

Table 1. *Codes for identified student behaviors*

Interpretation of others' ideas or your own idea through:		Others' ideas	Your own idea
	questioning it	I(q)	O(q)
	offering an idea	I(o)	O(o)
	showing it is valid	I(v)	O(v)
	showing it is invalid	I(i)	O(i)
	explaining it	I(e)	O(e)
	using it	I(u)	O(u)
	reorganizing it	I(r)	O(r)
	building on it	I(b)	O(b)
Use of multiple representations for the same idea.		MR	
Linking representations to each other	Attempts	LR(a)	
	Correct connection between representations	LR	
Setting up a hypothetical situation based on an existing problem		H	
Connecting contexts		CC	

Table 2. Codes for layers in the Pirie/Kieren model

Primitive Knowing	Image Making	Image Having	Property Noticing	Formalizing	Observing
PK	IM	IH	PN	F	O

Table 3. *Number of instances of observed behaviors associated with a particular layer*

	Image making	Image having	Property Noticing	Formalizing	Observing
Re-explaining, questioning or using	10	7	8	5	0
Moving to new representations	4	4	5	1	1
Reorganizing or building	5	5	13	4	2
Linking representations	2	0	11	7	5
Setting up hypothetical situations	0	1	4	3	5
Connecting contexts	0	1	8	7	5
Total number of observed behaviors	21	18	49	27	18

Table 4. *Percent of identified behaviors out of the total number observed*

	Image making	Image having	Property Noticing	Formalizing	Observing
Re-explaining, questioning or using	48%	39%	16%	19%	0%
Moving to new representations	19%	22%	10%	4%	6%
Reorganizing or building	24%	28%	27%	15%	11%
Linking representations	10%	0	22%	26%	28%
Setting up hypothetical situations	0%	6%	8%	11%	28%
Connecting contexts	0%	6%	16%	26%	28%