



Problem Level Visualizations

From Study Data Collected 1/31/2020

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Helpful Links



FH2T Researcher Key

What each problem is, the goal state, the best steps, and if it's a training problem (has video)

FH2T Game

The actual game that we had students play.

More updated than the one on GraspableMath.com

Create a free account or use login credentials demo/demo

Researcher Dashboard

Dashboard currently being developed using the most updated FH2T data that displays filterable student statistics, how the selected student solved the selected problem, and the most frequently used methods of solving each problem overall.

Key Terms



Completion

- Whether the student successfully reached the goal state at least once

Steps

- **Actual Steps**
 - The number of steps that the student took
- **Best Steps**
 - The optimal number of steps to transform from the start state to the goal state

Efficiency

- Ranging between 1 (perfect efficiency) and 0 (worst possible efficiency)

Error

- **Keypad**
 - Errors that the student made by attempting to enter an non-equivalent expression using the keypad
- **Shaking**
 - Errors that the student made by attempting to incorrectly use existing operators
- **Snapping**
 - Errors that the student made by attempting to incorrectly reorder terms



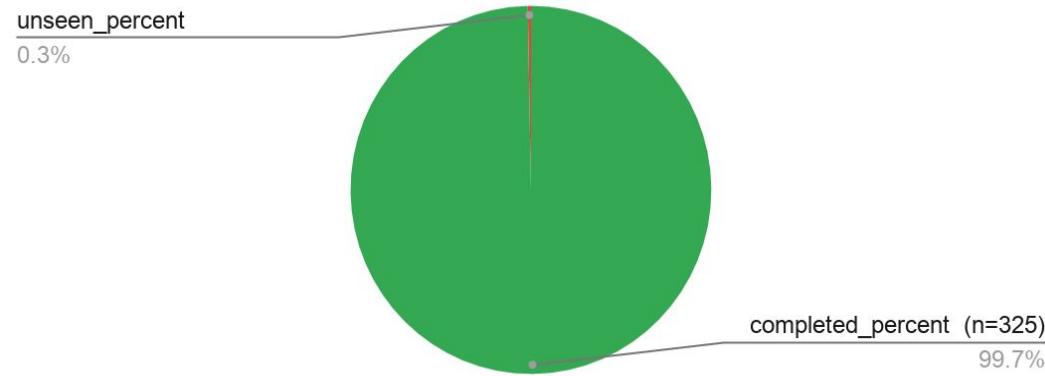
Problem Level Visualizations By World



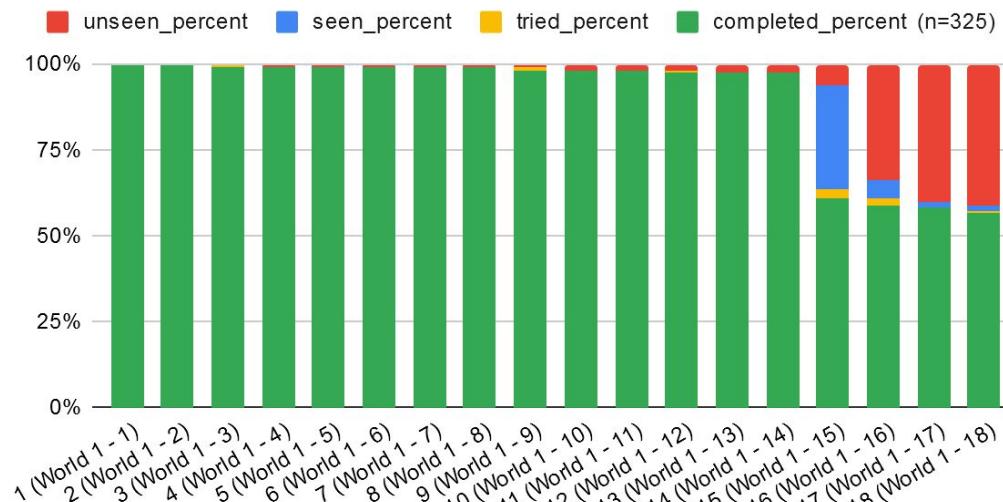
World 1 - Addition

Overall Completion

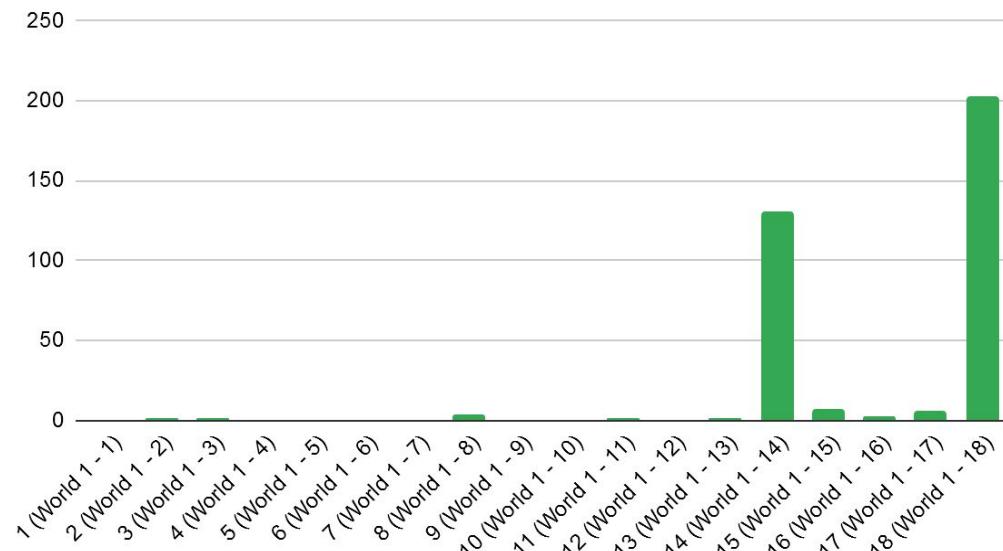
World 1



World 1

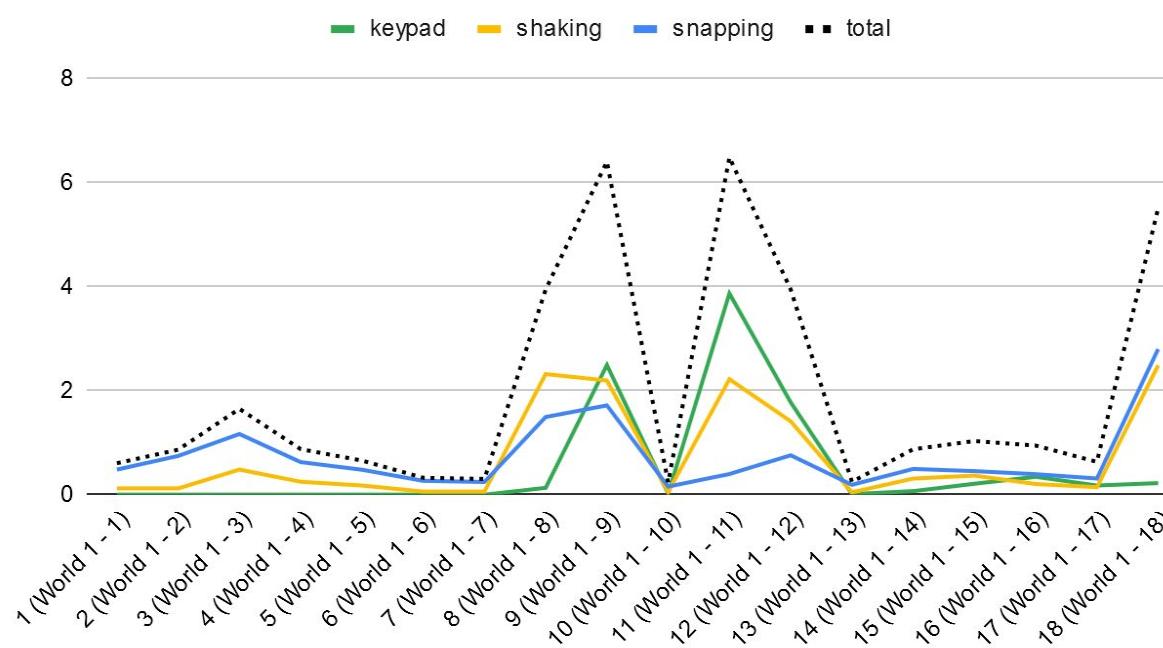


World 1

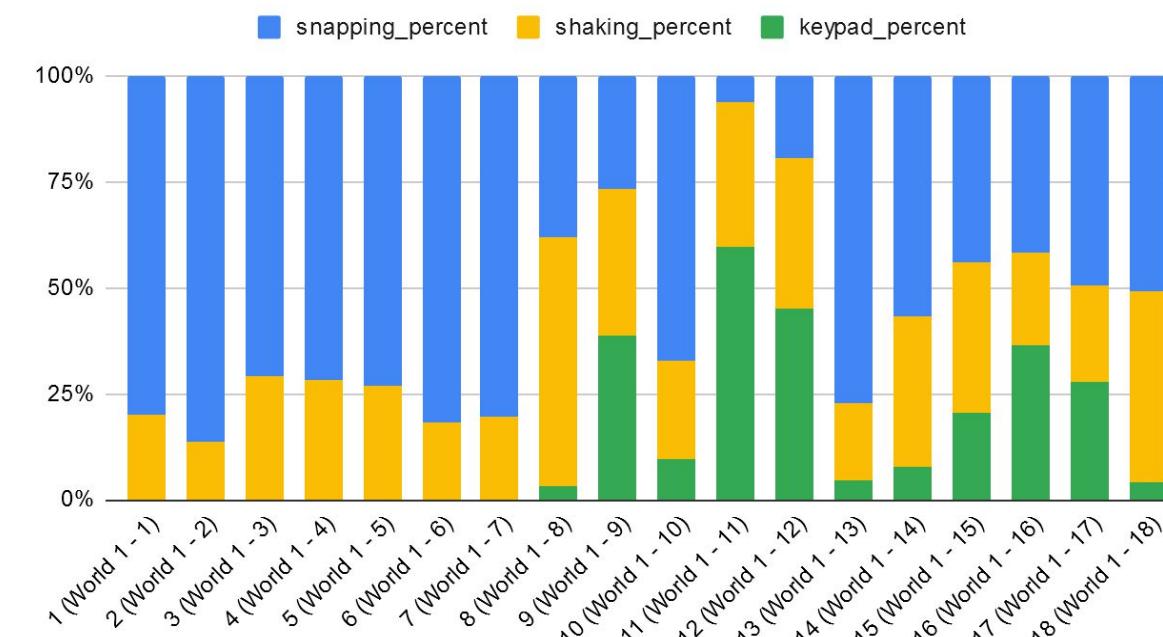


Error Type

World 1



World 1

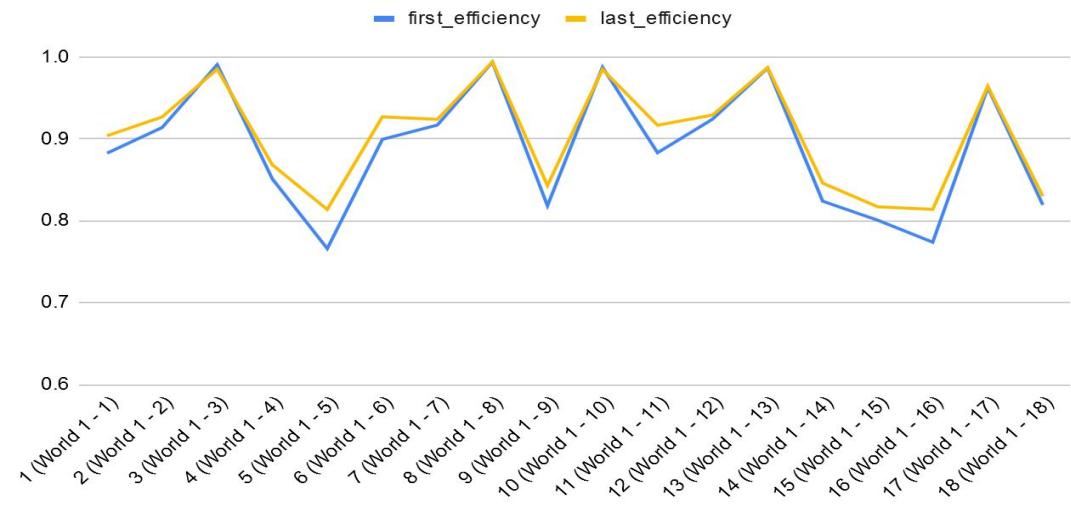


Steps & Efficiency

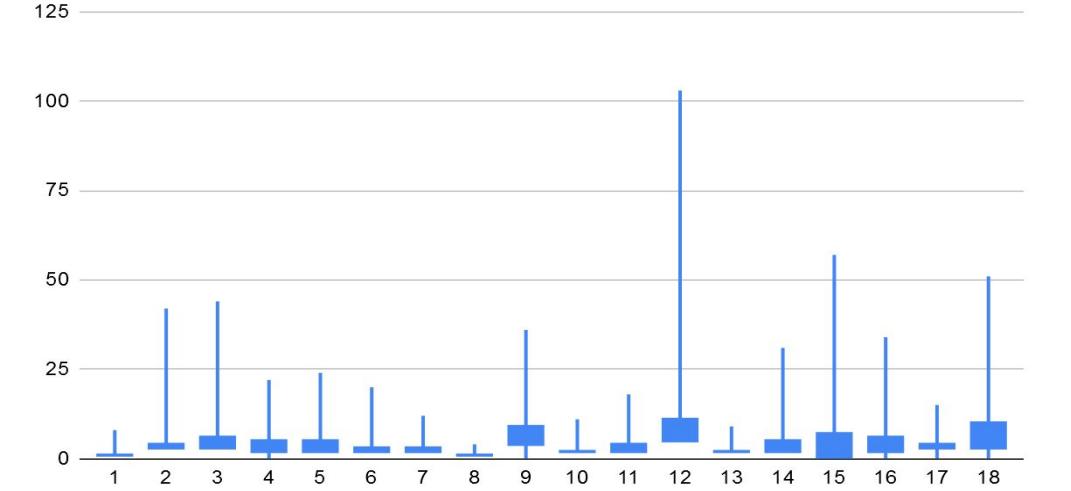
World 1



World 1



World 1



World 1 - Addition



Unique ID	Completion					Errors								Efficiency		Steps			
	Unique ID	Number of Students				Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps
1 (World 1 - 1)	358	99.72%	0.00%	0.00%	0.28%	0.00	0.00%	0.12	20.28%	0.48	79.72%	0.61	0.88	0.90	1.42	1			
2 (World 1 - 2)	358	99.72%	0.00%	0.00%	0.28%	0.00	0.00%	0.12	13.87%	0.75	86.13%	0.87	0.91	0.93	3.92	3			
3 (World 1 - 3)	357	99.44%	0.28%	0.00%	0.28%	0.00	0.00%	0.48	29.27%	1.17	70.73%	1.65	0.99	0.98	4.96	3			
4 (World 1 - 4)	356	99.16%	0.00%	0.28%	0.56%	0.00	0.00%	0.25	28.43%	0.63	71.57%	0.88	0.85	0.87	3.75	2			
5 (World 1 - 5)	356	99.16%	0.00%	0.00%	0.84%	0.00	0.00%	0.18	26.92%	0.48	73.08%	0.66	0.77	0.81	3.94	2			
6 (World 1 - 6)	356	99.16%	0.00%	0.00%	0.84%	0.00	0.00%	0.06	18.10%	0.27	81.90%	0.33	0.90	0.93	3.00	2			
7 (World 1 - 7)	356	99.16%	0.00%	0.00%	0.84%	0.00	0.00%	0.06	19.44%	0.24	80.56%	0.30	0.92	0.92	2.77	2			
8 (World 1 - 8)	356	99.16%	0.00%	0.00%	0.84%	0.13	3.35%	2.32	58.79%	1.49	37.86%	3.95	0.99	0.99	1.13	1			
9 (World 1 - 9)	352	98.05%	1.11%	0.28%	0.56%	2.49	38.92%	2.20	34.28%	1.72	26.80%	6.41	0.82	0.84	7.08	3			
10 (World 1 - 10)	352	98.05%	0.00%	0.00%	1.95%	0.02	9.76%	0.05	23.17%	0.16	67.07%	0.23	0.99	0.98	2.20	2			
11 (World 1 - 11)	352	98.05%	0.00%	0.00%	1.95%	3.87	59.63%	2.22	34.24%	0.40	6.13%	6.49	0.88	0.92	3.67	2			
12 (World 1 - 12)	351	97.77%	0.28%	0.00%	1.95%	1.78	45.04%	1.41	35.76%	0.76	19.21%	3.95	0.92	0.93	9.63	5			
13 (World 1 - 13)	351	97.77%	0.00%	0.00%	2.23%	0.01	4.60%	0.05	18.39%	0.19	77.01%	0.25	0.99	0.99	2.25	2			
14 (World 1 - 14)	350	97.49%	0.28%	0.00%	2.23%	0.07	7.82%	0.31	35.50%	0.50	56.68%	0.87	0.82	0.85	4.17	2			
15 (World 1 - 15)	219	61.00%	2.51%	30.36%	6.13%	0.21	20.40%	0.37	35.63%	0.45	43.97%	1.03	0.80	0.82	5.36	3			
16 (World 1 - 16)	212	59.05%	1.95%	5.29%	33.70%	0.34	36.44%	0.21	21.78%	0.39	41.78%	0.95	0.77	0.81	5.11	2			
17 (World 1 - 17)	209	58.22%	0.28%	1.39%	40.11%	0.18	27.94%	0.14	22.79%	0.31	49.26%	0.63	0.96	0.96	3.68	3			
18 (World 1 - 18)	203	56.55%	0.84%	1.39%	41.23%	0.22	4.04%	2.49	45.14%	2.80	50.82%	5.51	0.82	0.83	7.17	3			



