilities (LD), as well as some barriers that might prevent these same students from enjoying all of the opportunities in the law. In order to increase the accountability of at-risk groups of students and for the purpose of helping to close the achievement gap, NCLB further required that schools, school districts, and states disaggregate, or separate out, the test results for several subgroups of students. Students with disabilities who are receiving services under the Individuals with Disabilities Education Act (IDEA), that is, students with IEPs, are one of the subgroups that must be reported.

- Economically disadvantaged students
- Students from major racial and ethnic groups
- Students with disabilities under the IDEA
- Students with limited English proficiency

All students must be tested annually in grades 3-8 and once in high school (during the grade 10-12 span) in reading and mathematics. Schools must test students in science at least once in elementary, middle, and high school. These assessments were decided to be aligned with state academic standards. Schools were required to report the scores of the statewide assessments to parents in the form of a "report card." States must bring all students up to the "proficient" level on state tests by the 2013-14 school year. This certainly has not worked in a manner that it was intended and the rate of success has been questionable in many places for a variety of reasons.

Under NCLB, accommodations are defined as changes in testing materials or procedures that ensure that an assessment measures the student's knowledge rather than the student's disability. Students with Individualized Education Plans (IEP) may not be exempted from participating in a state's assessment system. The IEP determines how a student will participate, not whether a student will participate. Furthermore, out-of-level testing is not allowed under NCLB. Students, including students with disabilities, must be assessed at the student's assigned grade level.

A discussion about educational expectation and provision for students with disabilities emphasizes the importance of timely investment to help this group receive as much from the educational system as other students. This clearly shows that the importance of any program that can impact the situation and bring the level of learning of students with disabilities to the level of other students can be one of the most important developments that can help young people to overcome their learning problems. This is the most important element of this transformation and, at the same time, saves significant amounts of financial resources for many states who are involved in the process.

About the Hardy Brain Camp Workshop and Pilot Project

Boys & Girls Clubs of Greater Oxnard and Port Hueneme along with the United Boys & Girls Clubs of Santa Barbara County supported a joint effort to send a number of their members who needed such an intervention to the Hardy Brain Camp workshop over a period of twenty sessions.

The training was designed using the Interactive Metronome training equipment and a proprietary training formula developed by Sherrie Hardy that is customized for each student's needs. Students participate in pre-training exercises to prepare them for the "regular" training of 20 sessions if their millisecond (ms) timing is in the below average to severe range. Students with timings of less than 100 ms are ready to begin regular training. Most of the students selected for this pilot project had millisecond timings in the below average to severe range and needed pre-training prior to starting the regular training program.

Fifty-four students completed the study.⁴ Thirty-two students were chosen and tested by the school psychologists from The Rio School District and participated at the three school sites. Twenty two students were selected by Boys and Girls Club staff and participated at the Boys & Girls Clubhouses at 5th Street, Seventh Street, Port Hueneme and Carpentaria.

The students in both groups were selected because of observed difficulties with learning, attention, organization, behavior, poor grades, listening, following directions, completing schoolwork, reading and/or math weaknesses. Some of the students were struggling in regular classrooms, some in Special-Education pull-out programs, some with Special Education one-to-one aides, some in full-day Special Education programs and some in programs for emotionally disturbed children. Some had no diagnosis and some had diagnoses of Learning Disabilities, ADD, ADHD, dyslexia, Central Auditory Processing Disorder, speech and language delay, dysgraphia, dyscalculia, Asperger's Syndrome and autism. They all had severe difficulties that negatively impacted their ability to do well in school.

⁴ It should be mentioned that a significant number of the children who attended the training did not complete the full course of the intervention and therefore their progress has been impacted by inability to complete the entire course.

Methods: Data and Analyses

Data Gathering and Reporting

The students wore earphones through which they heard a rhythmic beat. Specific body movements were done to this beat. Triggers on hands and feet recorded the responses down to a hundredth of a millisecond. Fifteen different movement activities using hands, feet and a combination of hands and feet were used during the training. After each movement, the score was seen on the computer screen and an auditory tone was presented in the earphones simultaneously indicating if the response was “perfect” (within 20 milliseconds of the tone), slightly early, very early, slightly late or very late as the score flashed on the screen. The challenge the students faced was to reduce their millisecond times lower and lower, to learn how to get “perfect” hits and then to begin to get strings of perfect hits.

The training aimed at changing attention, learning, communication, behavior and organization for students who struggle in the classroom because it overwhelms the brain with more information than can be easily processed. The brain responds to this overload by growing new connections and strengthening existing ones to process the incoming information. The student’s millisecond scores drop as the brain is better able to process this massive amount of input. This growth is then used naturally in class to pay attention, learn, communicate, behave and organize better. Students who are behind in class and struggle with learning disabilities, ADD, ADHD, dyslexia, Central Auditory Processing Disorder, reading, math, speech & language delays, dysgraphia, dyscalculia, Asperger’s Syndrome and autism are able to make permanent gains in learning and attention. The program also helps average learners and gifted students who want to pay attention better, think faster, and do better in school.

Twenty-two of the students were pre- and post-tested at the Boys and Girls Clubs using the Woodcock-Johnson reading, math and processing speed inventories. The thirty two students who participated in conjunction with the Rio School District at the Boys and Girls Club School sites were trained at Rio Real, Rio Del Norte and Rio Del Valle Schools in the Rio School District. These students were selected by Rio School District psychologists due to the same observed criteria used to identify students at the Boys and Girls Club sites. The Rio School District school psychologist was in charge of the pre and post-testing of these students. They were pre and post-tested using the WISC Coding and Symbol Search tests to measure processing speed (see notes on the test sheet) and the Mathematics Performance Analysis.

Fourteen of the students in this group (the school-based sites) were post-tested prior to completing the entire training program of 20 sessions. Two of these students had some notable progress nevertheless in spite of the shortening of their program. One of the students who joined the program as a selective mute began communicating with peers, teachers, and BGC staff for the first time, using single words, text messages, and pictures to express his needs.

Another student who was a full-time special education day class student at the beginning of his training finished approximately half of the regular program and qualified to be moved out of full-time special education and mainstreamed into some regular classes for the first time ever.

Most of the other 12 students who did not finish the entire program required extensive pre-training time and they had to be tested at the end of the school year and training could not continue over the summer since they were all school site students. Nevertheless, most of them made positive progress.

Because test scores may not fully reflect the growth students achieve, to evaluate how well the training transferred to the students' classroom and home life, students were rated by their teachers, parents and Boys and Girls Club staff on their:

- Ability to pay attention
- Academic improvement in reading, math, spelling, and writing
- Ability to organize ideas and communicate
- Ability to focus on work
- Ability to finish work on time
- Ability to listen and follow directions
- Ability to manage frustration
- Ability to complete work independently
- Coordination and motor-skills
- Ability to work with others
- Self-confidence and self-esteem

The rating scale went from 1 (very poor), 3 (average) to 5 (excellent). In addition to the ratings, teachers, parents and staff were asked to write a comment on the progress they observed. There is one special rating from the school librarian at Rio Del Norte School who approached the program director about the positive overall changes she has observed in the entire group.

Data Analysis

A counterfactual research design was used, allowing us to compare the academic and behavioral performance of students in the Hardy Brain Camp Workshop, before and after the intervention.

Formal Achievement Test: Woodcock-Johnson and WISC

The Woodcock-Johnson metric was administered to 22 students before and after training (20 sessions). This metric measures the academic level of students for reading, mathematics, and processing speed.

The Wechsler Intelligence Scale for Children (WISC) was administered to 32 students before and after training (20 sessions). The WISC is an individual test that does not require reading or writing. Performance subtests are nonverbal problems, all of which are timed and some of which allow bonus points for extra fast work. A number of students in this group have had less than 20 sessions of training. The reports are for Coding and Symbol Search. The scores are reported in percentages. There is a considerable lack of consistent data that show the scores in the pre-post stages for a complete period of training due to the fourteen students who were unable to fully complete the training.

