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, Ovitt, 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.  

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.) $\overline{AD} \parallel \overline{BC}$</td>
<td>1.) Given</td>
</tr>
<tr>
<td>$\angle 2 \cong \angle 3$</td>
<td>2.) Def’n of $\cong$'s</td>
</tr>
<tr>
<td>$\angle 2 = \angle 3$</td>
<td>3.) same side int. angles are supp.</td>
</tr>
<tr>
<td>$\angle 5$ and $\angle 2$ are supp.</td>
<td>4.) Def’n of supp. angles.</td>
</tr>
<tr>
<td>$\angle 3$ and $\angle 6$ are supp.</td>
<td>5.) Subst.</td>
</tr>
<tr>
<td>$\angle 5 + \angle 2 = 180^\circ$</td>
<td>6.) Subst.</td>
</tr>
<tr>
<td>$\angle 3 + \angle 6 = 180^\circ$</td>
<td>7.) Same side interior angles are supp. in parallel lines.</td>
</tr>
<tr>
<td>$\angle 5 + \angle 2 = \angle 3 + \angle 6$</td>
<td></td>
</tr>
<tr>
<td>$\angle 5 + \angle 3 = \angle 2 + \angle 6$</td>
<td></td>
</tr>
<tr>
<td>$\overline{AB} \parallel \overline{CD}$</td>
<td></td>
</tr>
</tbody>
</table>

**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.