World 1

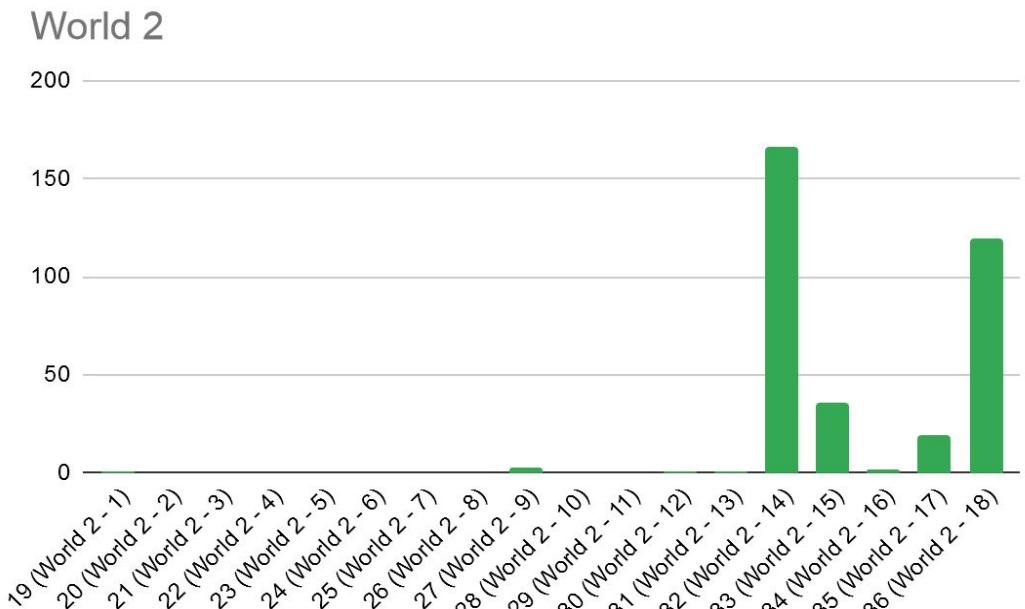
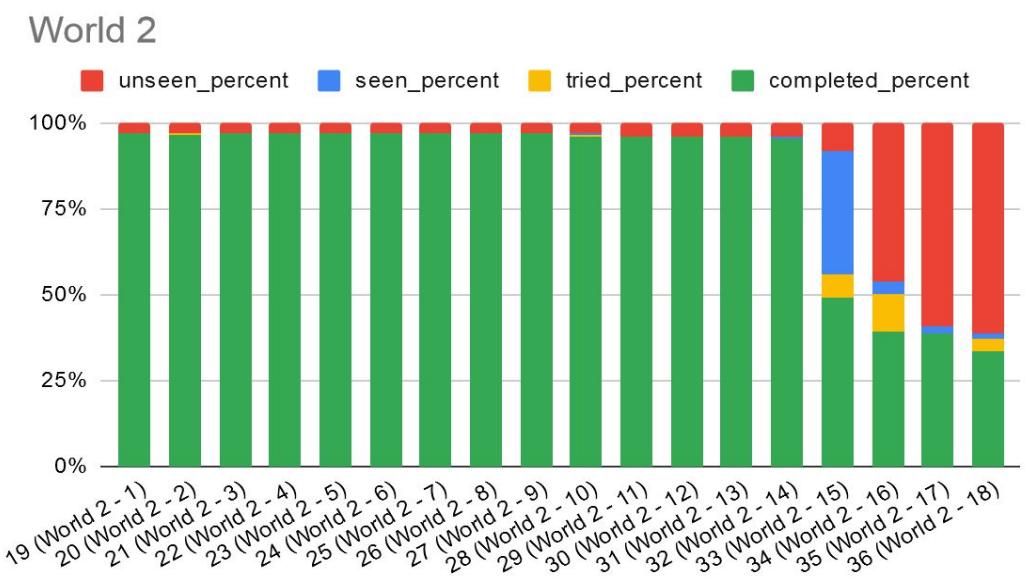
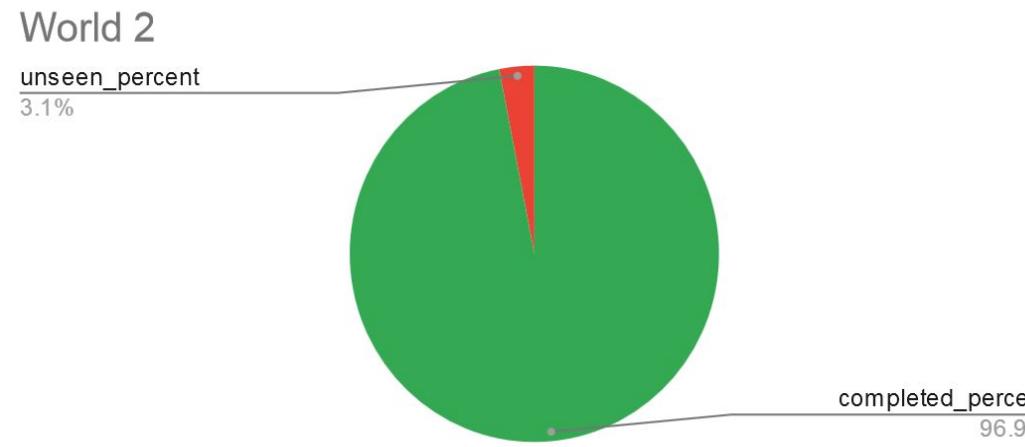
Addition

World 1 - Addition						
Unique ID	#	Problem	Goal	Best Steps	Video	
1	1	$b+c+a$	$a+b+c$	1		
2	2	$0+1+2+3$	$3+2+1+0$	3		
3	3	$2+15+6+3$	$9+17$	3		
4	4	$5+x+2+y$	$y+x+2+5$	2		
5	5	$24+y+6+13$	$13+y+30$	2		
6	6	$5+15+13+4$	$9+28$	2		
7	7	$11+55+y+89+45$	$100+y+100$	2		
8	8	9	4+5	1		
9	9	$7+6+b+10$	$12+11+b$	3		
10	10	$44+56+a+72+28$	$100+a+100$	2		
11	11	6	$2+2+2$	2		
12	12	$3+3+3+3$	$4+4+4$	5		
13	13	$15+87+c+66+32$	$102+c+98$	2		
14	14	$47+33+b+52+68$	$99+b+101$	2		
15	15	$7+2+10+8$	$5+2+5+15$	3		
16	16	$5+13+4+5$	$10+7+6+4$	2		
17	17	$a+5+4+10$	$a+7+12$	3		
18	18	$10+3+z+7$	$8+z+12$	3		

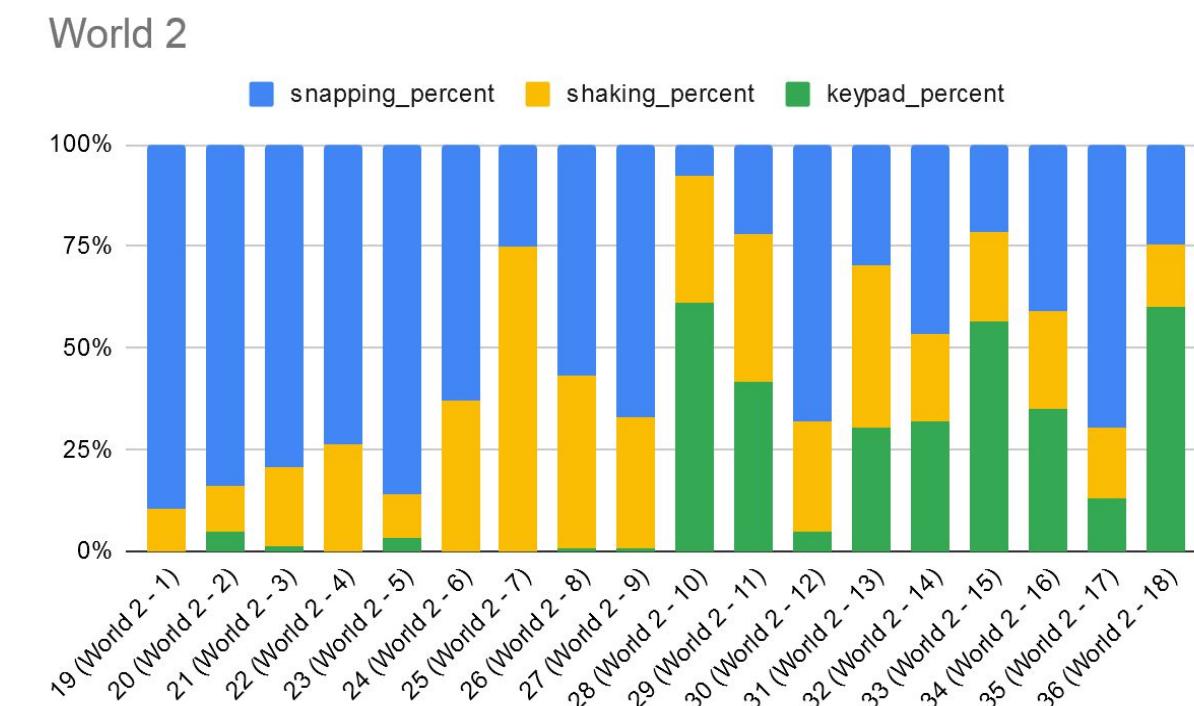
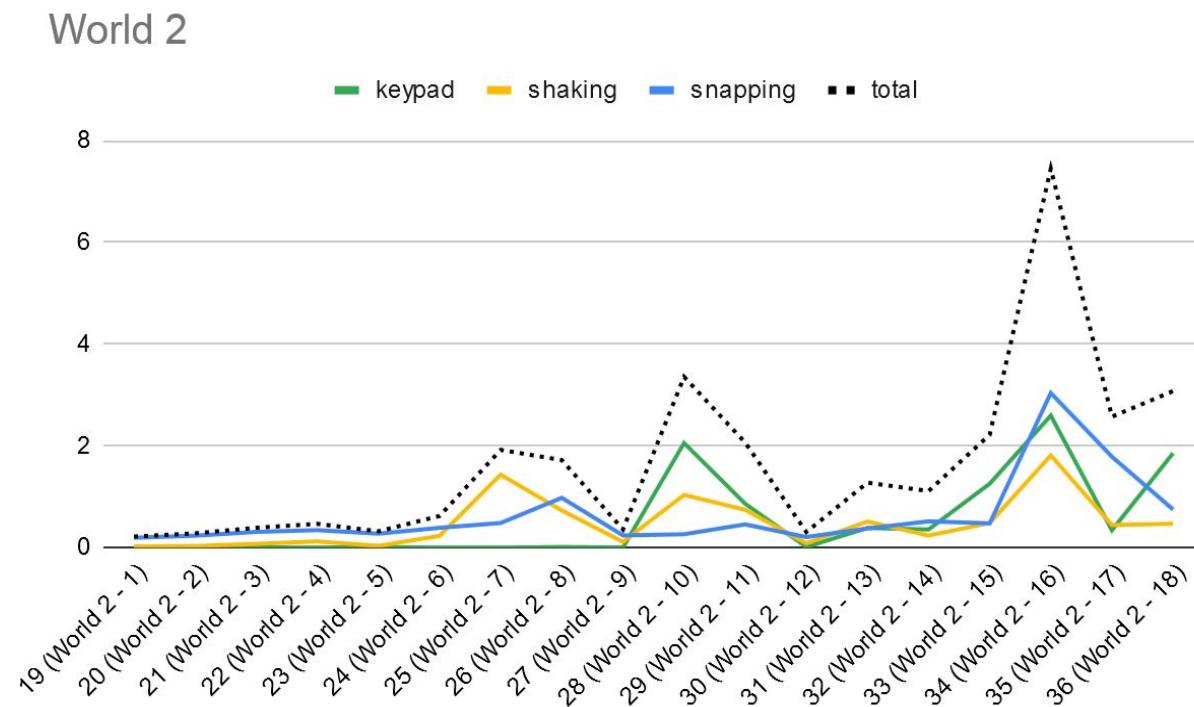