Students' Rating Scores by Parents, Teachers, and Boys & Girls Clubs Facilitators

The objectives of the program are to help students develop other useful skills that allow them to manage their lives better and function better in relation to others around them. The program's objectives are to help students with:

- Ability to pay Attention
- Academic Improvement
- Ability to Organize Ideas
- Ability to Focus on Work
- Ability to Finish Work on Time
- Ability to Listen and Follow Directions
- Ability to Manage Frustration Level
- Ability to Complete Work Independently
- Coordination of Motor Skills
- Ability to Work with Others
- Improving Self Confidence and Self Esteem

Parents, teachers, and BGC facilitators rated each student on a scale of 1 to 5 (1 being the lowest, 3 being average and 5 the highest scores) for these traits.

Results and Discussion

Below are the results from the pre- and post-training tests, including the formal achievements tests (Woodcock-Johnson and WISC) and the eleven areas of improvements in academic, skill, and attitude of individual participants rated by their parents, teachers, and the Boys & Girls Clubs counselors. A more comprehensive report of the findings in graphic format can be found in the appendix of this report.

Woodcock-Johnson Test

This method was used for 22 students. We had consistent data for almost all of these 22 participants based on their pre- and post-workshop scores.

Reading, math, and processing results are reported in Table 1, Table 2, and Table 3, respectively. Respecting student confidentiality, student names are not reported. Test scores from Woodcock-Johnson are reported based on the age and grade level of the students.

Takeaways from Reading Tests Results

- Every student showed improvement in reading, with the exception of one whose score did not change and one whose score showed a slight decline.
- The **average student gained 9.1 months** in reading
- Almost half of the students made improvements of **more than 1 year** in reading (9 students)
- In one case, the **student gained 6 years** in reading
- There was no apparent relationship between the grade of the students and her/his level of improvement.

Takeaways from Math Tests Results

- Students showed an average of **3.9 months improvement in math**
- **77% of the students showed improvement** (17 students)
- One student's score stayed the same.
- Four students declined. It shows that their performance was not impacted by the workshop intervention and they may have fallen back to a lower level.

Takeaways from Processing Speed Results

- The average student had **16 months (1.6 academic years) improvement in processing speed**
- After training, 54% of the students performed at a level higher than their existing grade level.
- This area of improvement was by far the most outstanding of the three areas.

Table 1: Summary of Reading Scores for Group of 22 Students Using Woodcock-Johnson Method

| Pre-Training Reading Grade Level | Post-Training Reading Grade Level | Change in Score | Months Improvement |
|--|-----------------------------------|-----------------|--------------------|
| 3.1 | 3.4 | 0.3 | 3.0 |
| 2.3 | 2.1 | -0.2 | -2.0 |
| 4.0 | 4.8 | 0.8 | 8.0 |
| 0.8 | 1.3 | 0.5 | 5.0 |
| 2.3 | 2.9 | 0.6 | 6.0 |
| 2.7 | 3.6 | 0.9 | 9.0 |
| below K | 1.8 | 1.8 | 18.0 |
| 2.2 | 2.4 | 0.2 | 2.0 |
| below k | 1.1 | 1.1 | 11.0 |
| 2.2 | 2.4 | 0.2 | 2.0 |
| 2.7 | 2.8 | 0.1 | 1.0 |
| 4.0 | 4.6 | 0.6 | 6.0 |
| 1.6 | 3.6 | 2.0 | 20.0 |
| 2.6 | 9.0 | 6.4 | 64.0 |
| 7.3 | 9.0 | 1.7 | 17.0 |
| 2.1 | 3.4 | 1.3 | 13.0 |
| 2.1 | 2.3 | 0.2 | 2.0 |
| 1.6 | 2.0 | 0.4 | 4.0 |
| 4.0 | 4.6 | 0.6 | 6.0 |
| 2.4 | 2.4 | 0.0 | 0.0 |
| 1.8 | 2.1 | 0.3 | 3.0 |
| 2.8 | 3.1 | 0.3 | 3.0 |
| Average Months Improved Per Student | | | 9.1 months |

Table 2: Summary of Math Scores for Group of 22 Students Using Woodcock-Johnson Method

| Pre-Training Math Grade Level | Post-Training Math Grade Level | Change | Months Improvement |
|--|---|---------------|---------------------------|
| 6.1 | 6.2 | 0.1 | 1.0 |
| 2.4 | 2.6 | 0.2 | 2.0 |
| 2.0 | 2.5 | 0.5 | 5.0 |
| 1.6 | 1.1 | -0.5 | -5.0 |
| 2.0 | 2.8 | 0.8 | 8.0 |
| 2.9 | 3.5 | 0.6 | 6.0 |
| 1.6 | 1.8 | 0.2 | 2.0 |
| 4.9 | 4.4 | -0.5 | -5.0 |
| 1.2 | 0.5 | -0.7 | -7.0 |
| 2.3 | 2.2 | -0.1 | -1.0 |
| 0.0 | 2.2 | 2.2 | 22.0 |
| 6.8 | 7.1 | 0.3 | 3.0 |
| 1.7 | 2.9 | 1.2 | 12.0 |
| 2.7 | 5.4 | 2.7 | 27.0 |
| 8.7 | 6.8 | -1.9 | -19.0 |
| 2.2 | 3.4 | 1.2 | 12.0 |
| 3.0 | 3.3 | 0.3 | 3.0 |
| 2.9 | 3.0 | 0.1 | 1.0 |
| 3.9 | 4.1 | 0.2 | 2.0 |
| 1.1 | 2.0 | 0.9 | 9.0 |
| 2.4 | 2.4 | 0.0 | 0.0 |
| 3.0 | 3.8 | 0.8 | 8.0 |
| Average Months Improved Per Student | | | 3.9 months |

Table 3: Summary of Processing Speed for Group of 22 Students Using Woodcock-Johnson Method

| Pre-Training Processing Grade Level | Post-Training Processing Grade Level | Change | Months Improvement |
|--|--------------------------------------|--------|--------------------|
| 3.5 | 5.4 | 1.9 | 19.0 |
| 3.0 | 4.2 | 1.2 | 12.0 |
| 1.9 | 3.8 | 1.9 | 19.0 |
| 2.1 | 3.6 | 1.5 | 15.0 |
| 0.6 | 2.1 | 1.5 | 15.0 |
| 5.2 | 7.3 | 2.1 | 21.0 |
| 2.1 | 2.3 | 0.2 | 2.0 |
| 2.8 | 4.5 | 1.7 | 17.0 |
| 0.2 | 1.5 | 1.3 | 13.0 |
| 2.4 | 4.5 | 2.1 | 21.0 |
| 2.5 | 4.2 | 1.7 | 17.0 |
| 3.2 | 4.3 | 1.1 | 11.0 |
| 2.4 | 3.3 | 0.9 | 9.0 |
| 2.5 | 8.5 | 6.0 | 60.0 |
| 4.6 | 5.2 | 0.6 | 6.0 |
| 1.4 | 3.0 | 1.6 | 16.0 |
| 3.0 | 4.2 | 1.2 | 12.0 |
| 3.6 | 5.2 | 1.6 | 16.0 |
| 6.0 | 8.2 | 2.2 | 22.0 |
| 1.0 | 0.7 | -0.3 | -3.0 |
| 2.4 | 4.3 | 1.9 | 19.0 |
| 3.6 | 5.8 | 2.2 | 22.0 |
| Average Months Improved Per Student | | | 16 months |

Wechsler Intelligence Scale for Children (WISC) Test

The WISC test was administered to 32 students for two areas: Coding and Symbol Search. These students also completed the Mathematics Performance Inventory. The results of each are reported in Table 4, Table 5, and Table 6.

