



“The goal of collaboration is not collaboration itself, but great results.”

— Morten Hansen

Examining the Effectiveness of mcSquares in Classrooms

Boredom and disengagement are real problems in traditional classroom settings, where teachers deliver lessons with one-way communication and students lack the ability to engage in true discussion with both their teacher and their peers.

In 2016, we conducted a breakthrough study over the course of two days with 7th graders in an urban public middle school. During the study, we uncovered the astonishing benefits of increasing collaboration in the classroom with our handheld whiteboard system.



FULL STUDY

mcSquares is a product designed to make learning more collaborative, creative, and engaging for students. The mcSquares system is a collection of many hand held collaboration boards that allow students to work through their lessons and then share them with their fellow classmates. mcSquares mount easily to walls for display, and offer students the ability to see each other's work and discuss the progression of their thinking. For students who might be less willing to share their thoughts openly, mcSquares allows them the space to display their work with their classmates and teachers so that they can be more participatory in the learning process. Additionally, the product works to engage students who benefit from a diversity of learning styles, from auditory to visual, to kinesthetic.

mcSquares desires to expand the utilization of its product in classrooms, and to do this, they conducted a study in a public middle school to demonstrate the efficacy of the product in the learning process. The study sought to analyze student scores on assessments of learning objectives. Lessons were delivered by their teacher, and the aim was to measure whether or not using mcSquares would improve posttest scores and overall student learning experiences when compared to lessons delivered without the use of mcSquares. In this study, the data indeed show that using mcSquares to deliver a lesson both enhances student learning experiences and improves assessment scores over teaching without mcSquares.

METHODS

In this quasi-experimental study, we utilized a mix methods approach to measure whether the use of mcSquares to deliver a lesson would impact student assessments of lesson objectives and learning experiences. Students completed pre and posttest measures of a learning objective and also took self-administered surveys in which they answered both quantitative and qualitative measures of their experience using mcSquares. mcSquares recruited a 6th grade teacher currently using their product, who teaches four English classes. This teacher was not picked randomly, because of the challenge of finding teachers willing to take time out of their day to participate. Consent forms were signed by the teacher and the principal of the school for the teacher to administer the study to four classes in December, 2016. The study was conducted at an urban public middle school.

The teacher prepared one lesson about [enter lesson here]. Then, in consult with the teacher, an associate at mcSquares devised a pre and posttest assessment of five multiple choice questions, based on the lesson objectives provided by the teacher. The teacher randomly assigned half of the classes to receive the lesson with mcSquares, and the other two classes worked through the lesson without mcSquares. [Identify the method with which the teacher delivered the lesson without mcSquares here (chalkboard, whiteboard, Smartboard, etc.)]. The teacher distributed a pretest to every student in each class to gauge student knowledge before the lesson, and then delivered the lesson with or without mcSquares. The teacher then administered a posttest, identical to the pretest, after the lesson. Additionally, all students completed a brief, 11 question self-administered survey containing both quantitative and qualitative measures. A copy of the pre and posttest as well as the survey is attached to this report.

A total of 100 students participated in the study, but four did not reveal their block or class number, and one did not take the pre or posttest, but completed the survey about the product, so five students were excluded (N = 95). Student names were written on a coversheet so that the teacher could match the posttests to the correct students/pretests. The teacher tore off the cover sheet, with all identifying information, before returning the ungraded pre and posttests to mcSquares. All tests were graded by an associate of mcSquares, and all tests were given a number, to maintain anonymity of the students. Students also identified gender and class period. All other identifying information about the school, teacher, and administration is withheld from this report. All scores were entered into a spreadsheet, and an outside consultant analyzed data and compiled this report.

Pretests and posttests were graded and recorded by an associate with mcSquares. Each correct answer earned 20 points for a total of 100 points possible on each assessment. A passing grade is 60 out of 100 points. This data was analyzed to determine the degree to which students improved from their pretests to their posttests, and then also to assess whether or not the use of mcSquares affected student posttest scores. Qualitative and quantitative data collected from student surveys about their experiences with mcSquares were analyzed also.