World 2 - Multiplication

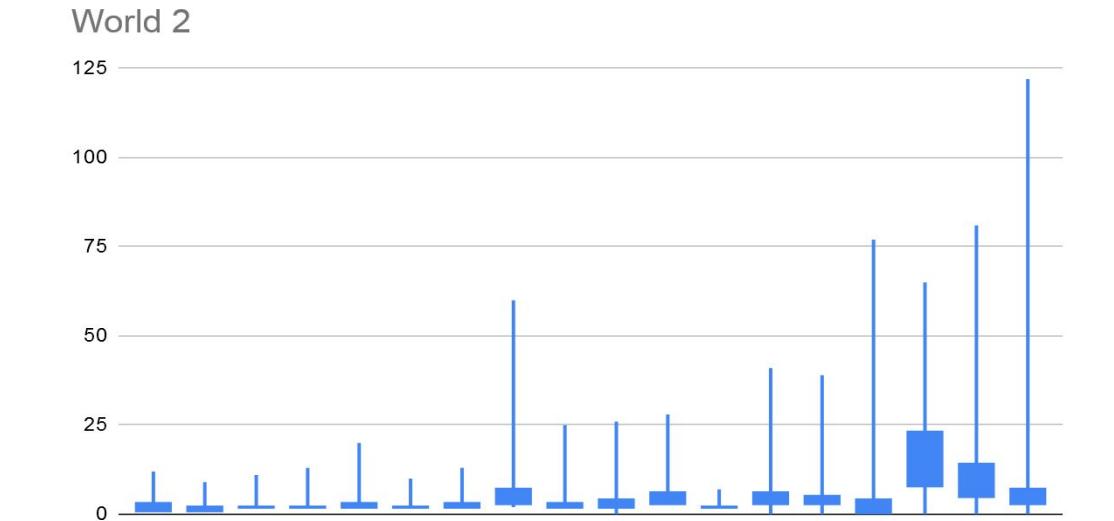
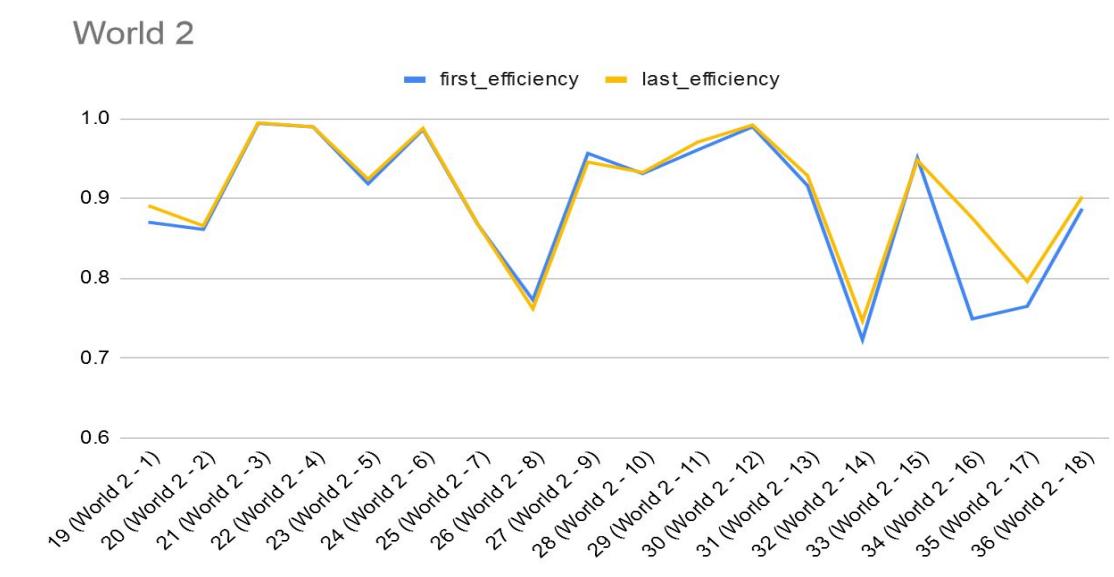
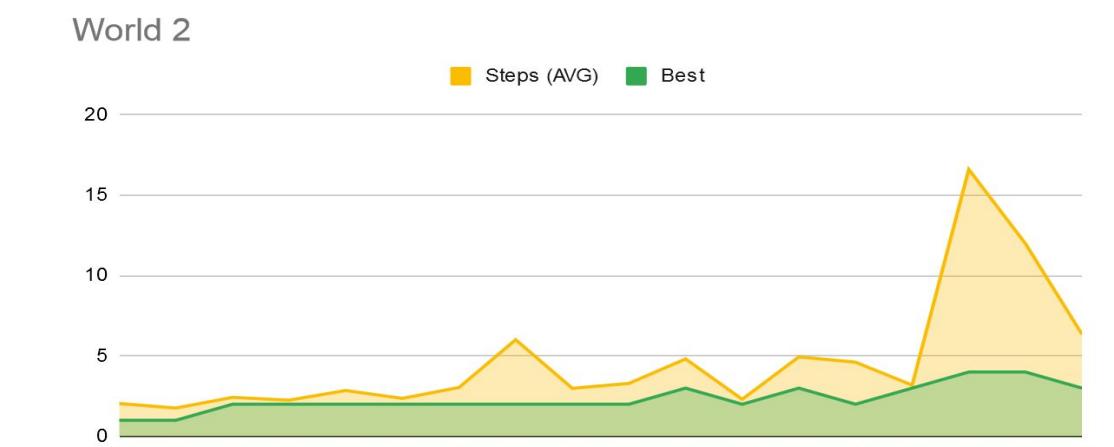
Overall Completion



Error Type



Steps & Efficiency



World 2 - Multiplication



Unique ID	Completion					Errors								Efficiency		Steps	
	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps	
Unique ID																	
19 (World 2 - 1)	348	96.94%	0.00%	0.00%	3.06%	0.00	0.00%	0.02	10.53%	0.20	89.47%	0.22	0.87	0.89	2.04	1	
20 (World 2 - 2)	347	96.66%	0.28%	0.00%	3.06%	0.01	5.10%	0.03	11.22%	0.24	83.67%	0.28	0.86	0.87	1.76	1	
21 (World 2 - 3)	348	96.94%	0.00%	0.00%	3.06%	0.01	1.47%	0.07	19.12%	0.31	79.41%	0.39	0.99	0.99	2.43	2	
22 (World 2 - 4)	348	96.94%	0.00%	0.00%	3.06%	0.00	0.00%	0.12	26.38%	0.34	73.62%	0.47	0.99	0.99	2.25	2	
23 (World 2 - 5)	348	96.94%	0.00%	0.00%	3.06%	0.01	3.57%	0.03	10.71%	0.28	85.71%	0.32	0.92	0.92	2.85	2	
24 (World 2 - 6)	348	96.94%	0.00%	0.00%	3.06%	0.00	0.00%	0.23	37.33%	0.39	62.67%	0.62	0.99	0.99	2.36	2	
25 (World 2 - 7)	348	96.94%	0.00%	0.00%	3.06%	0.00	0.00%	1.44	74.74%	0.49	25.26%	1.92	0.87	0.87	3.04	2	
26 (World 2 - 8)	348	96.94%	0.00%	0.00%	3.06%	0.01	0.67%	0.73	42.40%	0.98	56.93%	1.72	0.77	0.76	6.01	2	
27 (World 2 - 9)	348	96.94%	0.00%	0.00%	3.06%	0.00	0.80%	0.11	32.00%	0.24	67.20%	0.36	0.96	0.95	2.99	2	
28 (World 2 - 10)	345	96.10%	0.56%	0.28%	3.06%	2.06	61.25%	1.04	30.88%	0.26	7.87%	3.36	0.93	0.93	3.29	2	
29 (World 2 - 11)	345	96.10%	0.00%	0.00%	3.90%	0.86	41.80%	0.74	36.04%	0.46	22.16%	2.07	0.96	0.97	4.81	3	
30 (World 2 - 12)	345	96.10%	0.00%	0.00%	3.90%	0.01	4.72%	0.08	27.36%	0.21	67.92%	0.31	0.99	0.99	2.31	2	
31 (World 2 - 13)	344	95.82%	0.28%	0.00%	3.90%	0.39	30.39%	0.51	40.14%	0.38	29.48%	1.28	0.92	0.93	4.94	3	
32 (World 2 - 14)	343	95.54%	0.00%	0.28%	4.18%	0.36	32.11%	0.24	21.41%	0.52	46.48%	1.11	0.72	0.75	4.61	2	
33 (World 2 - 15)	177	49.30%	6.69%	35.93%	8.08%	1.26	56.62%	0.48	21.83%	0.48	21.56%	2.22	0.95	0.95	3.18	3	
34 (World 2 - 16)	141	39.28%	10.86%	3.90%	45.96%	2.60	34.85%	1.81	24.34%	3.04	40.80%	7.45	0.75	0.88	16.60	4	
35 (World 2 - 17)	139	38.72%	0.00%	1.95%	59.33%	0.34	13.30%	0.45	17.29%	1.79	69.41%	2.58	0.76	0.80	11.99	4	
36 (World 2 - 18)	120	33.43%	3.90%	1.67%	61.00%	1.86	60.32%	0.47	15.31%	0.75	24.36%	3.08	0.89	0.90	6.34	3	

World 2 - Multiplication

Unique ID	#	Problem	Goal	Best Steps	Video
19	1	$9*6*7*8$	$6*7*8*9$	1	
20	2	$3*4*5$	$4*5*3$	1	
21	3	$2*3*4*5$	$6*20$	2	
22	4	$3*5*a*4*6$	$15a*24$	2	
23	5	$4*3*7*2$	$8*21$	2	
24	6	$25*4*b*50*2$	$100*b*100$	2	
25	7	$2*a*4*2$	$16*a$	2	
26	8	$4*6*c*24*16$	$96*96*c$	2	
27	9	$2*y*0*6*3*4$	$12*y*0*12$	2	
28	10	64	$2*4*8$	2	
29	11	$9*4$	$3*6*2$	3	
30	12	$8*12*d*3*32$	$96*d*96$	2	
31	13	$6*10$	$2*15*2$	3	
32	14	$10*20*a*10*5$	$a*100*100$	2	
33	15	$121*144$	$11*132*12$	3	
34	16	$11*15*5*0*a*33$	$165*0*165*0*a$	4	
35	17	$14*2*7*y*1*4$	$1*28*y*28*1$	4	
36	18	$120*77$	$15*56*11$	3	



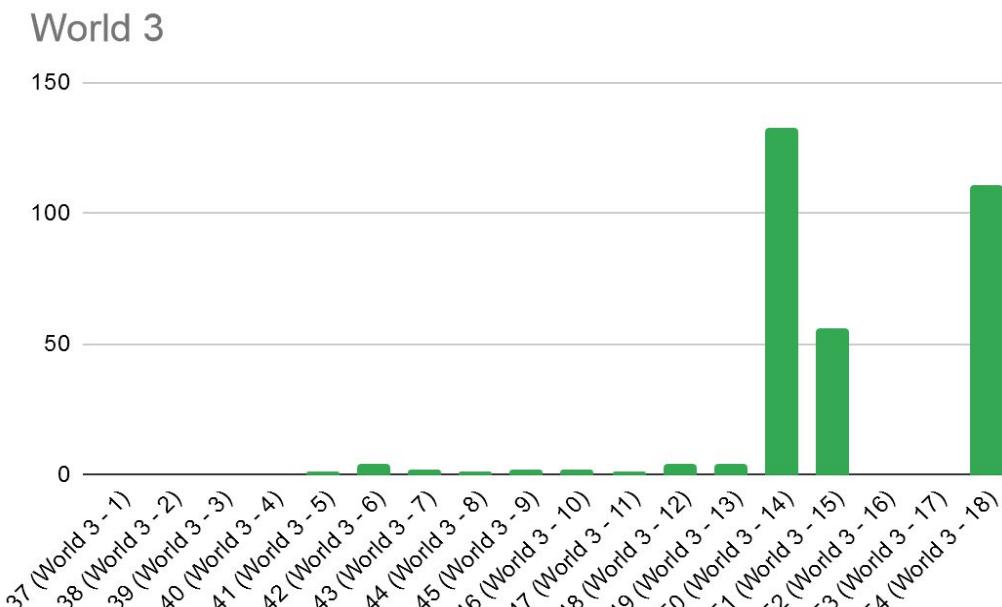
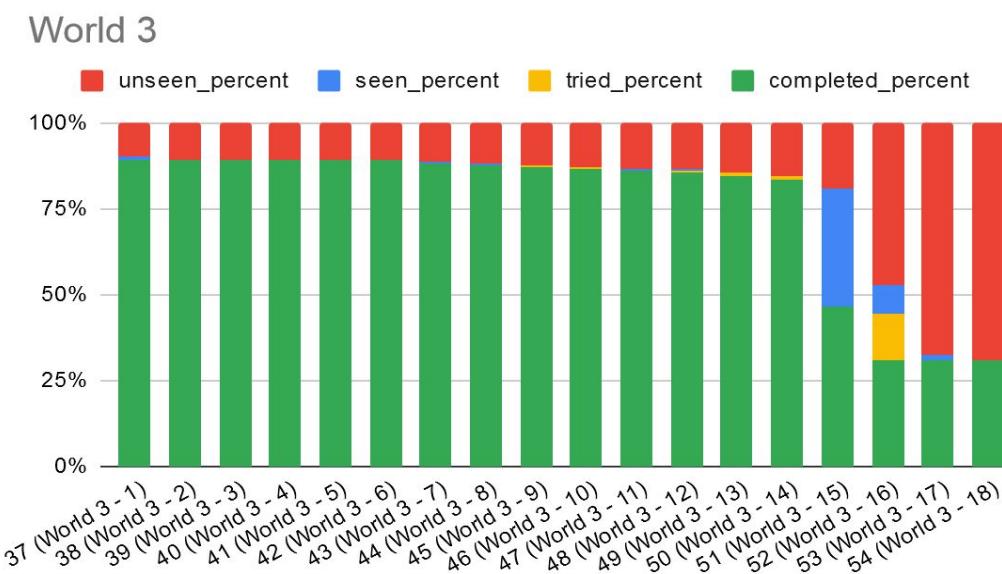
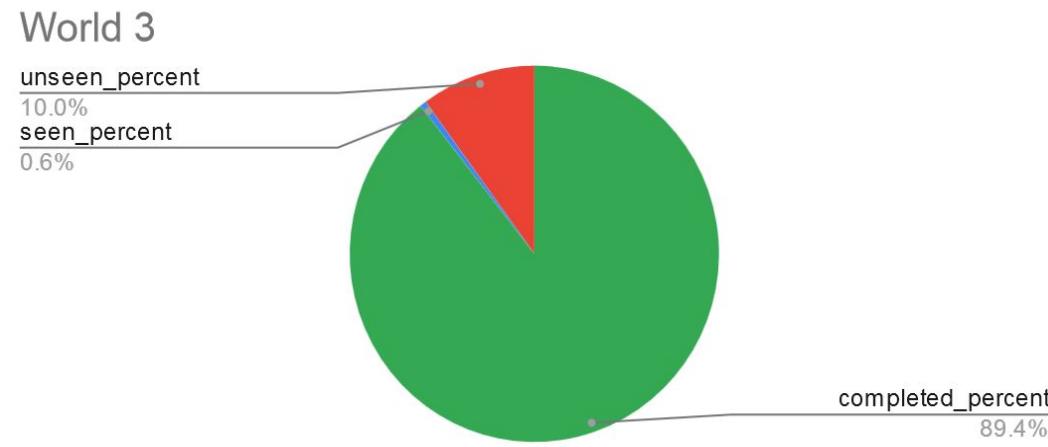
World 2