Takeaways from Change in Coding Test Results:

- Students showed an **average improvement of 10.9%**
- **46% of students (15 students) improved**, some with minor improvement but most with a significant level of improvement
- 11 of the students with less than the desired level of improvement also did not complete training

Takeaways from Change in Symbol Search Test Results:

- Students showed an **average improvement of 31.2%**
- **81% (26 cases) of students showed improvement**, 2 students showed no change, and 2 declined

Takeaways from Change in Math Test Results:

- The Mathematics Performance Inventory requires a full years' growth (rather than month-by-month, as in the Woodcock-Johnson) to show any gains. Gains of even 9 months therefore appear as 0.
- 30% of students showed improvement in math scores, despite the metric's limitations
- 43% (14 students) did not make at least one whole year of growth
- 15% (5 students) were performing at their existing grade level
- 12% (4 students) declined in grade level
- Overall, the **average improvement was 2.9 months**

Table 4: Summary of Coding Testing for 32 students Using WISC Method

| Pre-Training Percentile | Post-Training Percentile | Improvement |
|--|--------------------------|--------------|
| 5% | 39% | 34% |
| can't use scores | * | * |
| 0% | 12% | 12% |
| 0% | 1% | 1% |
| 39% | 68% | 29% |
| 16% | 50% | 34% |
| 37% | 42% | 5% |
| 84% | 99% | 15% |
| 87% | 87% | 0% |
| 1% | 1% | 0% |
| 50% | 50% | 0% |
| 63% | 25% | -38% |
| 1% | 84% | 83% |
| 10% | 19% | 9% |
| 30% | 30% | 0% |
| 0% | 1% | 1% |
| can't use scores | * | * |
| 45% | 50% | 5% |
| * | * | * |
| * | * | * |
| * | * | * |
| 1% | 97% | 96% |
| 68% | 95% | 27% |
| 50% | 50% | 0% |
| * | * | * |
| 5% | 9% | 4% |
| 42% | 68% | 26% |
| 55% | 19% | -36% |
| 50% | 50% | 0% |
| 99% | 96% | -3% |
| can't use scores | * | * |
| 81% | 50% | -31% |
| Improvement per person on average | | 10.9% |

Table 5: Summary of Symbol Testing for 32 students Using WISC Method

| Pre-Training Percentile | Post-Training Percentile | Improvement |
|--|--------------------------|--------------|
| 5% | 87% | 82% |
| 42% | 68% | 26% |
| 42% | 79% | 37% |
| 0% | 19% | 19% |
| 1% | 75% | 74% |
| * | * | |
| 0% | 87% | 87% |
| * | * | |
| 30% | 99% | 69% |
| 1% | 25% | 24% |
| 30% | 96% | 66% |
| 1% | 37% | 36% |
| 1% | 63% | 62% |
| 30% | 19% | -11% |
| 1% | 12% | 11% |
| 1% | 1% | 0% |
| can't use scores | | |
| 81% | 99% | 18% |
| 0% | 68% | 68% |
| 6% | 42% | 36% |
| 1% | 37% | 36% |
| 1% | 21% | 20% |
| 68% | 86% | 18% |
| 42% | 68% | 26% |
| 19% | 50% | 31% |
| 2% | 32% | 30% |
| 98% | 30% | -68% |
| 42% | 89% | 47% |
| 30% | 30% | 0% |
| 87% | 96% | 9% |
| 19% | 42% | 23% |
| 50% | 79% | 29% |
| Improvement per person on average | | 31.2% |

Table 6: Summary of Math Scores for Group of 32 Students Using Mathematics Performance Inventory

| Pre-Training Math Grade Level | Post-Training Math Grade Level | Change | Months Improvement |
|--|--------------------------------|--------|--------------------|
| 2 | 1 | -1 | -9 |
| 1 | 2 | 1 | 9 |
| 1 | K | | 0 |
| 0 | 2 | 2 | 18 |
| 3 | 3 | 0 | 0 |
| 2 | 3 | 1 | 9 |
| 1 | 3 | 2 | 18 |
| 0 | 0 | 0 | 0 |
| 3 | 3 | 0 | 0 |
| 4 | 4 | 0 | 0 |
| 1 | 2 | 1 | 9 |
| 4 | 4 | 0 | 0 |
| 2 | 3 | 1 | 9 |
| 4 | 4 | 0 | 0 |
| 3 | 3 | 0 | 0 |
| K | K | 0 | 0 |
| 3 | 4 | 1 | 9 |
| 4 | 5 | 1 | 9 |
| K | K | 0 | 0 |
| 1 | 0 | -1 | -9 |
| 4 | 4 | 0 | 0 |
| 0 | 1 | 1 | 9 |
| 4 | 5 | 1 | 9 |
| 4 | 4 | 0 | 0 |
| 3 | 1 | -2 | -18 |
| 0 | 1 | 1 | 9 |
| 2 | 2 | 0 | 0 |
| 4 | 5 | 1 | 9 |
| 3 | 3 | 0 | 0 |
| can't use scores | | | |
| K | K | | 0 |
| 3 | 3 | 0 | 0 |
| Average Months Improved Per Student | 2.9 months | | |

Summary of Achievement Test Results

- **Regardless of the achievement test used, students showed improvement on all metrics after completing Hardy Brain Camp:**
 - **Math skills improved.** Students taking the Woodcock-Johnson Mathematics Skills test showed an average of *3.9 months improvement* in math. Students taking the Mathematics Performance Inventory showed only *2.9 months average growth*; however, this was likely due to the fact that the inventory is only sensitive to a full year's growth.
 - **Reading skills improved.** Students taking the Woodcock-Johnson Reading Skills test showed an average of *9.1 months improvement in reading*.
 - **Processing speed improved.** Students taking the Woodcock-Johnson processing skills test showed an average of *16 months improvement*. Students taking the Coding processing test showed an average of 10.9% improvement; students taking the Symbol Search test showed an average of 31.2% improvement.
- The students who showed less improvement than most only partially completed the prescribed 20 sessions. This may have contributed to their comparatively lower level of performance and improvement.

Results from Ranking of the Students' Abilities

Students were ranked in eleven competency areas, both before and after completion of the Hardy Brain Camp program. The evaluators were the parents, teachers, and Boys & Girls Club counselors and program coordinators, who have been in close contacts with the program participants before, during and after the training was over. Results from these evaluations are tabulated in Table 7. All three groups of evaluators found significant positive growth in the students' performance. For many students, the growth was huge: moving from a score of 1 to 5.

Overall, the evaluators found:

- 32.1% improvement in reading, math, spelling, and writing
- 35.2% improvement in ability to pay attention
- 35.1% improvement in ability to focus
- 32.1% improvement in listening skills
- 30.5% improvement in self confidence
- 31.3% improvement in ability to finish work independently
- 30.4% improvement in ability to finish work on time
- 27.5% improvement in ability to manage frustration levels
- 26.7% improvement in ability to organize and communicate ideas
- 25.4% improvement in ability to work well with others
- 20.8% improvement in coordination and motor skills

Table 7: Ranking of eleven areas of student ability assessed by parents, teachers, and counselors

| Trait | Overall Improvement | Detailed Data Breakdown | | | | | |
|---|---------------------|-------------------------|---------------|------------|------------|--------------|-------|
| | | | # of Students | Min Change | Max Change | Mean Change | +/- |
| Attention | 35.2% | Parents | 52 | 0% | 100% | 39.3% | 24.9% |
| | | Teachers | 54 | -75% | 75% | 24.0% | 26.2% |
| | | BGC Counselors | 53 | 0% | 100% | 42.3% | 19.5% |
| Academic Performance | 32.1% | Parents | 52 | 0% | 100% | 39.2% | 23.0% |
| | | Teachers | 53 | -75% | 100% | 24.1% | 25.2% |
| | | BGC Counselors | 49 | 0% | 75% | 33.0% | 22.9% |
| Ability to Organize Ideas & Communicate | 26.7% | Parents | 52 | 0% | 75% | 31.7% | 23.2% |
| | | Teachers | 53 | -50% | 75% | 19.4% | 22.6% |
| | | BGC Counselors | 52 | 0% | 100% | 29.0% | 23.6% |
| Focus | 35.1% | Parents | 52 | -25% | 10% | 40.4% | 27.8% |
| | | Teachers | 53 | -75% | 75% | 23.1% | 26.6% |
| | | BGC Counselors | 51 | 0% | 75% | 41.8% | 17.1% |
| Ability to Finish Work on Time | 30.4% | Parents | 50 | -25% | 100% | 37.3% | 24.4% |
| | | Teachers | 53 | -75% | 75% | 21.2% | 24.8% |
| | | BGC Counselors | 51 | 0% | 75% | 32.8% | 20.2% |
| Listening Skills | 32.1% | Parents | 51 | 0% | 100% | 33.1% | 23.9% |
| | | Teachers | 54 | -75% | 75% | 24.1% | 24.6% |
| | | BGC Counselors | 52 | 0% | 100% | 39.1% | 26.1% |
| Ability to Avoid Frustration | 27.5% | Parents | 52 | -50% | 100% | 24.7% | 28.2% |
| | | Teachers | 54 | -50% | 75% | 20.8% | 28.9% |
| | | BGC Counselors | 51 | -50% | 100% | 36.9% | 30.0% |
| Ability to Finish Work Independently | 31.3% | Parents | 51 | 0% | 100% | 38.1% | 24.1% |
| | | Teachers | 54 | -75% | 100% | 23.8% | 29.2% |
| | | BGC Counselors | 51 | 0% | 87.5% | 32.0% | 22.1% |
| Coordination & Motor Skills | 20.8% | Parents | 52 | 0% | 75% | 17.4% | 22.0% |
| | | Teachers | 51 | 0% | 75% | 18.9% | 23.1% |
| | | BGC Counselors | 52 | 0% | 75% | 26.1% | 21.5% |
| Ability to Work Well with Others | 25.4% | Parents | 52 | 0% | 100% | 26.8% | 24.4% |
| | | Teachers | 54 | -50% | 100% | 20.0% | 27.8% |
| | | BGC Counselors | 52 | 0% | 100% | 29.3% | 23.1% |
| Self Confidence | 30.5% | Parents | 52 | 0% | 75% | 32.8% | 23.2% |
| | | Teachers | 54 | -75% | 75% | 22.1% | 25.2% |
| | | BGC Counselors | 52 | 0% | 75% | 36.7% | 22.2% |

