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Mathematics as a Language

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Mathematics as a Language

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Research Question

How does the implementation of academic language affect student learning?

Literature Review

- Gottlieb and Ernst-Slavit (2013) define *academic language* as a way to communicate ideas, concepts, and higher thinking processes, but it is used so that students may acquire a greater insight into the materials.
- Marino (2005) emphasizes that pre-planning, open ended questioning, grouping and time all affect the implementation of academic language in the classroom.
- Fry and Villagomez (2013) and Glanfield, Oviatt, and Bazcuk (2006) found positive qualitative results in implementing academic language in relation to student learning.

Methodology

- Twenty-one eighth grade students and two seventh grade students in a high school were the participants of the study.
- Formative and summative assessments, student responses and lesson plans were collected during student teaching and content analyzed.
- Used class discussions/activities to determine the increased and correct use of academic language.

Common Mistakes with Language

Figure 1: *Student sample work that shows a proof in the opposite direction.*

Statements:	Reasons:
1.) $\overline{AD} \parallel \overline{BC}$	1.) Given
$\angle 2 \cong \angle 3$	2.) Def'n of $\cong$ ∠'s
2.) $\angle 2 = \angle 3$	3.) same side int. angles are supp.
3.) $\angle 5$ and $\angle 2$ are supp.	4.) Def'n of supp. angles.
$\angle 3$ and $\angle 6$ are supp.	5.) Subst.
4.) $\angle 5 + \angle 2 = 180°$	6.) Subst.
$\angle 3 + \angle 6 = 180°$	7.) Same side interior angles are supp. in parallel lines.
5.) $\angle 5 + \angle 2 = \angle 3 + \angle 6$	
6.) $\angle 5 + \angle 3 = \angle 2 + \angle 6$	
7.) $\overline{AB} \parallel \overline{CD}$	

Figure 2: *Student sample work includes the confusion between transitive and substitution property.*

Statements:	Reasons:
2.) $\angle 5$ is supp. $\angle 3$	2.) Consecutive angles
3.) $\angle 2$ is supp. $\angle 6$	3.) Consecutive angles
4.) $\angle 2$ is supp. $\angle 5$	4.) Substitution
5.) $\angle 3$ is supp. $\angle 6$	5.) Substitution
6.) $\angle 5 \cong \angle 6$	6.) Substitution

Figure 3: *Student sample works that demonstrates the students mathematical reasoning skills on the topic.*

Find x to make *a* and *b* parallel. Justify why the lines would be parallel.

a.) $m\angle 7 = x;\ m\angle 9 = 4x + 20$

$x + 4x + 20 = 180$

$5x + 20 = 180$

$x = 32$

b.) $m\angle 8 = 3x - 12;\ m\angle 7 = 2x + 10$

$3x - 12 = 2x + 10$

$x = 22$

Results and Data Analysis

- There was significant confusion on the direction of the proof (*Figure 1*) and the difference between transitive property of congruence and the substitution property of equality *(Figure 2*).
- Students who were not able to justify their work, had difficulty discovering correct solutions *(Figure 3)*.
- Student responses corroborate with student work findings where students shared about having more issues with word problems (mathematical skills and reasoning) than procedural problems.

Conclusion

- There are several clear misconceptions caused by a lack of academic language use in the classroom, however, students also had a better understanding of the material when they were able to use academic language effectively.
- I recommend teachers pay precise attention to the language used in the classroom to benefit student learning.
- There is room for future research on how the implementation of academic language affects the students as they progress through mathematics courses.