Multiplication

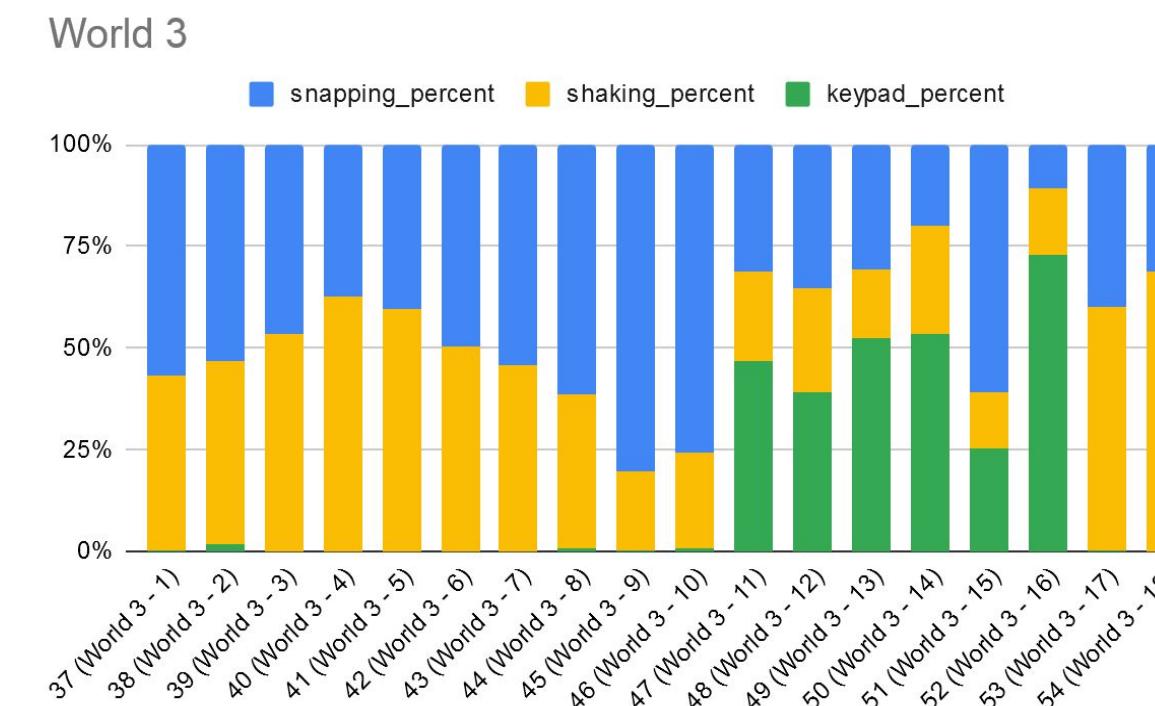
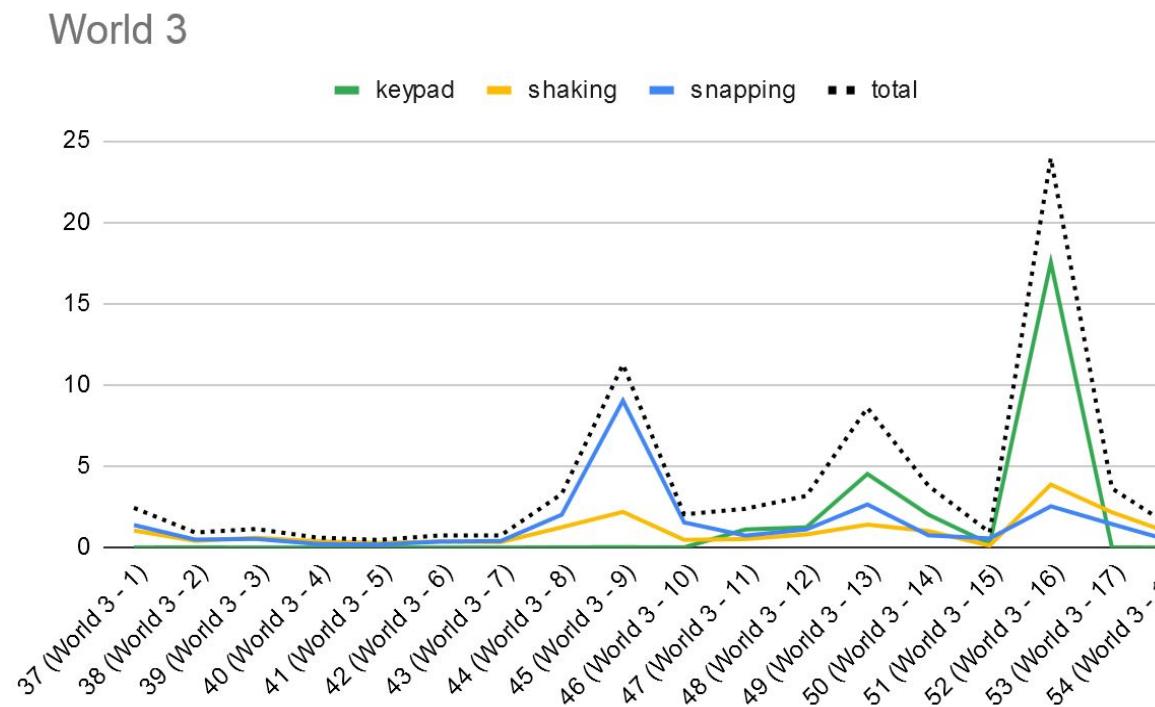


World 3 - Order of Operations + and -

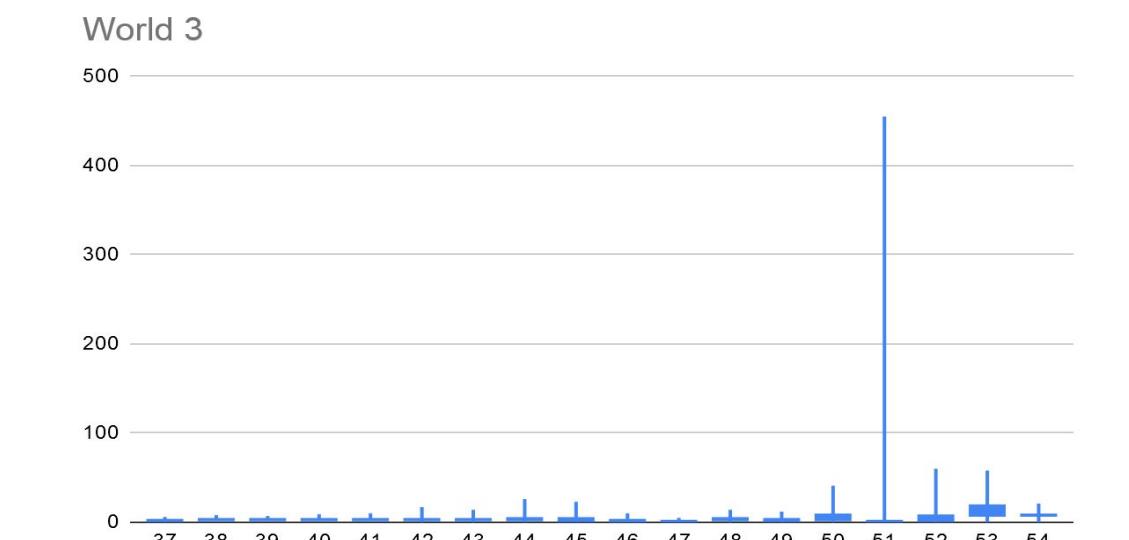
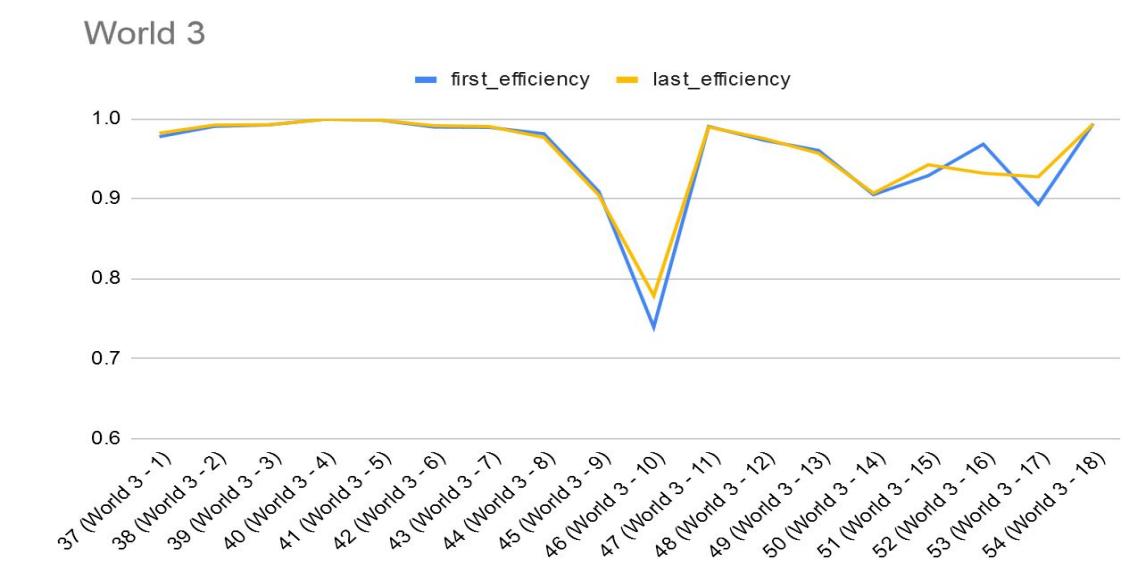
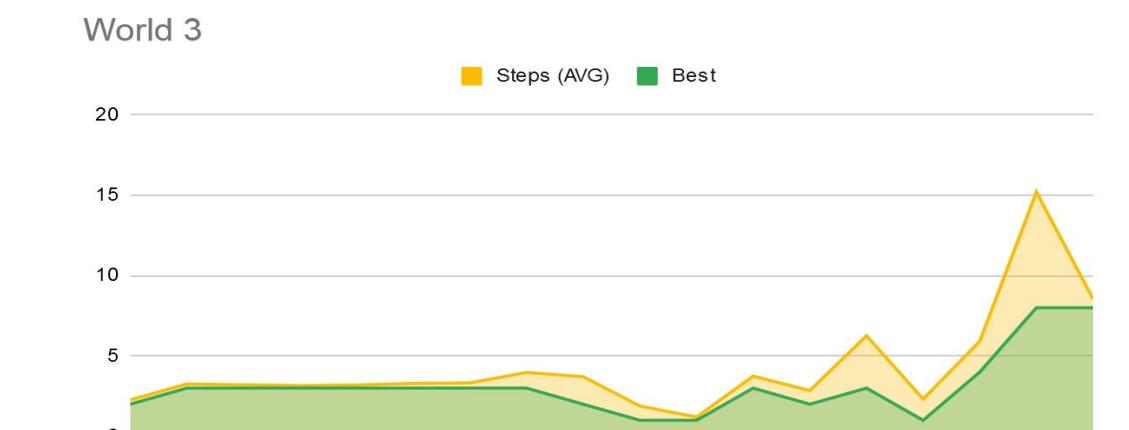
Overall Completion



Error Type



Steps & Efficiency



World 3 - Order of Operations + and -



Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
37 (World 3 - 1)	321	89.42%	0.00%	0.56%	10.03%	0.01	0.25%	1.05	42.91%	1.39	56.84%	2.45	0.98	0.98	2.28	2	
38 (World 3 - 2)	321	89.42%	0.00%	0.00%	10.58%	0.02	2.01%	0.42	44.82%	0.50	53.18%	0.93	0.99	0.99	3.26	3	
39 (World 3 - 3)	321	89.42%	0.00%	0.00%	10.58%	0.00	0.00%	0.61	53.26%	0.54	46.74%	1.15	0.99	0.99	3.20	3	
40 (World 3 - 4)	321	89.42%	0.00%	0.00%	10.58%	0.00	0.00%	0.39	62.81%	0.23	37.19%	0.62	1.00	1.00	3.16	3	
41 (World 3 - 5)	321	89.42%	0.00%	0.00%	10.58%	0.00	0.00%	0.28	59.87%	0.19	40.13%	0.47	1.00	1.00	3.19	3	
42 (World 3 - 6)	320	89.14%	0.00%	0.28%	10.58%	0.00	0.00%	0.38	50.62%	0.37	49.38%	0.75	0.99	0.99	3.29	3	
43 (World 3 - 7)	316	88.02%	0.00%	0.84%	11.14%	0.00	0.00%	0.34	45.61%	0.41	54.39%	0.75	0.99	0.99	3.33	3	
44 (World 3 - 8)	314	87.47%	0.28%	0.28%	11.98%	0.02	0.67%	1.26	37.99%	2.03	61.34%	3.31	0.98	0.98	3.97	3	
45 (World 3 - 9)	313	87.19%	0.28%	0.00%	12.53%	0.03	0.25%	2.20	19.51%	9.04	80.23%	11.26	0.91	0.90	3.71	2	
46 (World 3 - 10)	311	86.63%	0.28%	0.28%	12.81%	0.01	0.62%	0.48	23.56%	1.55	75.82%	2.05	0.74	0.78	1.89	1	
47 (World 3 - 11)	309	86.07%	0.00%	0.56%	13.65%	1.12	46.76%	0.53	22.16%	0.74	31.08%	2.39	0.99	0.99	1.20	1	
48 (World 3 - 12)	308	85.79%	0.28%	0.28%	13.65%	1.25	39.25%	0.81	25.56%	1.12	35.19%	3.18	0.97	0.98	3.75	3	
49 (World 3 - 13)	304	84.68%	0.84%	0.28%	14.21%	4.53	52.66%	1.42	16.47%	2.65	30.87%	8.59	0.96	0.96	2.85	2	
50 (World 3 - 14)	300	83.57%	1.11%	0.00%	15.32%	2.02	53.29%	1.02	26.78%	0.76	19.93%	3.80	0.90	0.91	6.26	3	
51 (World 3 - 15)	167	46.52%	0.28%	33.98%	19.22%	0.24	25.37%	0.13	13.97%	0.57	60.66%	0.94	0.93	0.94	2.32	1	
52 (World 3 - 16)	111	30.92%	13.65%	8.36%	47.08%	17.53	73.19%	3.88	16.20%	2.54	10.62%	23.95	0.97	0.93	5.91	4	
53 (World 3 - 17)	111	30.92%	0.28%	1.11%	67.69%	0.02	0.47%	2.17	59.72%	1.45	39.81%	3.64	0.89	0.93	15.19	8	
54 (World 3 - 18)	111	30.92%	0.00%	0.28%	68.80%	0.00	0.00%	0.84	68.61%	0.38	31.39%	1.22	0.99	0.99	8.54	8	



World 3

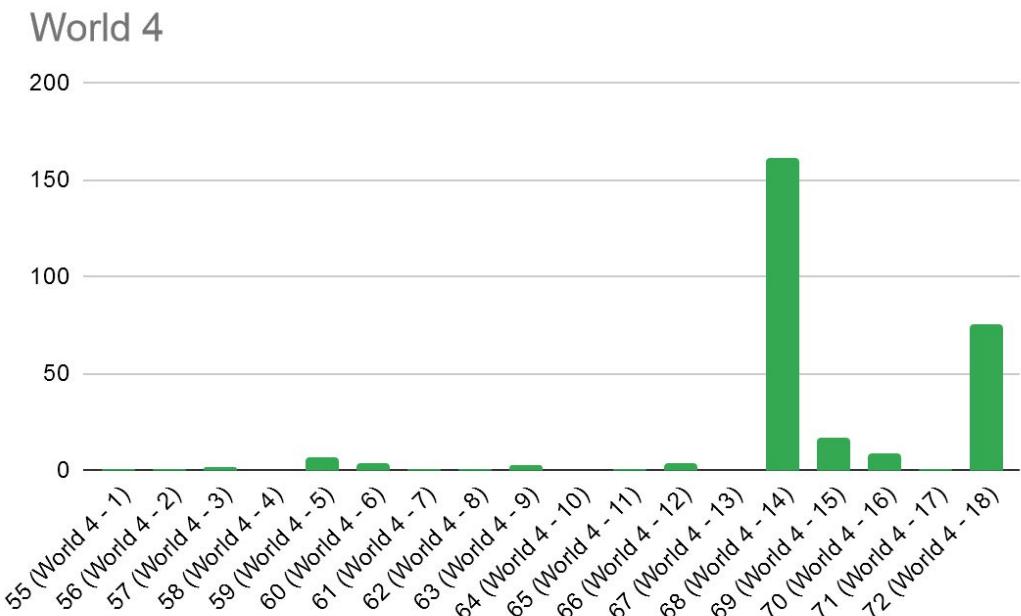
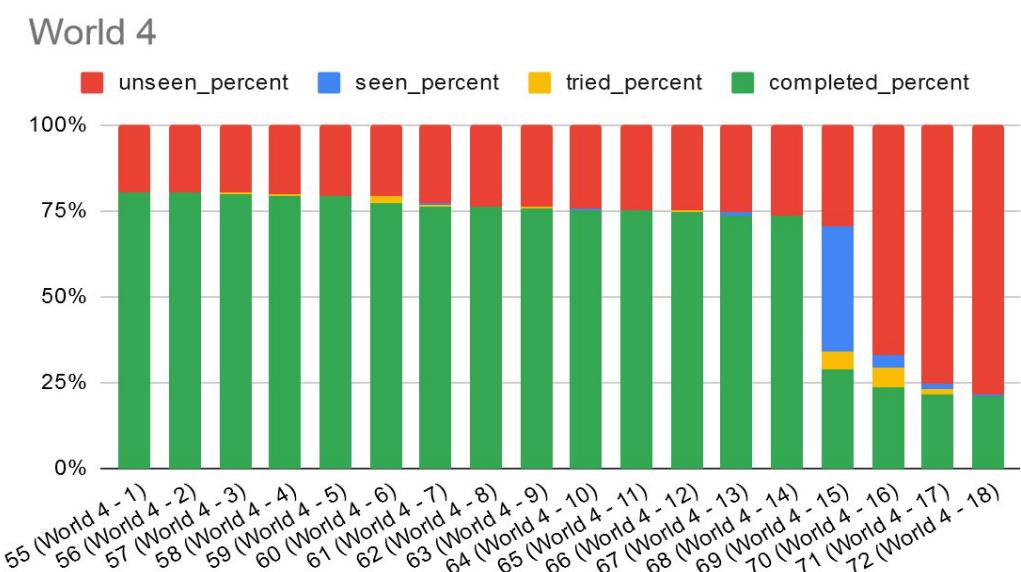
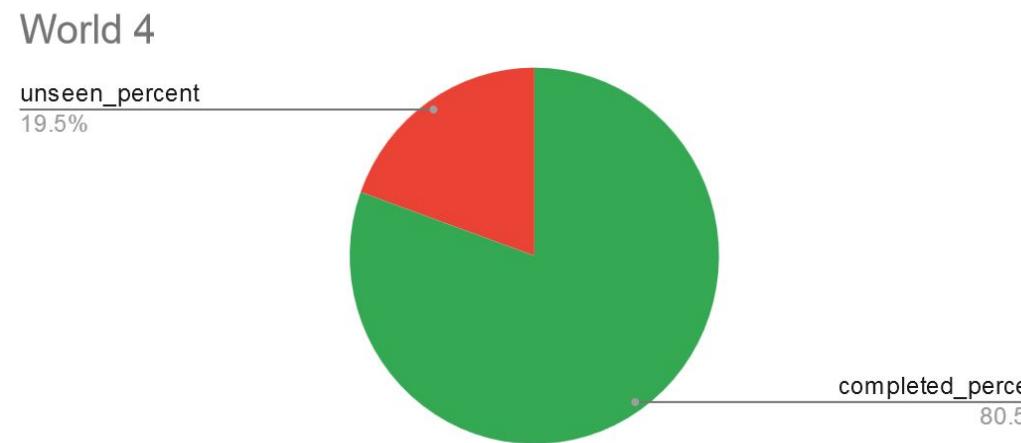
Order of Operations + and -