Raw data from Table 7:

| Descriptive Statistics of Changes in Ranking provided by Parents, Teachers and the Counselors | | | | | | |
|---|----|---------|---------|-------|----------------|--|
| | N | Minimum | Maximum | Mean | Std. Deviation | |
| P_Attention | 51 | 0 | 4 | 1.55 | 0.996 | |
| T_Attention | 53 | -3 | 3 | 0.92 | 1.046 | |
| BGC_Attention | 53 | 0 | 4 | 1.70 | 0.780 | |
| P_Academic | 53 | 0 | 4 | 1.56 | 0.918 | |
| T_Academic | 53 | -3 | 4 | 0.92 | 1.007 | |
| BGC_Academic | 49 | 0 | 3 | 1.34 | 0.915 | |
| P_OrgIdea | 53 | 0 | 3 | 1.25 | 0.928 | |
| T_OrgIdea | 53 | -2 | 3 | 0.73 | 0.902 | |
| BGC_OrgIdea | 52 | 0 | 4 | 1.16 | 0.943 | |
| P_Focus | 53 | -1 | 4 | 1.59 | 1.110 | |
| T_Focus | 53 | -3 | 3 | 0.86 | 1.062 | |
| BGC_Focus | 51 | 0.0 | 3.0 | 1.686 | 0.6853 | |
| P_Finish | 51 | -1 | 4 | 1.47 | 0.977 | |
| T_Finish | 53 | -3 | 3 | 0.80 | 0.992 | |
| BGC_Finish | 51 | 0 | 3 | 1.31 | 0.806 | |
| P_Listen | 52 | 0 | 4 | 1.28 | 0.957 | |
| T_Listen | 54 | -3 | 3 | 0.93 | 0.983 | |
| BGC_Listen | 52 | 0 | 4 | 1.57 | 1.043 | |
| P_Frustration | 53 | -2 | 4 | 0.97 | 1.128 | |
| T_Frustration | 54 | -2 | 3 | 0.79 | 1.156 | |
| BGC_Frustration | 51 | -2 | 4 | 1.48 | 1.200 | |
| P_CompWork | 52 | 0 | 4 | 1.50 | 0.965 | |
| T_CompWork | 53 | -3 | 4 | 0.89 | 1.167 | |
| BGC_CompWork | 51 | 0.0 | 3.5 | 1.284 | 0.8846 | |
| P_Motor | 53 | 0 | 3 | 0.69 | 0.878 | |
| T_Motor | 51 | 0 | 3 | 0.71 | 0.923 | |
| BGC_Motor | 52 | 0 | 3 | 1.05 | 0.859 | |
| P_WorkOthers | 54 | 0 | 4 | 1.04 | 0.975 | |
| T_WorkOthers | 54 | -2 | 4 | 0.78 | 1.110 | |
| BGC_WorkOthers | 52 | 0 | 4 | 1.17 | 0.923 | |
| P_SelfConf | 53 | 0 | 3 | 1.29 | 0.927 | |
| T_SelfConf | 54 | -3 | 3 | 0.84 | 1.009 | |
| BGC_SelfConf | 52 | 0 | 3 | 1.47 | 0.888 | |

Note:

P: Stands for parents
 T: stands for teachers
 BGC: presents ranking provided by the Boys & Girls Clubs Counselors
 Attention: Ability to pay attention
 Academic: Academic improvement
 OrgIdea: Ability to organize ideas and communicate

Focus: Ability to focus on work
 Finish: Ability to finish work on time
 Listen: Ability to listen and follow directions
 Frustration: Frustration level
 CompWork: Ability to complete work independently
 Motor: Coordination and motor-skills
 WorkOthers: Ability to work well with others
 SElfConf: Self-confidence and self-esteem

Conclusions

The twenty-two students tested with the Woodcock-Johnson gained an average of:

- **9.1 months improvement in reading.**
- **3.9 months improvement in math.**
- **16 months (1.6 years) improvement in processing speed. This was the most significant outcome.** Processing speed is the combination of thinking speed and decision-making speed. As students improve their processing speed they are able to think faster and absorb information more easily.

The thirty-two students who were tested with the WISC showed an average of:

- **10.9% improvement in processing speed** in the WISC Coding measurement.
- **31.2% improvement in processing speed** in the WISC Symbol Search.

The thirty-two students who were tested on the Mathematics Performance Inventory showed an average of:

- **2.9 months improvement in math.**

The students also showed dramatic improvement in ratings from teachers, parents, and Boys and Girls Club counselors on the 11 academic and behavior traits for which they were tested. Remarkable improvements were made in academic performance, attitude, ability to process information, and ability to deal with the surrounding environment

Students showed an average improvement of:

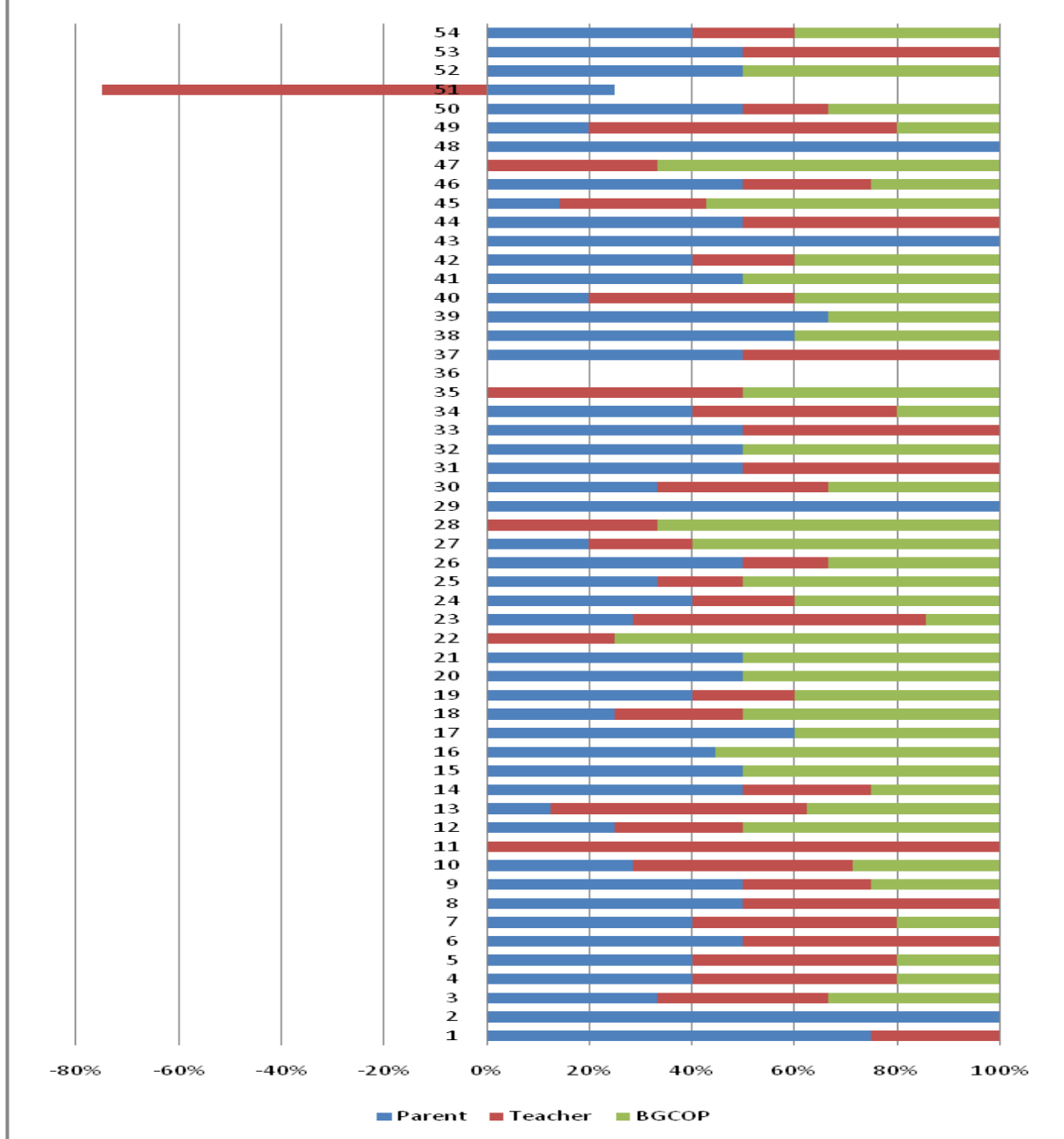
- Ability to pay attention: **35.2%** improvement
- Reading, math, spelling, and writing: **32.1%** improvement
- Ability to organize and communicate ideas: **26.7%** improvement
- Focus: **35.1%** improvement
- Ability to finish work on time: **30.4%** improvement
- Listening skills: **32.1%** improvement
- Ability to manage frustration: **27.5%** improvement
- Ability to finish work independently: **31.3%** improvement
- Coordination and motor skills: **20.8%** improvement
- Ability to work well with others: **25.4%** improvement
- Self confidence: **30.5%** improvement

