VAN ROBOTICS
THE SMART ROBOT TUTOR COMPANY

"Breaking Barriers for Academic Achievement through Artificial Intelligence (AI)"

July 2022 Report

Grant Recipient Information

Van Robotics, Inc.
712 Richland Street, Suite F
Columbia, SC 29201

Partner districts	Partner Schools
Sumter County School District	Alice Drive Elementary School Cherryvale Elementary High Hills Elementary Kingsbury Elementary Lemira Elementary Manchester Elementary Millwood Elementary Oakland Primary Rafting Creek Elementary Shaw Heights Elementary Willow Drive Elementary
Rock Hill (York 3) School District	Ebinport Elementary Sunset Park Elementary
Laurens 55 County School District	Waterloo Elementary Ford Elementary

I. Overview of Progress

a. Activities students and teachers participated in over the reporting period

This year, we launched a continuing study to empirically evaluate how an AI-enabled robot can support improvements in social emotional learning (SEL) by comparing (a) student learning gains observed after teacher-led delivery of the InFocus SEL curriculum only, to (b) student learning gains observed after teacher-led instruction plus an AI-enabled robot, named ABii, to reinforce concepts. We enrolled a **group of 89 teachers and 1,281 Kindergarten-5th grade students from SC Title 1 schools**, who were at high risk for school disengagement and social emotional and behavioral challenges. In total, 35 teachers and 586 students completed all the requirements for the study. This large-scale study evaluated improvements in social emotional learning (SEL) for students in K-5, over the course of a full academic year, with and without the use of the ABii robot. The total duration of teacher/student activities for this project was **approximately 30 weeks**.

We enrolled participants from fifteen (15) K-5 Title 1 schools, for three study groups:

(1) Teacher-led InFocus curriculum only
(2) Teacher-led InFocus plus ABii robot with InFocus curriculum and,
(3) ABii robot with InFocus curriculum only.

We will refer to the study groups 1-3 below as we describe the activities below.

Week 1: Each teacher in study groups 2 and 3 received 1-2 robots for their classroom. All teachers in all groups (1, 2 and 3) received a packet of IRB-approved consent forms for parents and one for themselves, as well as assent forms for their students.

Week 2-3: Enrolled teachers shipped back all signed consent and assent forms using a school-issued or Van Robotics prepaid return label and box.

Training.
All teachers, some technology staff and administrators from study groups 2 and 3, attended a 3-hour professional development training to acquaint participants with how ABii works, share details and answer any questions about the research protocol, and introduce the Van project manager (who was their primary contact for study communication and support, to help with study protocol adherence).

Study groups 1 and 2 separately received a 3-hour introduction to the InFocus curriculum and regular, monthly "check-in" meetings throughout the course of the 30 weeks (all hosted by the InFocus founder, Tom McSheehy).

Pre-assessments.
Next, teachers and students in all study groups and all K-5 grades completed a **validated, multi-scale pre-assessment based on a grade level-appropriate Panorama SEL questionnaire**.

- Teachers from K-5th grade classrooms from all study groups completed a personal, 28-question survey measuring baseline across eight SEL scales including Self-Awareness, Imperfection is Perfection in Teaching SEL, Emotional Awareness and Expression, Self-Regulation Strategies, Integration of SEL into Academic Subjects, School Climate, Professional Learning About SEL-Teacher, Teacher Self-Reflection.

- Students in 3rd-5th grade each completed a 48-question survey measuring baseline across eight SEL scales including: Self-Management, Awareness, Climate, Teacher-Student, Belonging, Positive, Challenging, Safety.

- Teachers of students in K-2nd grade classrooms additionally completed a 14-question survey for each of their students to collect a baseline for each of the following SEL scales: Self-Management, Awareness, Self-Efficacy, Classroom, Perspective-Taking, Emotion, Engagement, Relationship.

All pre-assessment survey responses were collected electronically and securely stored as baseline SEL scores for each participant.

Weeks 4-28:
For each week of the next 24 weeks, students in each group were expected to receive either: (Group 1) Four 15-minute InFocus lessons delivered by their teacher, or (Group 2) Four 15-minute InFocus lessons delivered by their teacher plus two 10-15 minute SEL lessons delivered by ABii, or (Group 3) Two 10-15 minute ABii SEL lessons.

Weeks 29-30:
Finally, all teachers and students in all study groups and all K-5 grades completed a **validated, multi-scale post-assessment based on a grade level-appropriate Panorama SEL questionnaire**.

- Teachers from K-5th grade classrooms from all study groups completed a personal, 28-question survey measuring baseline across eight SEL scales including Self-Awareness, Imperfection is Perfection in Teaching SEL, Emotional Awareness and Expression, Self-Regulation Strategies, Integration of SEL into Academic Subjects, School Climate, Professional Learning About SEL-Teacher, Teacher Self-Reflection.

- Students in 3rd-5th grade each completed a 48-question survey measuring baseline across eight SEL scales including: Self-Management, Awareness, Climate, Teacher-Student, Belonging, Positive, Challenging, Safety.

- Teachers of students in K-2nd grade classrooms additionally completed a 14-question survey for each of their students to collect a baseline for each of the following eight SEL scales: Self-Management, Awareness, Self-Efficacy, Classroom, Perspective-Taking, Emotion, Engagement, Relationship.

Post-assessment survey responses were collected electronically and securely stored as growth SEL scores for each participant.

Week 32: Data aggregation and analysis began.

b. Major milestones accomplished
We completed the Year 3 study with fair participant retention and few deviations from the study design. Our Year 1 study met all criteria for an ESSA Tier 1 research study, and although our Year 2 study fell short of the 350 student criterion (due to fewer robots deployed) all other criteria were met for ESSA Tier 1. **This year's research study again meets all criteria for an ESSA Tier 1 research study** with more than 600 participants, 15 educational sites and a statistically significant positive effect.