World 3 - Order of Operations + and -					
Unique ID	#	Problem	Goal	Best Steps	Video
37	1	$1+1*1$	2	2	
38	2	$3*7+7+3$	31	3	
39	3	$8+4*4*8$	136	3	
40	4	$2*3+3*2$	12	3	
41	5	$5+2+2*5$	17	3	
42	6	$4+1*1+4$	9	3	
43	7	$1*6*6+1$	37	3	
44	8	$8+2 + 3*5c$	$15c+10$	3	
45	9	$2y + 5*3x$	$15x + 2y$	2	
46	10	$2y+6 +3y$	$5y + 6$	1	
47	11	$2*y$	$y+y$	1	
48	12	$2*a+2*b$	$a+b+a+b$	3	
49	13	$b*c+c+b$	$c+c*b+b$	2	
50	14	120	$5*12+12*5$	3	
51	15	$5m$	$2m+3m$	1	
52	16	$1*a+2*b+3*c$	$a+b+b+c+c+c$	4	
53	17	$0+1*1+2*2+3*3+4*4+5$	15+20	8	
54	18	$0*1+1*2+2*3+3*4+4*5$	20+20	8	

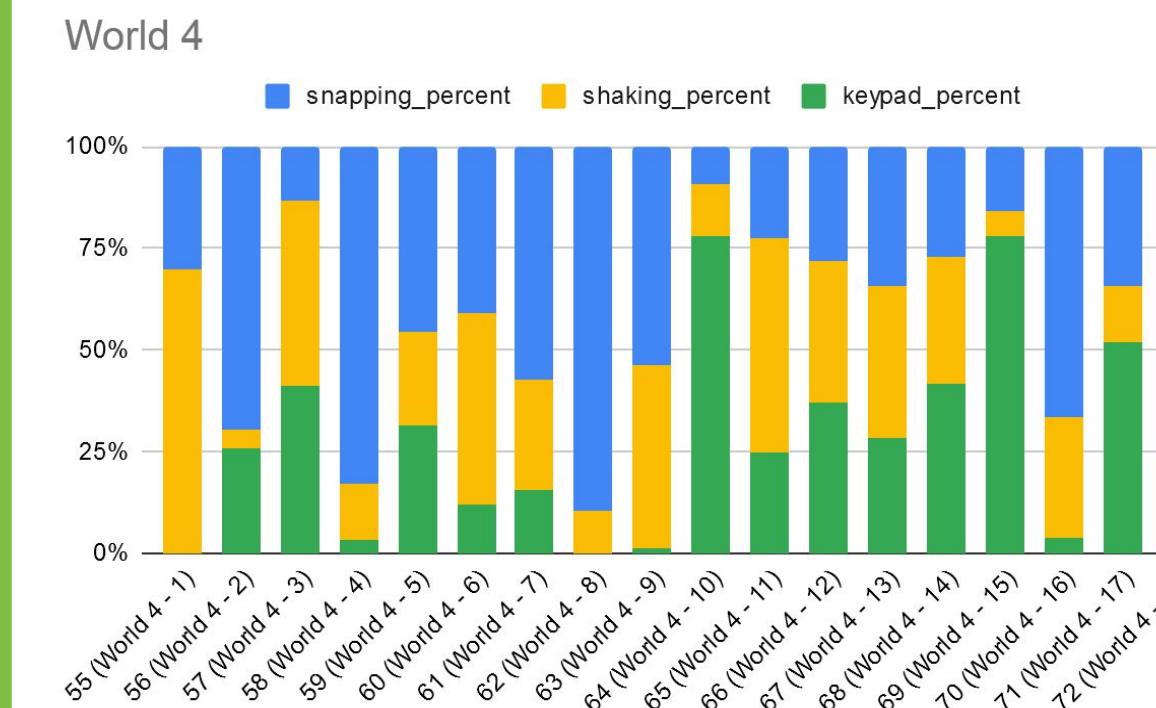
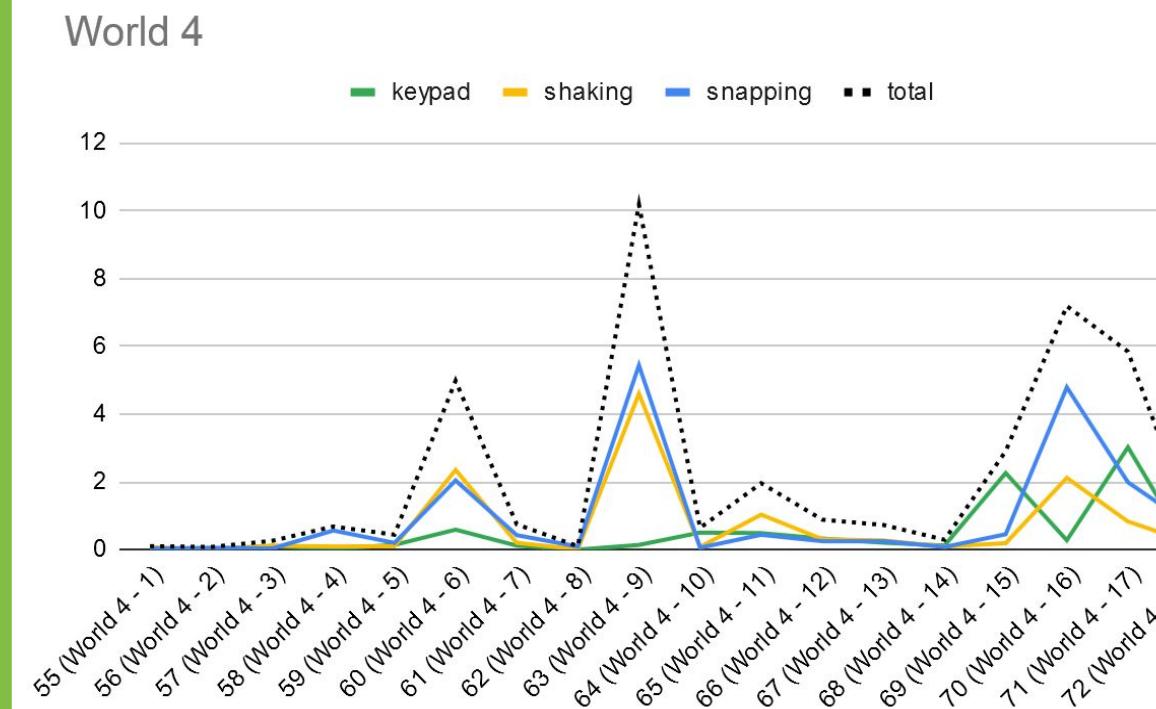
World 4 - Subtraction and Negative Numbers



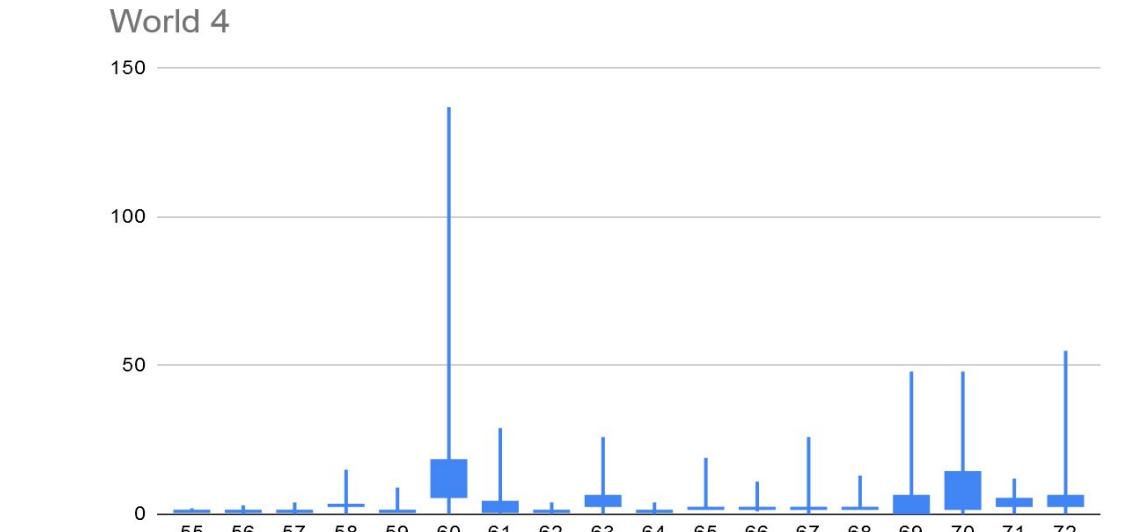
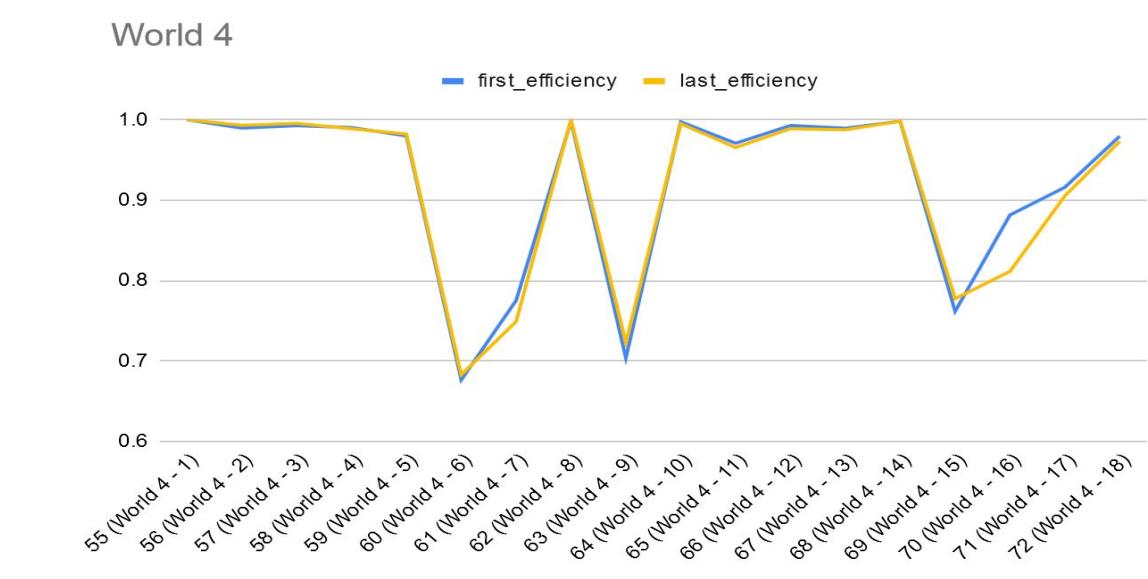
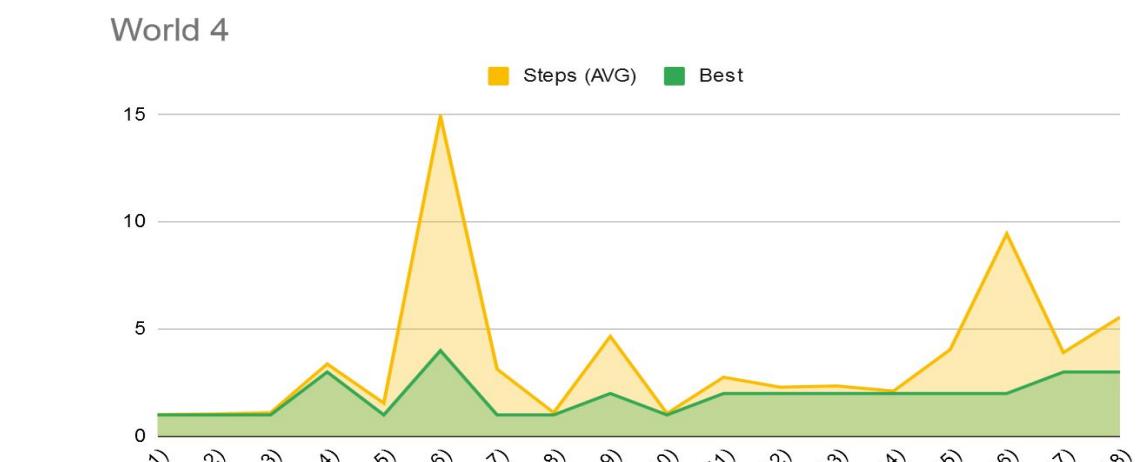
Overall Completion