For the 11 traits reported, teachers reported an average of 21.9% improvement, parents reported an average of 32.8% improvement and Boys and Girls Club counselors reported an average of 34.4% improvement.

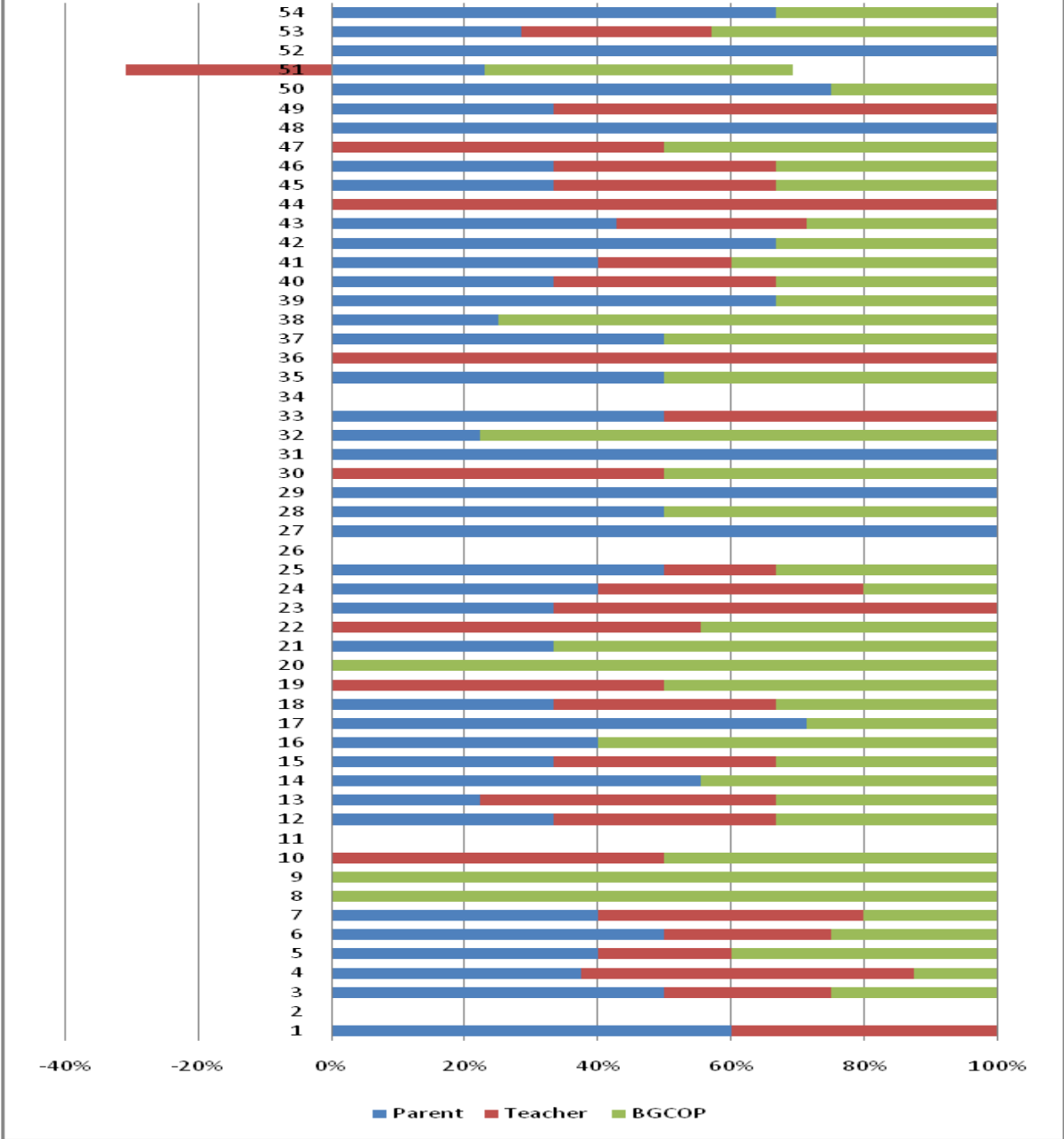
Appendix A: Graphic Presentation of Differential Changes in Eleven Areas Evaluated by Parents, Teachers, and Counselors