Self-administered Surveys

Students answered nine multiple choice questions using a basic Likert Scale with answers 1 through 5 (from strongly disagree to strongly agree). Students then answered two open-ended questions at the end of the survey. 84 students completed the surveys (N=84). See tables 3 through 11 below.

Table 3: Survey Question 1: I enjoy using mcSquares when compared to pencil and paper

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	4	4	17	22	37

Table 4: Survey Question 2: mcSquares are better than using a singular regular whiteboard

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	3	8	20	29	24

Table 5: Survey Question 3: mcSquares are better than using a chalkboard

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	3	9	8	21	43

Table 6: Survey Question 4: mcSquares are better than using a Smartboard/Promethean Board/Projector

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	17	29	21	15	2

Table 7: Survey Question 5: mcSquares are better than using a whiteboard desk

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	12	24	33	7	8

Table 8: Survey Question 6: I learn more in my lessons that use mcSquares

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	5	11	28	28	12

Table 9: Survey Question 7: I enjoy lessons that use mcSquares more than I enjoy lessons that don't use them

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	3	8	17	34	20

Table 10: Survey Question 8: I want my teacher to use mcSquares more often

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	5	5	14	28	30

Table 11: Survey Question 9: mcSquares makes it easier to work with other students

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
n=	4	8	18	31	21

FINDINGS

Pre and Posttest Assessments

The teacher identified the lesson objective as:

“Enter lesson objective here”

The teacher administered a pretest of five multiple choice questions (worth 20 points each) and then delivered their lesson to Blocks (class periods) 2, 3, 5, and 7. Blocks 2 & 7 (n = 45 students) received the lesson without mcSquares, and blocks 3 and 5 worked through the same lesson with mcSquares (n = 55 students). After the lesson, students took a posttest with the same five questions as the pretest. For students who did not work with mcSquares, on the pretest, 6.67% (n=3) scored a 0%; 28.89% (n=13) scored 20%; 31.11% (n=14) scored 40%; 17.77% (n=8) scored 60%; 15.56% (n=7) scored 80%; 0% (n=0) scored 100%. On the posttest, 2.22% (n=1) scored 0%; 40% (n=18) scored 20%; 33.33% (n=15) scored 40%; 8.88% (n=4) scored 60%; 11.11% (n=5) scored 80%; 4.44% (n=2) scored 100%. See Table 1 below.

Table 1: Pre and Posttest Scores from Lesson Delivered WITHOUT mcSquares (N = 45)

SCORE	PRETEST (n)	PRETEST (% of Total)	POSTTEST (n)	POSTTEST (%) (% of total)
0%	12	11%	5	4.58%
20%	20	18.35%	39	35.77%
40%	34	31.19%	31	28.44%
60%	31	28.44%	17	15.59%
80%	9	8.26%	14	12.84%
100%	3	2.75%	3	2.75%
TOTAL	109	99.99%	109	99.97%

Of the students who did not use mcSquares, 4.44% (n=2) of students moved from failing (grade <60%) to passing with a grade of 60% or above. 17.77% (n=8) improved their scores from the pretest to the post test, and 51.11% (n=23) of student scores stayed the same from the pretest to the posttest.

Table 2: Pre and Posttest Scores From Lesson Delivered WITH mcSquares (N = 50)

SCORE	PRETEST (n)	PRETEST (% of Total)	POSTTEST (n)	POSTTEST (%) (% of Total)
0%	6	5.5%	4	3.67%
20%	27	24.77%	15	13.76%
40%	27	24.77%	22	20.18%
60%	26	23.85%	28	25.69%
80%	16	14.73%	27	24.77%
100%	7	6.42%	13	11.93%
TOTAL	109	100%	109	100%

Of the students who worked through the lesson with mcSquares, nine students (18%) moved from a failing grade on the pretest (score < 60%) to a passing grade of 60% or higher. Additionally, the data show that two more students improved to a 100% grade from their pretest. After working with mcSquares, 24 out of 50 students or 48% of students improved from the pretest to the posttest while 16 students, or 32%, maintained the same score from the pretest to the posttest.