Error Type



Steps & Efficiency



World 4 - Subtraction and Negative Numbers



Unique ID	Completion					Errors								Efficiency		Steps			
	Unique ID	Number of Students				Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps
55 (World 4 - 1)	289	80.50%	0.00%	0.00%	19.50%	0.00	0.00%	0.07	70.00%	0.03	30.00%	0.10	1.00	1.00	1.00	1.02	1		
56 (World 4 - 2)	288	80.22%	0.00%	0.28%	19.50%	0.02	26.09%	0.00	4.35%	0.06	69.57%	0.08	0.99	0.99	0.99	1.04	1		
57 (World 4 - 3)	287	79.94%	0.28%	0.00%	19.78%	0.11	41.33%	0.12	45.33%	0.03	13.33%	0.26	0.99	1.00	1.00	1.10	1		
58 (World 4 - 4)	285	79.39%	0.28%	0.28%	20.06%	0.02	3.57%	0.09	13.78%	0.56	82.65%	0.68	0.99	0.99	0.99	3.38	3		
59 (World 4 - 5)	285	79.39%	0.00%	0.00%	20.61%	0.14	31.75%	0.10	23.02%	0.20	45.24%	0.44	0.98	0.98	0.98	1.55	1		
60 (World 4 - 6)	278	77.44%	1.95%	0.00%	20.61%	0.59	11.83%	2.35	47.18%	2.04	40.99%	4.98	0.68	0.68	0.68	14.92	4		
61 (World 4 - 7)	274	76.32%	0.56%	0.56%	22.56%	0.12	15.87%	0.20	26.92%	0.43	57.21%	0.75	0.78	0.78	0.75	3.14	1		
62 (World 4 - 8)	273	76.04%	0.00%	0.28%	23.68%	0.00	0.00%	0.01	10.71%	0.09	89.29%	0.10	1.00	1.00	1.00	1.11	1		
63 (World 4 - 9)	272	75.77%	0.28%	0.00%	23.96%	0.14	1.37%	4.60	45.20%	5.44	53.44%	10.18	0.70	0.72	0.72	4.66	2		
64 (World 4 - 10)	269	74.93%	0.28%	0.56%	24.23%	0.50	78.29%	0.08	12.57%	0.06	9.14%	0.64	1.00	1.00	1.00	1.07	1		
65 (World 4 - 11)	269	74.93%	0.00%	0.00%	25.07%	0.49	24.86%	1.03	52.75%	0.44	22.39%	1.96	0.97	0.97	0.97	2.76	2		
66 (World 4 - 12)	268	74.65%	0.28%	0.00%	25.07%	0.33	36.97%	0.31	34.87%	0.25	28.15%	0.88	0.99	0.99	0.99	2.29	2		
67 (World 4 - 13)	264	73.54%	0.28%	0.84%	25.35%	0.21	28.21%	0.27	37.44%	0.25	34.36%	0.73	0.99	0.99	0.99	2.35	2		
68 (World 4 - 14)	264	73.54%	0.00%	0.00%	26.46%	0.12	41.56%	0.09	31.17%	0.08	27.27%	0.29	1.00	1.00	1.00	2.11	2		
69 (World 4 - 15)	103	28.69%	5.57%	36.21%	29.53%	2.26	77.82%	0.19	6.53%	0.45	15.65%	2.91	0.76	0.78	0.78	4.04	2		
70 (World 4 - 16)	86	23.96%	5.57%	3.62%	66.85%	0.28	3.86%	2.12	29.47%	4.79	66.67%	7.18	0.88	0.81	0.81	9.45	2		
71 (World 4 - 17)	77	21.45%	1.95%	1.39%	75.21%	3.02	51.73%	0.83	14.23%	1.99	34.04%	5.84	0.92	0.91	0.91	3.91	3		
72 (World 4 - 18)	76	21.17%	0.00%	0.28%	78.55%	0.00	0.00%	0.22	22.67%	0.75	77.33%	0.97	0.98	0.97	0.97	5.56	3		

World 4 - Subtraction and Negative Numbers

Unique ID	#	Problem	Goal	Best Steps	Video
55	1	12-9	3	1	
56	2	9-12	-3	1	
57	3	3	12-9	1	
58	4	-9-(-12)	3	3	
59	5	35-25-15	35-40	1	
60	6	-14+(-5)-(-18)	-5 +4	4	
61	7	30-15-5	25 - 15	1	
62	8	6-4	-4+6	1	
63	9	-8-4a+10 -2a	-6a+2	2	
64	10	-8	-5-3	1	
65	11	-12-x-5-14	-6-6-x-19	2	
66	12	-4-11-x-16	-15-x-7-9	2	
67	13	-14-y-10-7	-8-6-y-17	2	
68	14	-8-5-y-18	-13-y-9-9	2	
69	15	30-20-20-30	20-20-20-20	2	
70	16	-23b+10b-17b - 5b	5b-40b	2	
71	17	-36-2c	-2c - 20 - 10 - 6	3	
72	18	55+45-35+25-15	100-25	3	



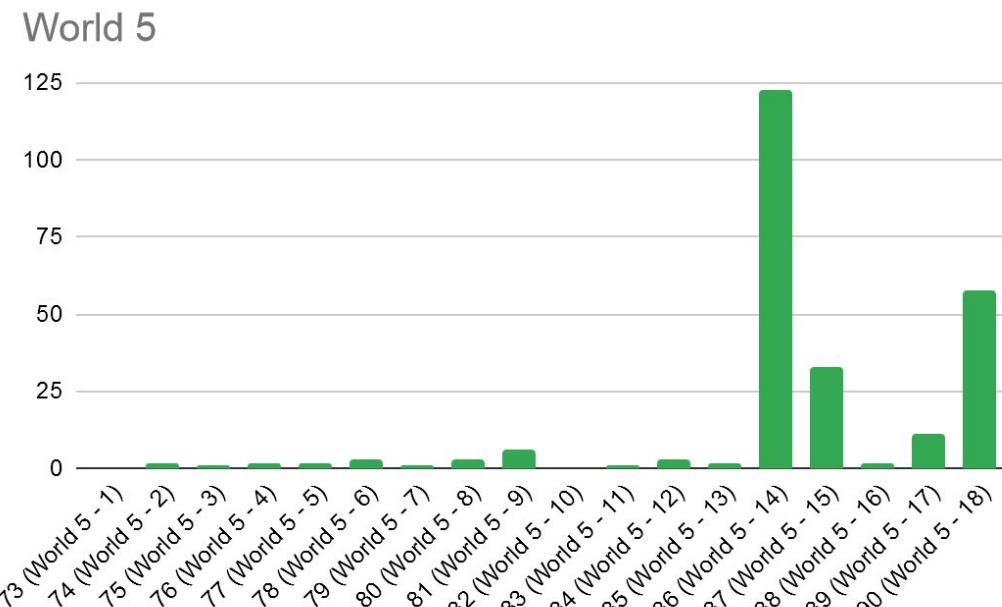
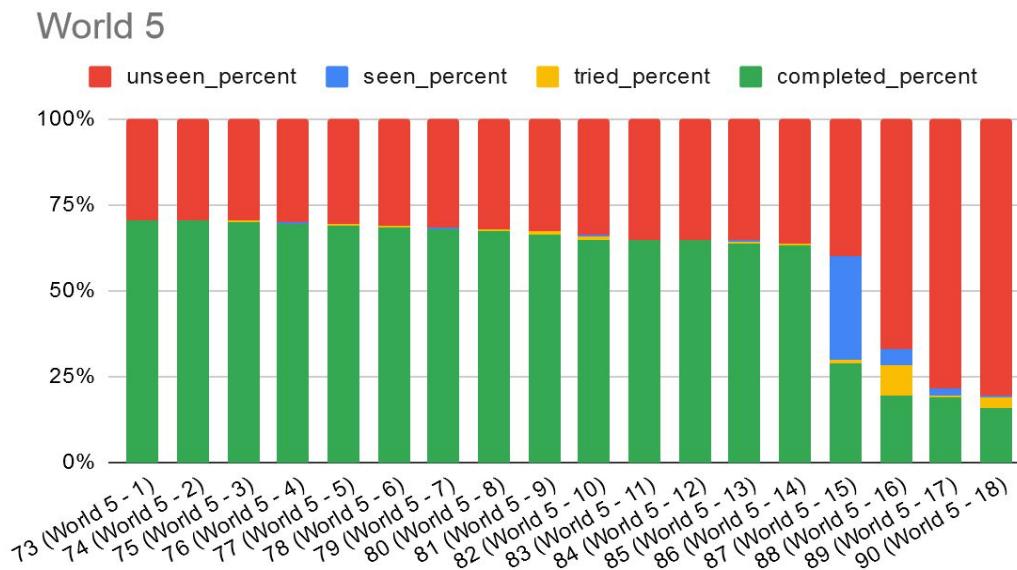
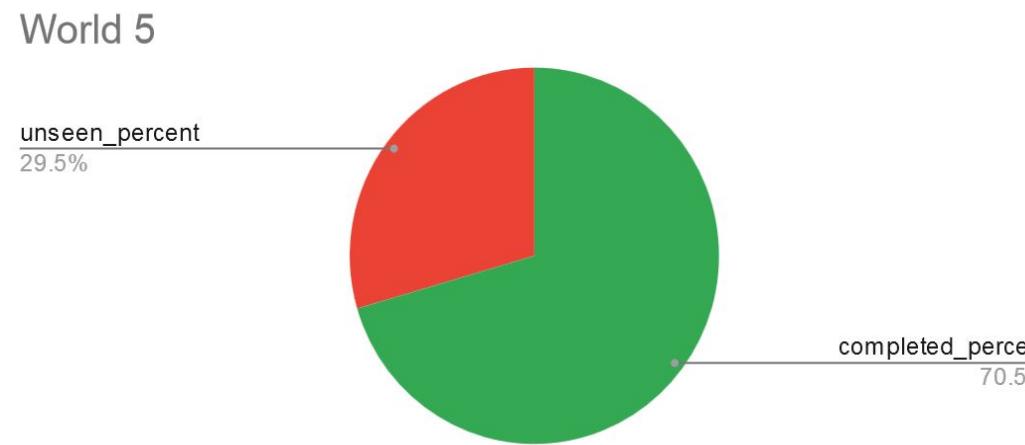
World 4

Subtraction and Negative Numbers

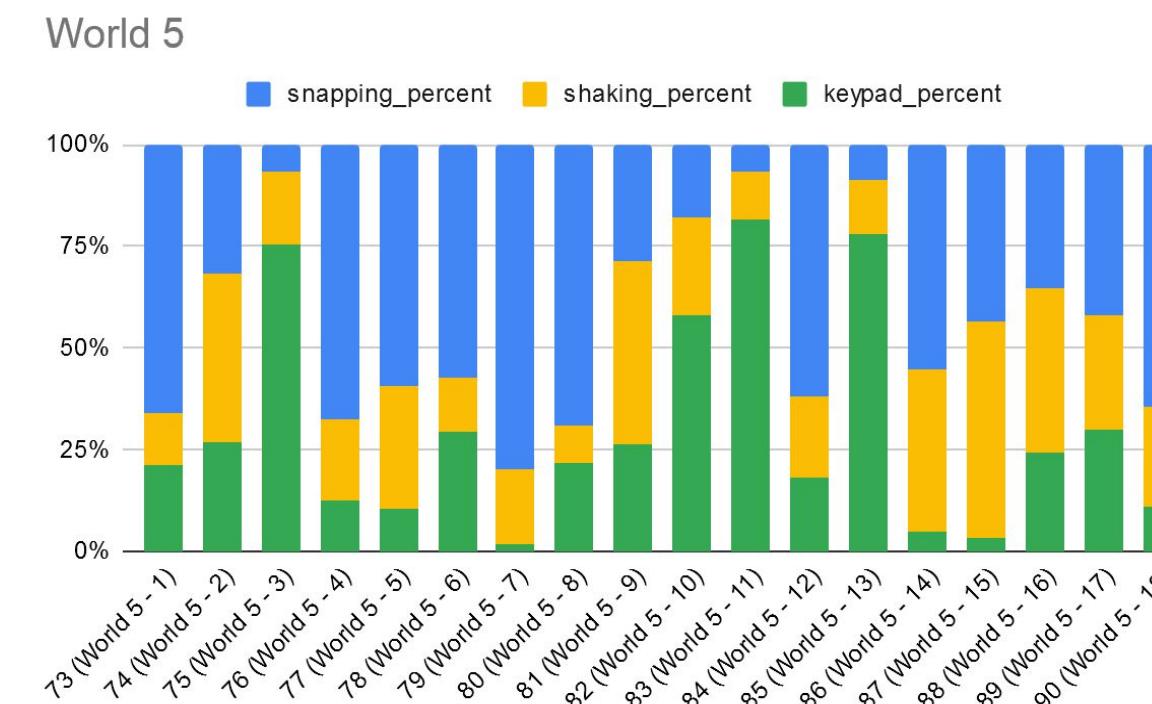
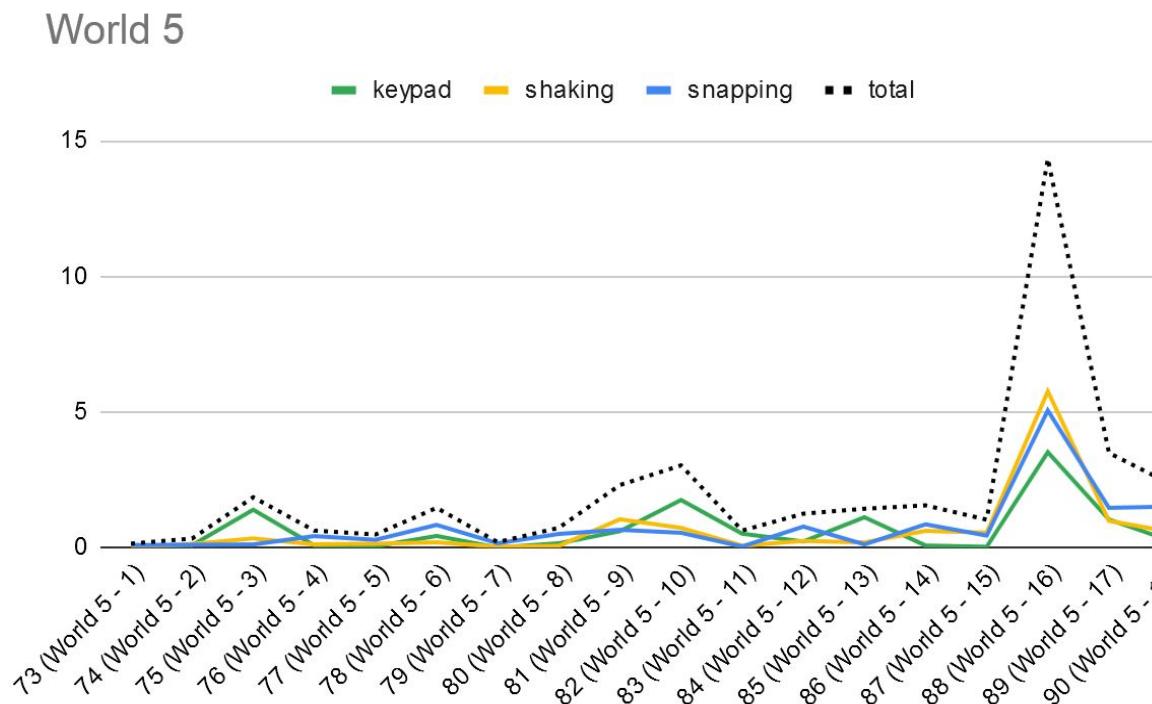