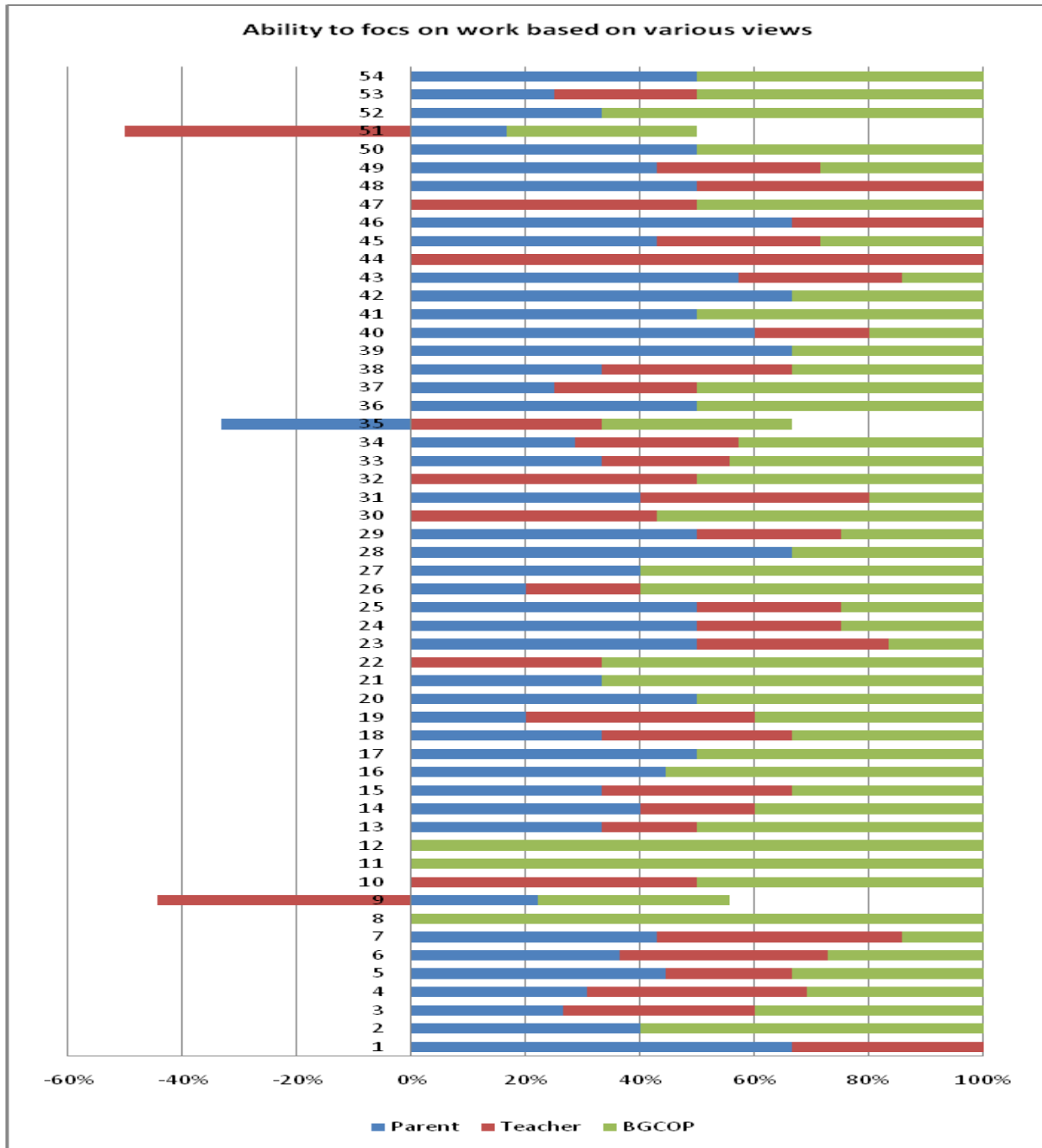


Academic Improvement based on various views

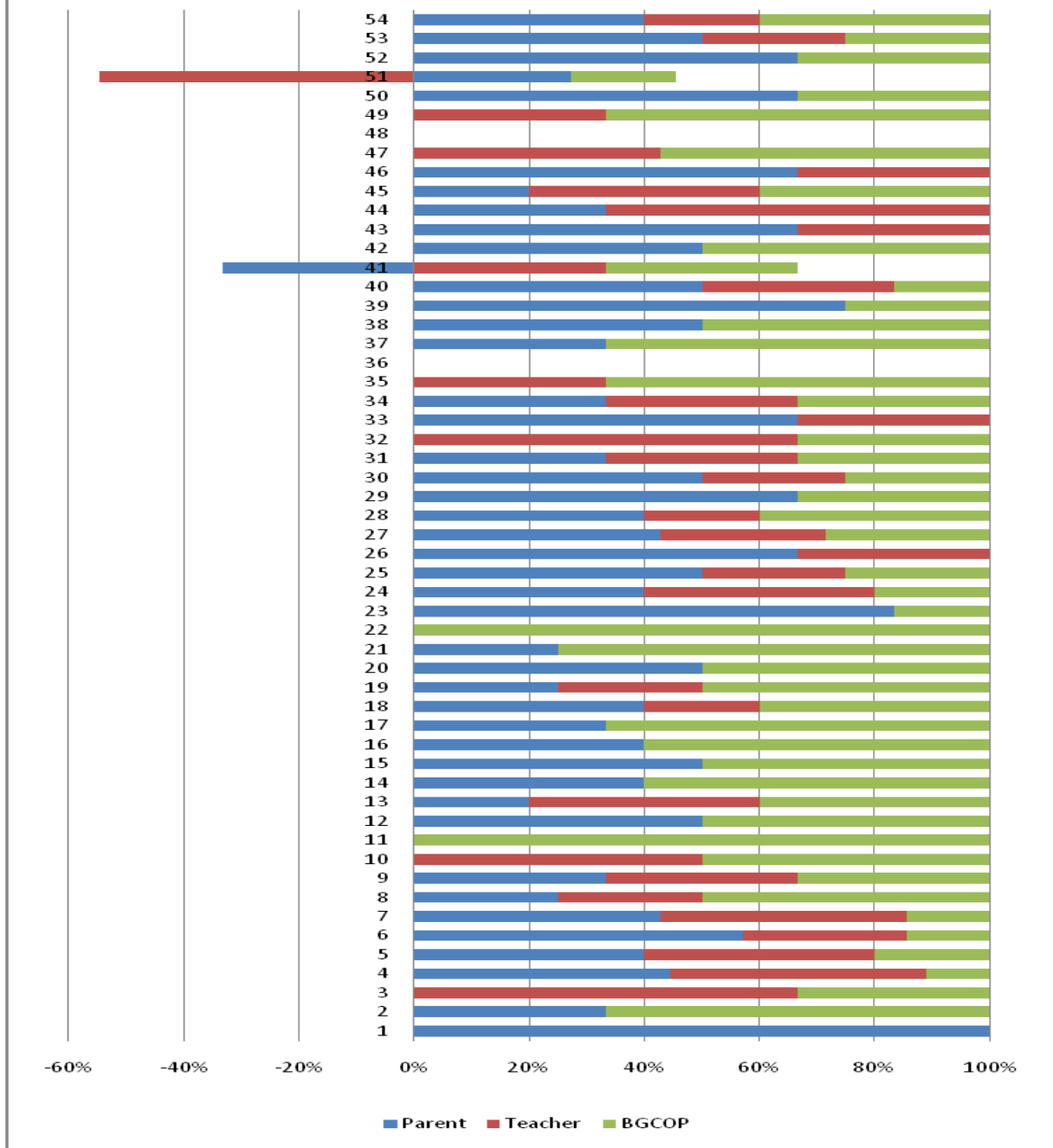


Ability to organize ideas and communicate based on various views