From the survey data, 70% of the 84 students who answered question 1 preferred using mcSquares over pencil and paper. When comparing the use of mcSquares over learning tools like a chalkboard or a regular whiteboard, students preferred using mcSquares: 76% preferred mcSquares over a chalkboard, and 63% preferred them over a regular whiteboard. When asked whether or not they preferred using mcSquares over other technology-based learning tools, like Smartboards, Promethian Boards, and whiteboard desks, students favored using those tools over mcSquares. 20% reported that they preferred mcSquares over Smartboards and Promethian Boards, while 18% said they preferred mcSquares over using a whiteboard desk.

Question six asked students to report their assumption about their level of learning when using mcSquares. 47.6% reported believing that they learned more when they used mcSquares. The last three questions on the surveys measured the appeal of mcSquares for students. 64% of students enjoyed learning from lessons that utilized mcSquares over lessons without mcSquares. Over 70% of students want their teachers to use mcSquares more often, and over 63% responded that mcSquares make it easier to collaborate with classmates.

To capture student thoughts on their experiences that may have been missed in the multiple choice questions, students were asked two open-ended questions. The first question asked, "What do you like about using mcSquares?" 49 students offered responses to this question, and their answers focused largely on ease of use and the enhanced enjoyment of learning and creativity. One student commented, "I like that you can use them for geography. They are also fun to use to rough draft stories." Another student wrote, "It is easier to make plans because we can know we can erase it and it won't waste our time." For another student, he likes mcSquares because "we can learn more with them and they are awesome." Another student commented, "I like that they help me plan out my writing." Finally, another student commented on the helpfulness of mcSquares in planning her writing, "I like that I can sort my ideas out and it is easier than using paper."

Three students critiqued mcSquares. Two stated they wished the squares were larger and one said, "the marker stinks." Overall, of the students who commented with qualitative answers, the majority of them thought mcSquares were "cool" and that they made learning easier and more fun.

ANALYSIS

Data from this study show that using mcSquares has a significant impact on student assessments of a lesson delivered using mcSquares when compared to lesson delivery without mcSquares. When looking at posttest scores from students who received a lesson with mcSquares, they were 2.8 times more likely to improve over their pretest scores, with 48% of them improving, compared with only 18% who did not use mcSquares. Additionally, while six students who used mcSquares were already passing their pretest, an additional nine students passed their posttest, after failing their pretest and then using mcSquares. Dissimilarly, while 15 students pretested as passing before receiving a lesson without mcSquares, only two more moved to passing. We can conclude, then, that students who received a lesson with mcSquares were significantly more likely to improve their assessment scores to passing.

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In the self-administered surveys, we captured data on student experiences with mcSquares. Most students agreed that they liked learning with mcSquares when compared to lessons delivered without the product. Similarly, over 60% of students believed that mcSquares made working with fellow classmates easier, which is a major goal of the product. Over 70% of students would like their teachers to utilize them more than they already do. Additionally, the posttest assessment scores certainly show that students are learning more when using mcSquares than they are when learning with more traditional lesson delivery on chalkboard or on a singular large whiteboard at the head of the classroom. This data makes clear that students enjoy working with mcSquares and would prefer that their teacher would deliver instruction with the product more often.

Students reported preferring alternative technology in the classroom, like Smartboards and Promethian Boards, as well as whiteboard desks, over mcSquares. It is possible that students prefer lessons that utilize these technologies because they are more technologically interactive in a generation of children that has an affinity for such technologies. A study would have to compare delivering a lesson with mcSquares to one class and delivering that same lesson using a Smartboard to better understand why students may or may not prefer the Smartboard. It is also possible that teachers utilize Smartboards for particular lessons or subjects where mcSquares are not as appropriate, or that lessons in which teachers are more likely to use mcSquares are less desirable lessons for the students. Students may enjoy the way a teacher delivers a lesson with a Smartboard, but that method of delivery may not allow for as much collaboration as using mcSquares.