World 5 - Mixed Practice of + and -

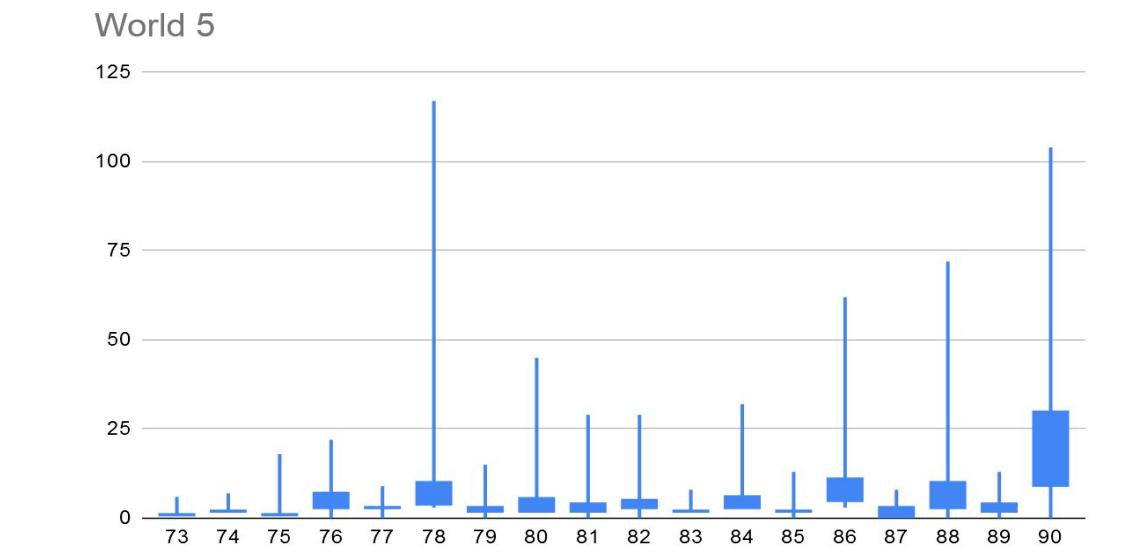
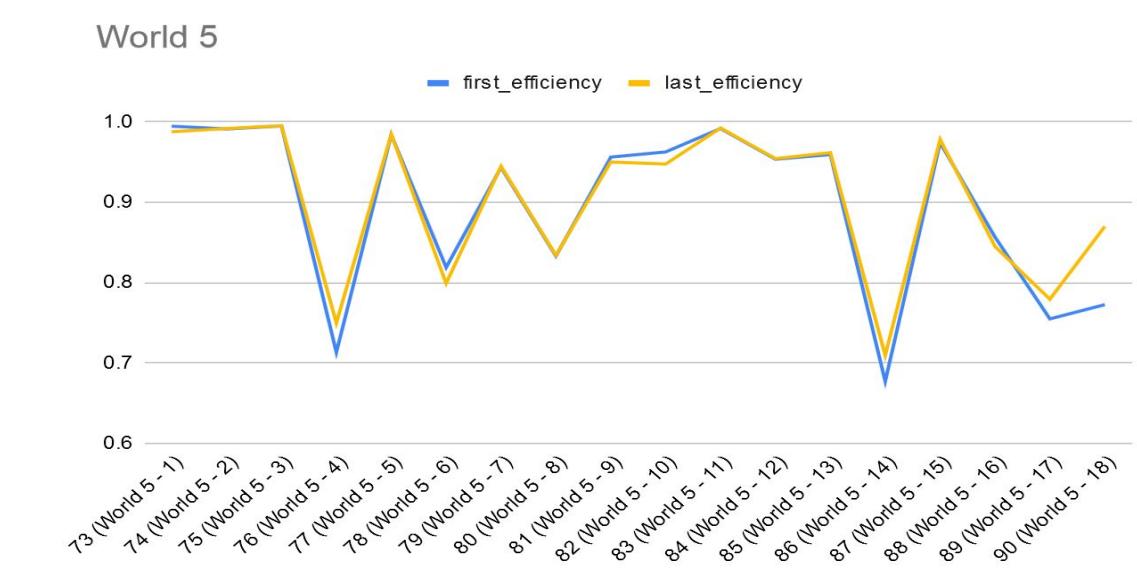
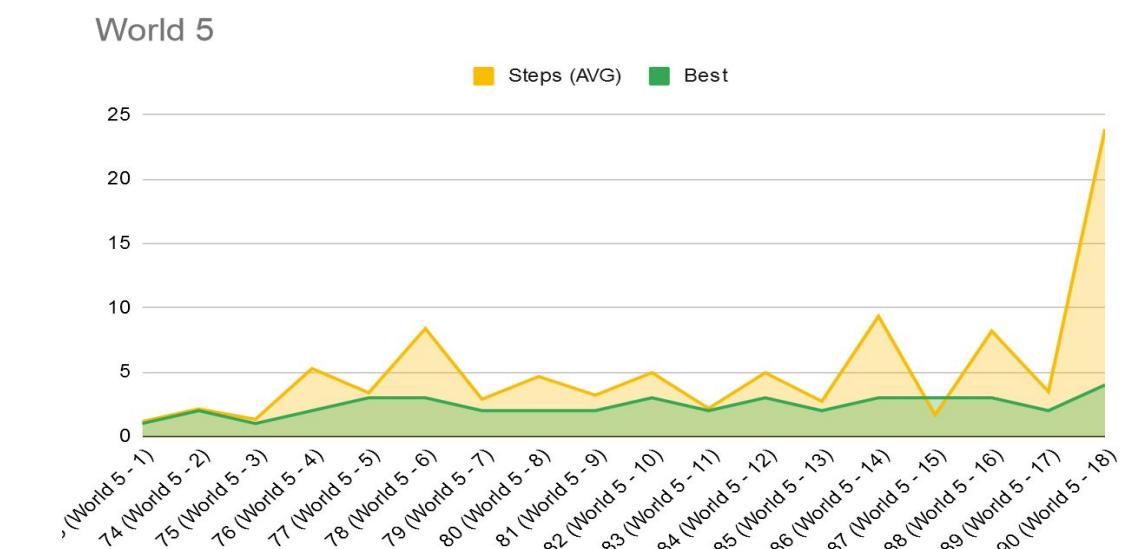
Overall Completion



Error Type



Steps & Efficiency





World 5 - Mixed Practice of + and -

Unique ID	Completion					Errors								Efficiency		Steps			
	Unique ID	Number of Students				Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps
73 (World 5 - 1)	253	70.47%	0.00%	0.00%	29.53%	0.03	21.05%	0.02	13.16%	0.10	65.79%	0.15	0.99	0.99	0.99	1.16	1		
74 (World 5 - 2)	253	70.47%	0.00%	0.00%	29.53%	0.09	27.06%	0.14	41.18%	0.11	31.76%	0.34	0.99	0.99	0.99	2.14	2		
75 (World 5 - 3)	251	69.92%	0.56%	0.00%	29.53%	1.40	75.32%	0.34	18.30%	0.12	6.38%	1.86	0.99	0.99	1.00	1.32	1		
76 (World 5 - 4)	250	69.64%	0.00%	0.28%	30.08%	0.08	12.66%	0.12	19.62%	0.43	67.72%	0.63	0.71	0.75	0.75	5.27	2		
77 (World 5 - 5)	248	69.08%	0.28%	0.28%	30.36%	0.05	10.74%	0.14	29.75%	0.29	59.50%	0.48	0.98	0.98	0.98	3.38	3		
78 (World 5 - 6)	246	68.52%	0.56%	0.00%	30.92%	0.43	29.40%	0.20	13.46%	0.84	57.14%	1.47	0.82	0.80	0.80	8.38	3		
79 (World 5 - 7)	243	67.69%	0.00%	0.84%	31.48%	0.00	2.00%	0.04	18.00%	0.16	80.00%	0.20	0.94	0.94	0.94	2.89	2		
80 (World 5 - 8)	242	67.41%	0.28%	0.00%	32.31%	0.16	21.91%	0.07	8.99%	0.51	69.10%	0.73	0.83	0.83	0.83	4.65	2		
81 (World 5 - 9)	239	66.57%	0.84%	0.00%	32.59%	0.61	26.30%	1.05	45.26%	0.66	28.44%	2.31	0.96	0.95	0.95	3.20	2		
82 (World 5 - 10)	233	64.90%	1.11%	0.56%	33.43%	1.76	57.93%	0.73	24.00%	0.55	18.07%	3.03	0.96	0.95	0.95	4.95	3		
83 (World 5 - 11)	233	64.90%	0.00%	0.00%	35.10%	0.52	81.63%	0.07	11.56%	0.04	6.80%	0.63	0.99	0.99	0.99	2.17	2		
84 (World 5 - 12)	232	64.62%	0.28%	0.00%	35.10%	0.23	18.15%	0.25	19.86%	0.78	61.99%	1.25	0.95	0.95	0.95	4.94	3		
85 (World 5 - 13)	229	63.79%	0.56%	0.28%	35.38%	1.12	78.08%	0.19	13.51%	0.12	8.41%	1.44	0.96	0.96	0.96	2.72	2		
86 (World 5 - 14)	227	63.23%	0.56%	0.00%	36.21%	0.08	5.04%	0.62	39.78%	0.86	55.18%	1.56	0.68	0.71	0.71	9.34	3		
87 (World 5 - 15)	104	28.97%	0.84%	30.08%	40.11%	0.03	3.15%	0.55	53.60%	0.45	43.24%	1.03	0.97	0.98	0.98	1.67	3		
88 (World 5 - 16)	71	19.78%	8.36%	5.01%	66.85%	3.52	24.55%	5.76	40.19%	5.06	35.27%	14.34	0.86	0.84	0.84	8.18	3		
89 (World 5 - 17)	69	19.22%	0.56%	1.67%	78.55%	1.04	29.74%	0.99	28.25%	1.47	42.01%	3.49	0.75	0.78	0.78	3.48	2		
90 (World 5 - 18)	58	16.16%	3.06%	0.28%	80.50%	0.26	10.91%	0.59	24.85%	1.51	64.24%	2.36	0.77	0.87	0.87	23.89	4		



World 5

Mixed Practice of + and -

World 5 - Mixed Practice of + and -

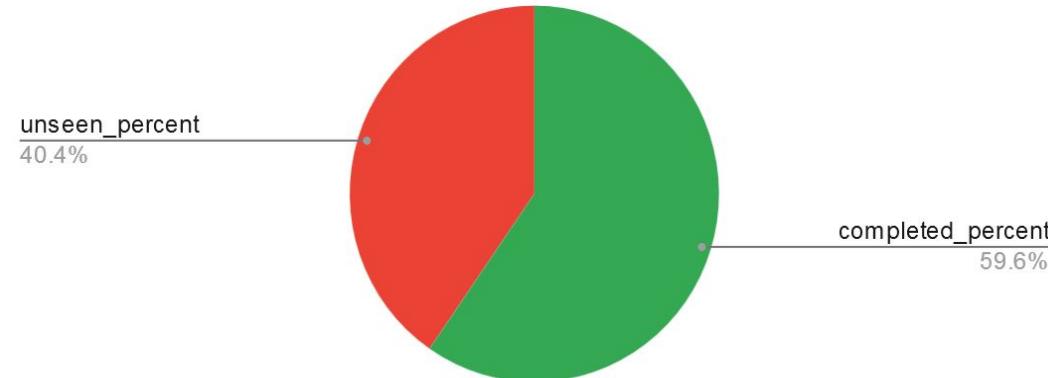
Unique ID	#	Problem	Goal	Best Steps Video
73	1	$8+4-4$	$8+0$	1
74	2	$15-6$	$9+0$	2
75	3	0	$171 - 171$	1
76	4	$3-4+5+5$	$8+1$	2
77	5	$6-2+7$	$11*1$	3
78	6	$4+6-3-7+0$	$-10+0+10$	3
79	7	$7+16-6-4$	$7+6$	2
80	8	$3+6-8+7$	$10-2$	2
81	9	$-45 + c - 17-6$	$-25-20+c-23$	2
82	10	$-14+16$	$-7+1+8$	3
83	11	20	$10+6+4$	2
84	12	$15-25+8+2$	$10-10$	3
85	13	$0-10-4$	$0-7-3-2-2$	2
86	14	$27+65+3-25+75-65$	$5+0+75$	3
87	15	$-7a - 5b + 5b - 17a$	$-24a$	3
88	16	$20a - 6b - 10b$	$-10a - 16b + 30a$	3
89	17	$-60-2c +8$	$-2c-40-12$	2
90	18	$0-1+2-3+4-5+6$	$0-9+12$	4