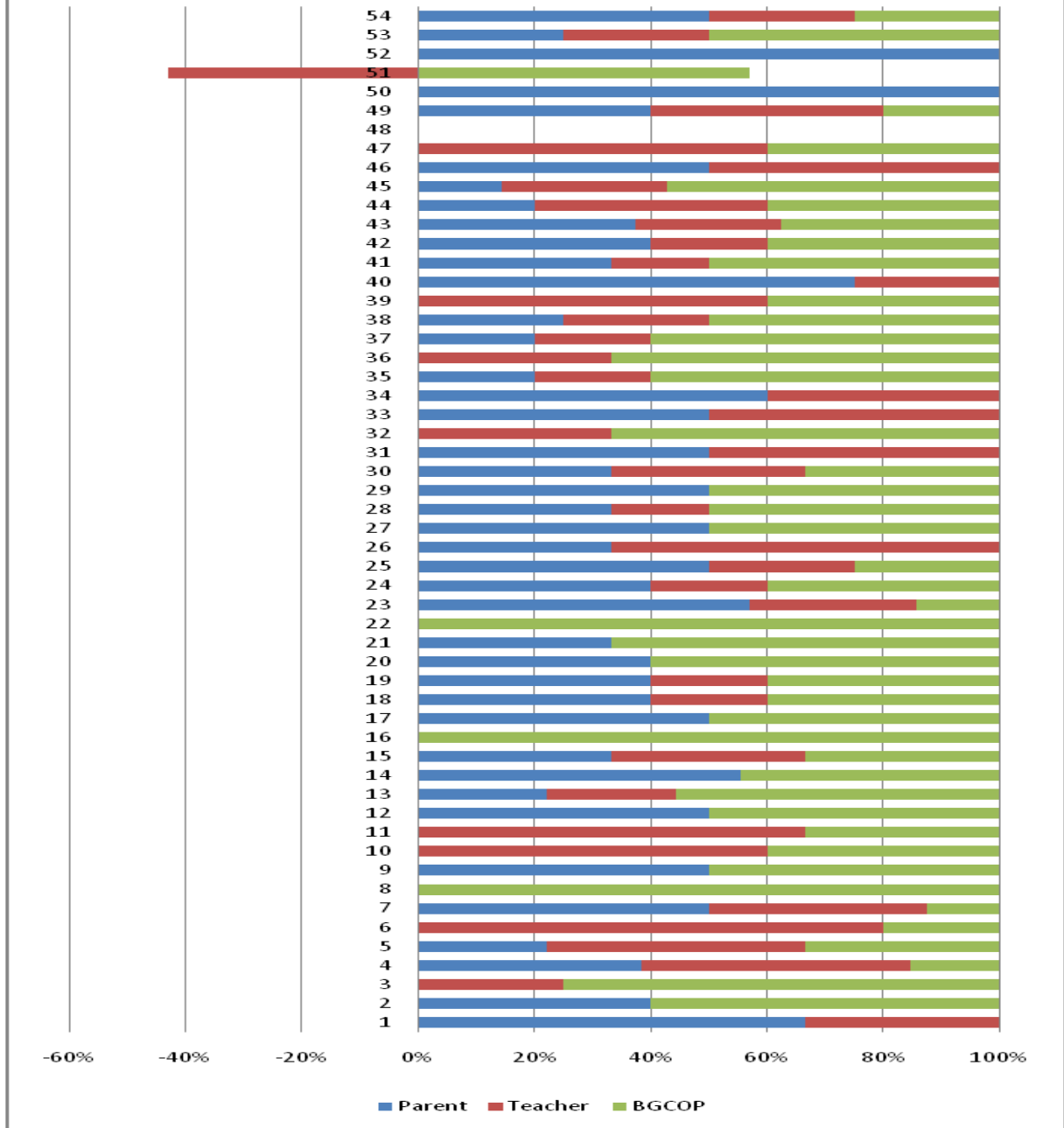


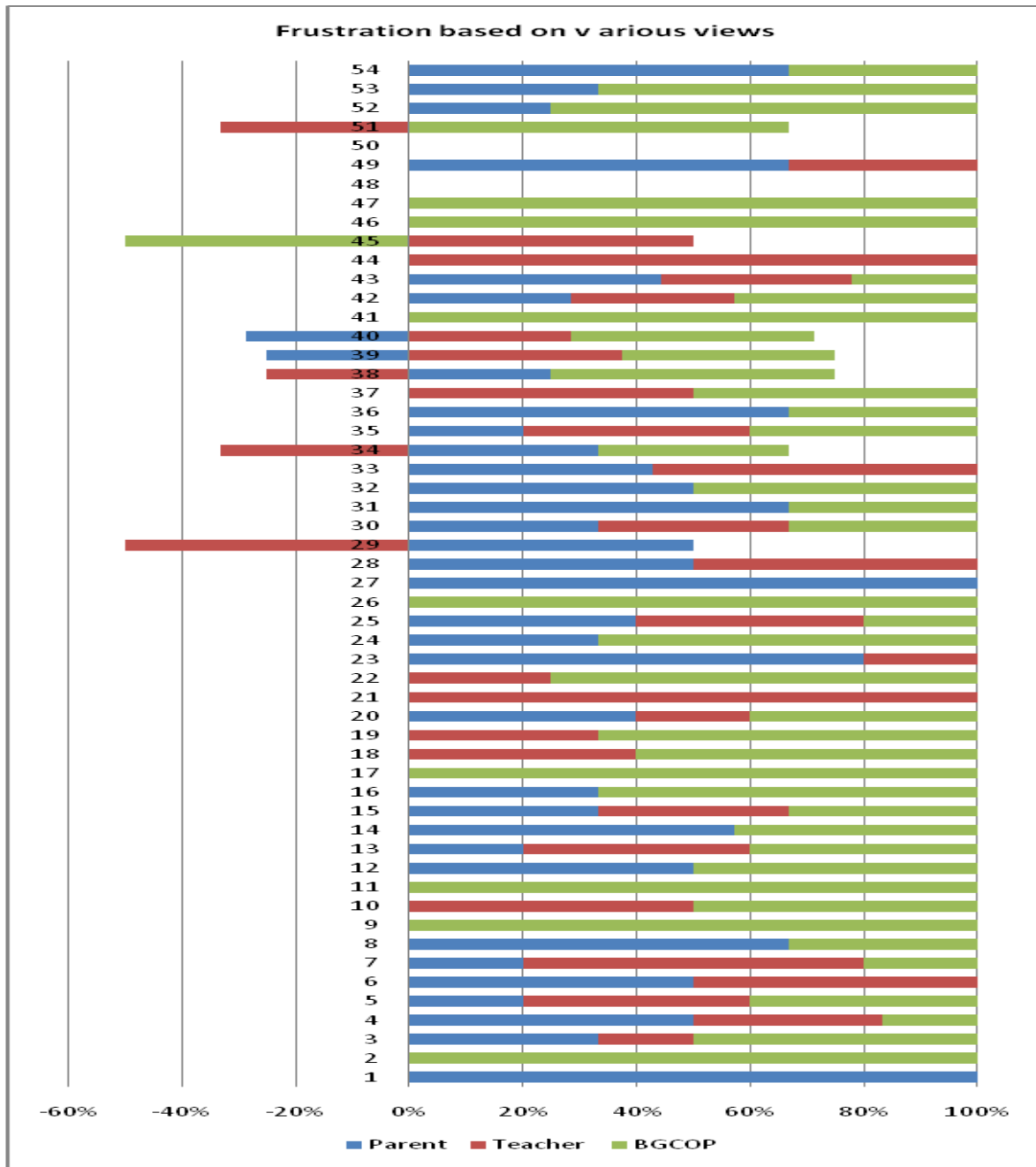


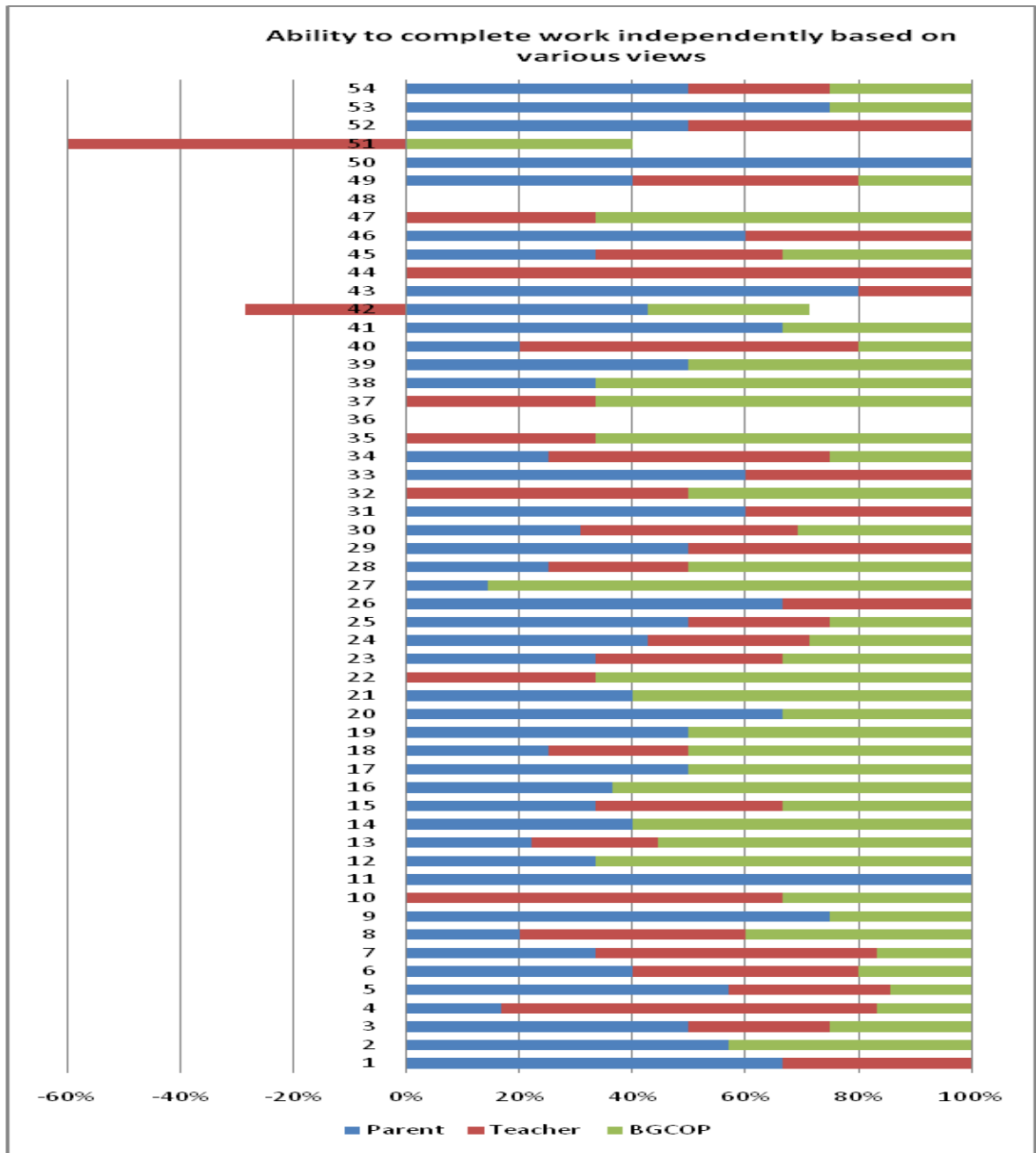
Ability to finish work on time based on various views