Data Analysis. Learning gains across eight SEL scales were evaluated with a validated pre- and post-assessment, administered approximately 30 weeks apart. Recorded scores were normalized and learning gains were computed for each student and each teacher. Overall results are featured in Table 1 below. Further analyses were also performed to examine whether the ratio of K-2nd to 3-5th grade students in each study group and the relative differences in SEL improvement contributed to the overall results. These grade-level results are highlighted in Table 2 below.

Summary of Results.

Group 1: Teacher-led InFocus curriculum only
Group 2: Teacher-led InFocus plus ABii robot with InFocus curriculum and,
Group 3: ABii robot with InFocus curriculum only.

Table 1. Overall Results

Group 1	% of Learners Improved 50.2%	Avg Improvement 10.8%	# of Students 245
Group 2	% of Learners Improved 73.0%	Avg Improvement 18.1%	# of Students 244
Group 3	% of Learners Improved 70.5%	Avg Improvement 10.2%	# of Students 61

Table 2. Grade-level Results

Group 1	Percent of K-2 37.14%	Percent of 3-5 62.86%	Avg Improvement K-2	14.59%	Avg Improvement 3-5	6.35%
Group 2	Percent of K-2 65.57%	Percent of 3-5 34.43%	Avg Improvement K-2	22.31%	Avg Improvement 3-5	4.74%
Group 3	Percent of K-2 57.38%	Percent of 3-5 42.62%	Avg Improvement K-2	11.71%	Avg Improvement 3-5	6.76%

Discussion of Results.

Data Cleanup.
Students from Group 3 whose ABii robots reported that they had not taken any lessons during the study period were removed from the data analysis. Students from Group 2 whose ABii robots reported that they had not taken any lessons during the study period were moved to Group 1 (Teacher-led InFocus lessons only). We also performed data analyses excluding their data entirely, with little change in the overall results.

Results from our data analyses further support findings from Years 1 and 2.
Significantly more students had greater learning gains, on average, among Group 2 (teacher-led InFocus plus 2 ABii-delivered lessons per week) compared to Groups 1 and 3. This outcome was expected since students in Group 2 received a greater dosage of SEL instruction when teacher-led lessons were supplemented with 2 additional ABii SEL lessons per week. Additionally, adding ABii as an alternative learning modality for students, may have contributed to the significantly greater percentage of students who improved from pre- to post-assessment in Groups 1 and 3.

Group 1. Teacher-led InFocus only Gains Overall:	10.8%
Group 2. Teacher-led InFocus + ABii Gains Overall:	**18.1%**
Group 3. ABii-delivered InFocus Lessons Gains Overall:	10.2%

Further evidence supporting results from Years 1 and 2. Students with the lowest pre-assessment scores (<=50%) tended to achieve significantly greater learning gains after adding ABii lessons to teacher-led instruction, compared to learning gains observed in the lowest-scoring students from the other 2 study groups.

Group 1. Teacher-led InFocus only Gains Lowest:	18.3%
Group 2. Teacher-led InFocus + ABii Gains Lowest:	**36.6%**
Group 3. ABii-delivered InFocus Lessons Gains Lowest:	15.2%

Statistically significant results

Learning Gains

(1) An independent-samples t-test was conducted to compare learning gains observed in **Group 1** (M=0.11, SD=0.08) compared to **Group 2** (M=0.18, SD=0.14). An extremely statistically significant result was observed between Group 1 and Group 2 learning gains, t(299)=5, p<0.0001. ***These results suggest that adding 2 lessons per week with the ABii robot have a very strong positive effect on learning gains.***

(2) An independent-samples t-test was conducted to compare learning gains observed in **Group 1** (M=0.11, SD=0.08) compared to **Group 3** (M=0.10, SD=0.09). *Learning gains observed in each group were not statistically significant*; t(164)=0.35, p=0.722.

(3) An independent-samples t-test was conducted to compare learning gains observed among the lowest scorers (<50% on pre-assessment) for **Group 1** (M=0.17, SD=0.09) and **Group 2** (M=0.36, SD=0.16). An extremely statistically significant result was again observed in learning gains between Group 1 lowest scorers and Group 2 lowest scorers, t(43)=4, p<0.0002. **These results suggest that adding 2 lessons per week with ABii have a very strong positive effect on learning gains among the lowest scorers on the pre-assessment.**

Number of Learners who improved

(4) An independent-samples t-test was conducted to compare the number of learners who improved from pre-assessment to post-assessment, observed in **Group 1** compared to **Group 2**. An extremely statistically significant result was observed in the number of learners who improved between Group 1 and Group 2, t(487)=5, p<0.0001. ***These results suggest that adding 2 lessons per week with the ABii robot has a very strong positive effect on the number of learners who show improvement on the post-assessment.***

(5) An independent-samples t-test was conducted to compare the number of learners who improved from pre-assessment to post-assessment, observed in **Group 1** compared to **Group 3**. A very statistically significant result was observed in the number of learners who improved between Group 1 and Group 3, t(304)=2.9, p<0.0043. ***These results suggest that providing just 2 lessons per week with the ABii robot has a strong positive effect on the number of learners who improve.***

II. Summary of Feedback Received

The majority of the feedback we received was from classroom teachers and fell into one of three requests: (1) More ABiis for their classroom, (2) More training to more effectively use the ABii and (3) More time to use ABii. We also received a few emails from teachers who initially had trouble with the setup (see below), but these were generally solved with help from the school's IT personnel. Overall, teachers appreciated the opportunity to work with ABii and the communication and support they received from our team.