This study did have a limitation in that this was a cross-sectional research design. Future studies should replicate and compare new findings to this one. Additionally, if a teacher would be willing, they could deliver a lesson another day, and switch the classes who used mcSquares the previous day so that we can analyze whether or not a student who used mcSquares on the previous day does less well on a posttest when mcSquares are not utilized. Another study might also capture the degree to which students utilize and are familiar with alternative technologies in the classroom (like Smartboards and Promethian Boards), in addition to mcSquares, so that we can draw stronger comparative conclusions about the products.

CONCLUSION

In this study, we measured the efficacy of utilizing mcSquares in a 6th grade English lesson with 95 students over 4 classes, and compared students' pretest and posttest scores done both with and without the use of mcSquares. We also measured student thoughts on their experiences learning with mcSquares. Based on the findings, we argue that mcSquares provides a richer, more diverse, and more collaborative learning experience for students. In addition to student posttest scores improving significantly after learning with mcSquares, the majority of students reported a desire to work more often with mcSquares. For these 6th grade students, mcSquares offered them another avenue for planning their writing by encouraging individuality, creativity, and an alternative way of learning beyond a traditional chalkboard or whiteboard lecture.

USING mcSQUARES TO DELIVER A LESSON ENHANCES STUDENT LEARNING EXPERIENCES THROUGH HAPTIC AND KINESTHETIC LEARNING

3x

50%

41%

Three times as many students received passing posttest scores after receiving a lesson with mcSquares.

Half of students believed that mcSquares made working with fellow classmates easier.

More than 41% of students improved on posttest scores after working with mcSquares.

“mcSquares are very easy to use, and make learning fun, more interesting, and easier.”

— Alicia, 7th grade student

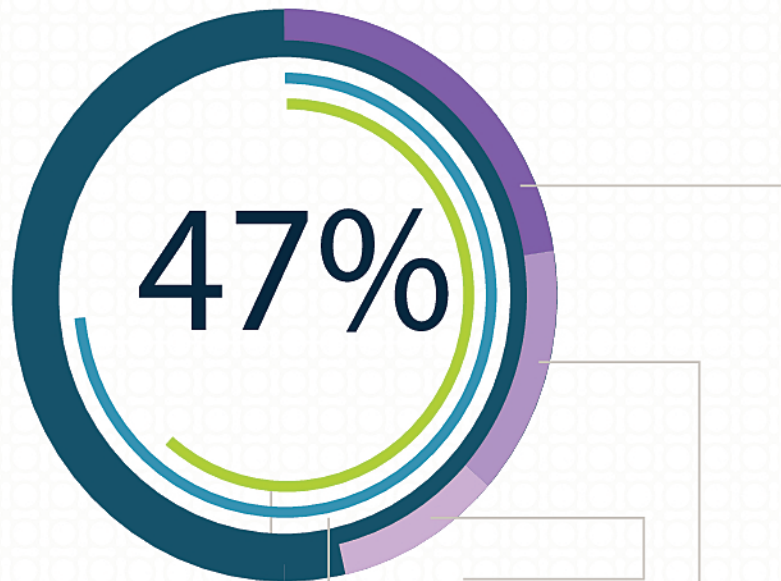
mcSQUARES PROVIDE RICHER, MORE DIVERSE, AND MORE COLLABORATIVE LEARNING EXPERIENCES FOR STUDENTS

Collaboration is key to not only improving student performance in traditional testing environments, but also to improving engagement and excitement about learning.

Students who use mcSquares find confidence in their ability to learn and engage with each other and with their teachers, improving the learning experience for all.

THE DATA

Students who were taught using mcSquares saw a 47% improvement over those who were taught using traditional tools.



64% of students would like their teacher to use mcSquares more often.

72% of the students preferred using mcSquares over pencil and paper.

20% improved by **60%**.

36% improved by **40%**

Of the students who saw improvement after receiving a lesson with mcSquares, **45%** improved by **20%**

Many educators are missing an opportunity to transform their classrooms with collaborative tools like mcSquares. *Are you one of them?*