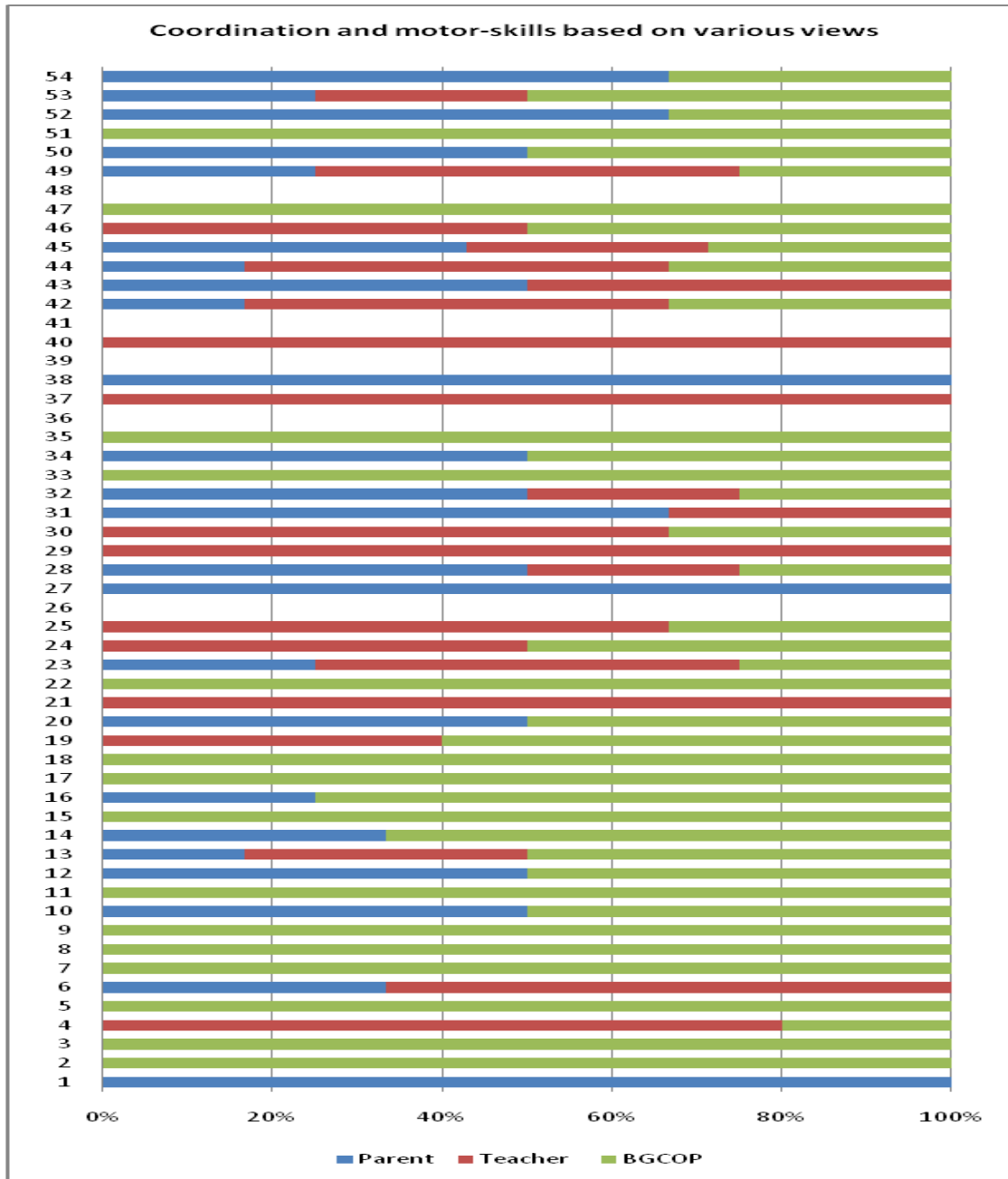


Ability to listen and follow directions based on various views



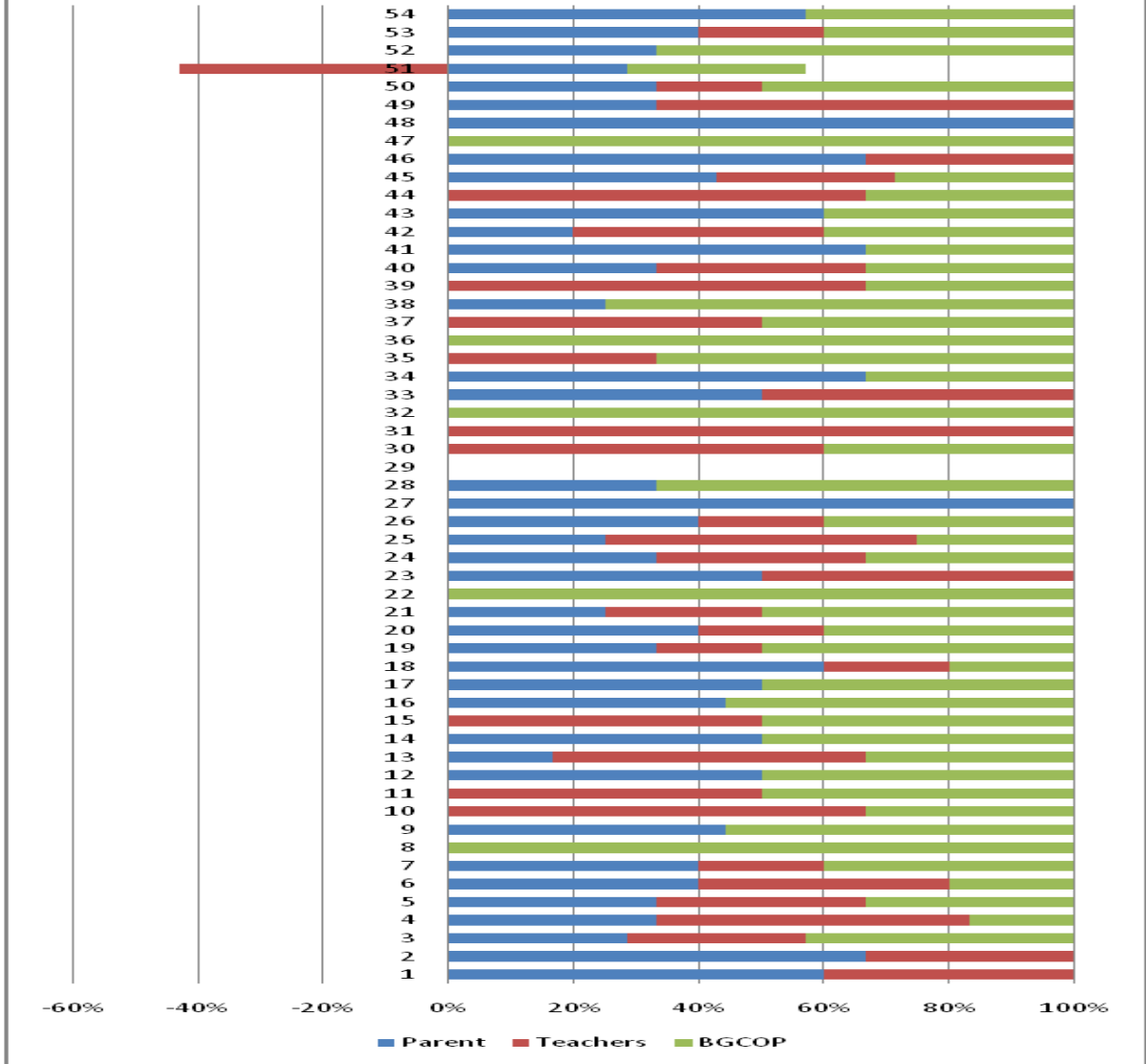








Self confidence and self-esteem based on various views



Appendix B: Graphic Results of Separate Areas of Evaluation by Parents, Teachers, and BGC Counselors