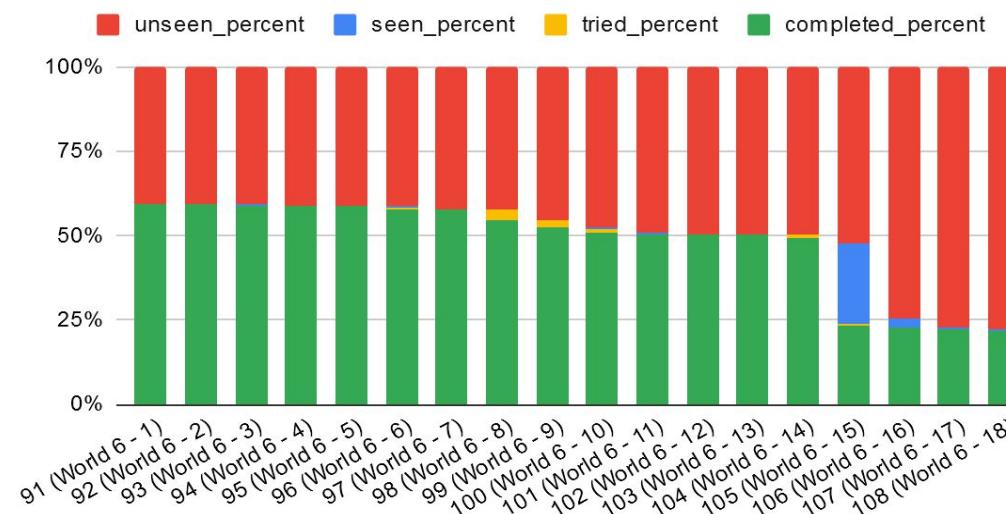
World 6 - Division

Overall Completion

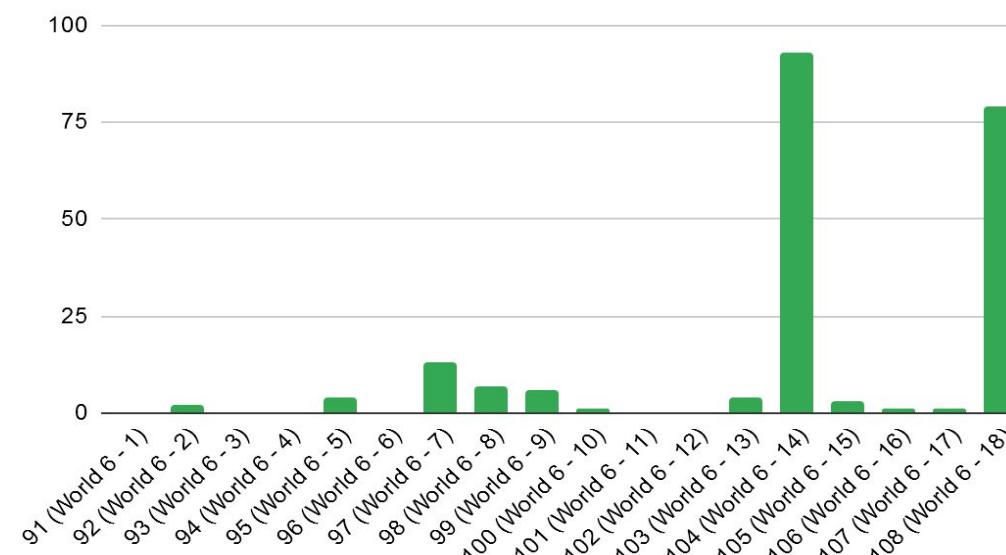
World 6



World 6

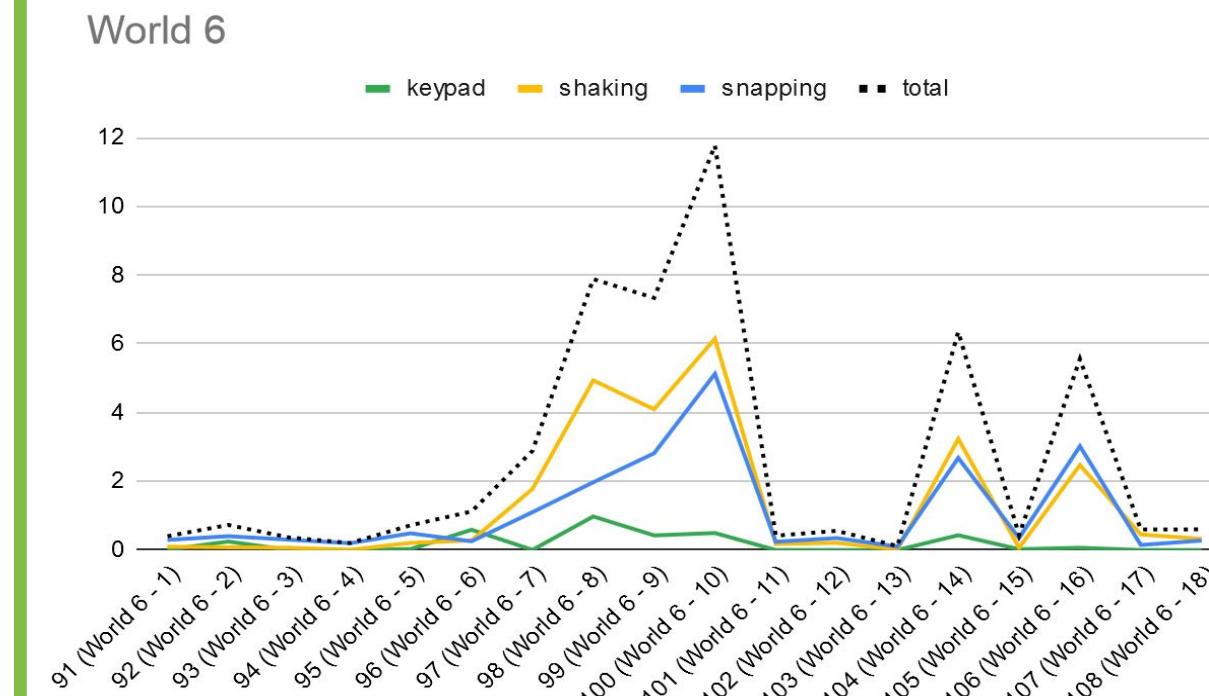


World 6

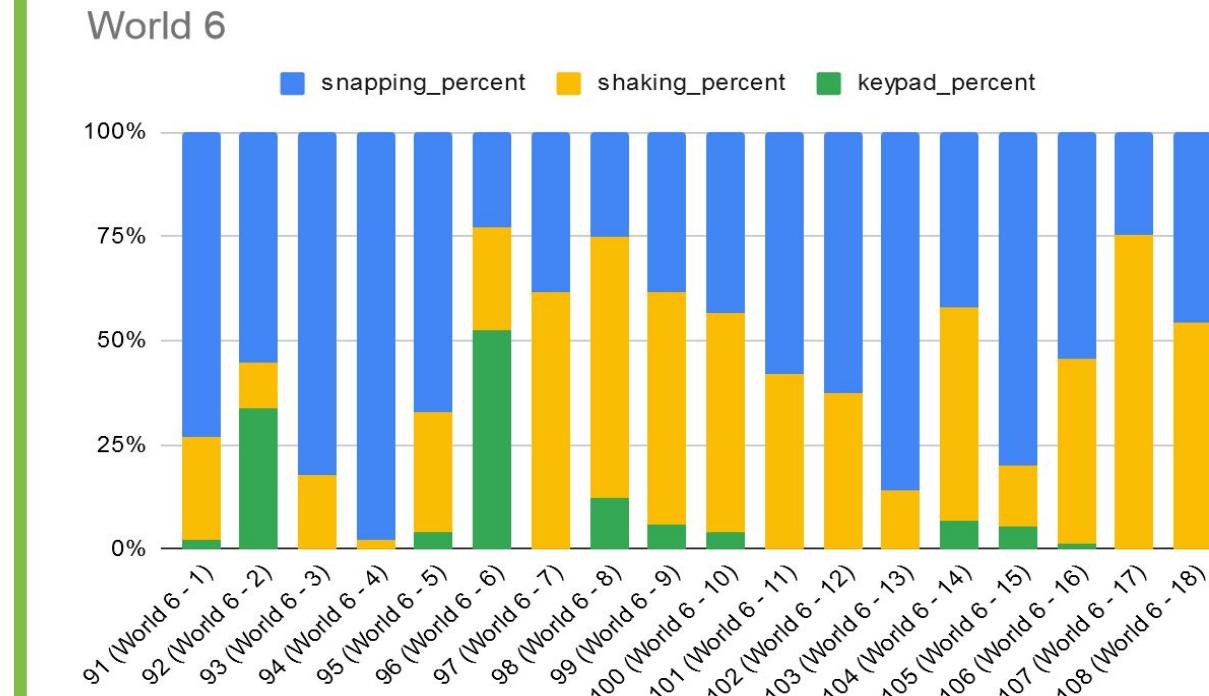


Error Type

World 6

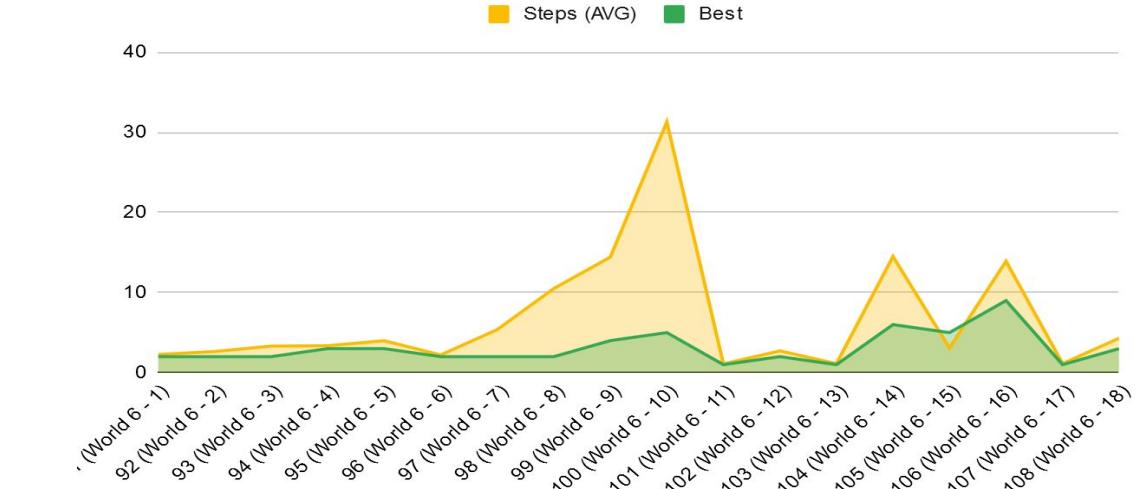


World 6

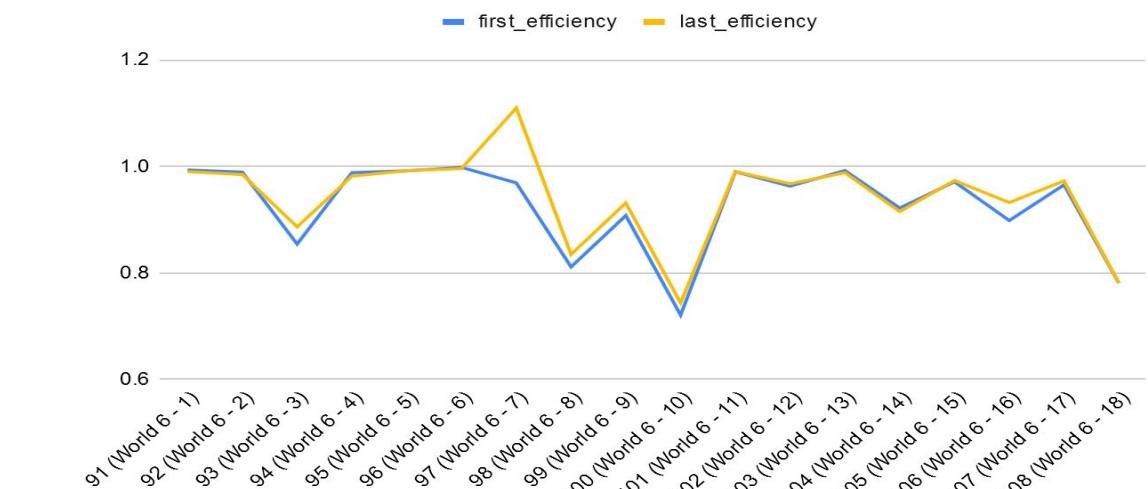


Steps & Efficiency

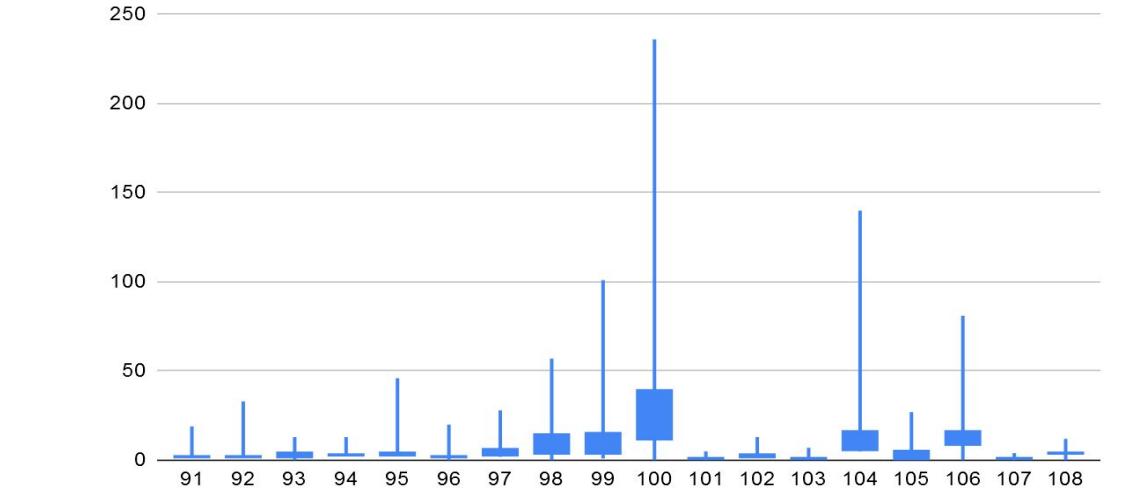
World 6



World 6



World 6





World 6 - Division

Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
91 (World 6 - 1)	214	214	59.61%	0.00%	0.00%	40.39%	0.01	2.33%	0.10	24.42%	0.29	73.26%	0.40	0.99	0.99	2.27	2
92 (World 6 - 2)	214	214	59.61%	0.00%	0.00%	40.39%	0.25	33.97%	0.08	10.90%	0.40	55.13%	0.73	0.99	0.98	2.64	2
93 (World 6 - 3)	212	212	59.05%	0.00%	0.28%	40.67%	0.00	0.00%	0.07	17.95%	0.30	82.05%	0.37	0.85	0.89	3.32	2
94 (World 6 - 4)	212	212	59.05%	0.00%	0.00%	40.95%	0.00	0.00%	0.00	2.33%	0.20	97.67%	0.20	0.99	0.98	3.36	3
95 (World 6 - 5)	212	212	59.05%	0.00%	0.00%	40.95%	0.03	3.92%	0.21	28.76%	0.49	67.32%	0.72	0.99	0.99	3.99	3
96 (World 6 - 6)	208	208	57.94%	0.28%	0.84%	40.95%	0.59	52.52%	0.28	24.79%	0.25	22.69%	1.12	1.00	1.00	2.21	2
97 (World 6 - 7)	208	208	57.94%	0.00%	0.00%	42.06%	0.00	0.17%	1.78	61.67%	1.10	38.17%	2.88	0.97	1.11	5.38	2
98 (World 6 - 8)	195	195	54.32%	3.62%	0.00%	42.06%	0.98	12.38%	4.94	62.62%	1.97	25.00%	7.88	0.81	0.83	10.50	2
99 (World 6 - 9)	188	188	52.37%	1.95%	0.00%	45.68%	0.43	5.80%	4.10	55.84%	2.82	38.36%	7.34	0.91	0.93	14.43	4
100 (World 6 - 10)	182	182	50.70%	1.39%	0.28%	47.63%	0.49	4.20%	6.15	52.24%	5.13	43.56%	11.77	0.72	0.74	31.29	5
101 (World 6 - 11)	181	181	50.42%	0.00%	0.28%	49.30%	0.00	0.00%	0.18	42.11%	0.24	57.89%	0.42	0.99	0.99	1.09	1
102 (World 6 - 12)	181	181	50.42%	0.00%	0.00%	49.58%	0.00	0.00%	0.21	37.62%	0.35	62.38%	0.56	0.96	0.97	2.72	2
103 (World 6 - 13)	181	181	50.42%	0.00%	0.00%	49.58%	0.00	0.00%	0.02	14.29%	0.10	85.71%	0.12	0.99	0.99	1.13	1
104 (World 6 - 14)	177	177	49.30%	1.11%	0.00%	49.58%	0.43	6.79%	3.24	51.00%	2.68	42.21%	6.35	0.92	0.92	14.50	6
105 (World 6 - 15)	84	84	23.40%	0.56%	23.96%	52.09%	0.02	5.33%	0.06	14.67%	0.35	80.00%	0.44	0.97	0.97	3.08	5
106 (World 6 - 16)	81	81	22.56%	0.00%	2.79%	74.65%	0.07	1.19%	2.47	44.47%	3.02	54.35%	5.56	0.90	0.93	13.91	9
107 (World 6 - 17)	80	80	22.28%	0.00%	0.56%	77.16%	0.00	0.00%	0.45	75.51%	0.15	24.49%	0.60	0.97	0.97	1.13	1
108 (World 6 - 18)	79	79	22.01%	0.00%	0.28%	77.72%	0.00	0.00%	0.33	54.17%	0.28	45.83%	0.60	0.78	0.78	4.30	3



World 6

Division

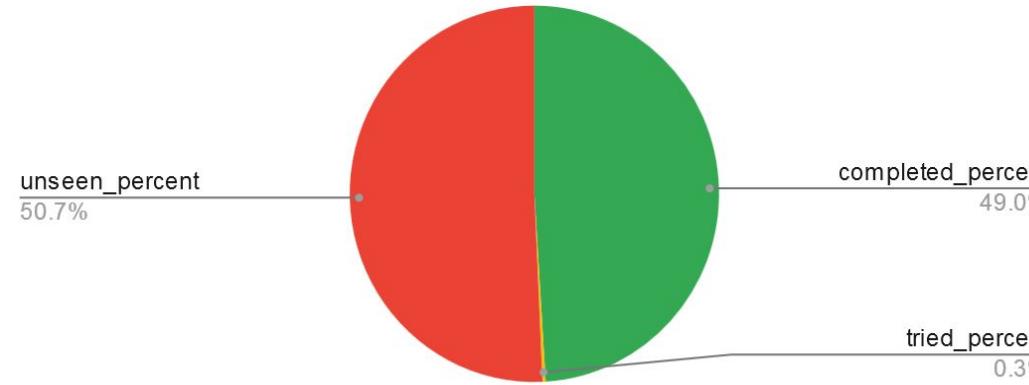
World 6 - Division					
Unique ID	#	Problem	Goal	Best Steps	Video
91	1	$12/3 + 10/2$	$4 + 5$	2	
92	2	$12/3 + 10/2$	$(3*4)/3 + (2*5)/2$	2	
93	3	$(3*4)/3 + (2*5)/2$	$4 + 5$	2	
94	4	$56/7 + 56/4 + 56/28$	$8+14+2$	3	
95	5	$56/7 + 56/4 + 56/28$	$(7*8)/7 + (4*14)/4 + (28*2)/28$	3	
96	6	$5+7$	$20/4 + 42/6$	2	
97	7	$(8*2)/16$	1	2	
98	8	$5 / (2*40)$	$1 / (2*8)$	2	
99	9	$24/21 + 10/15$	$8/7 + 2/3$	4	
100	10	$46/32*8/23$	$1/2$	5	
101	11	$10*a / 5$	$(10*a)/5$	1	
102	12	$5*2 / (7*5)$	$(5*2)/(5*7)$	2	
103	13	$(6*b)/2$	$6/2 * b$	1	
104	14	$(5*a)/15 + (14*13)/42$	$1/3*a+1/3*13$	6	
105	15	$30/10 + 300/100 + 3000/1000$	9	5	
106	16	$8/24+800/2400+80000/240000$	1	9	
107	17	$(5*b)/(7*b)$	$5/7$	1	
108	18	$(42*c)/(2*3*7*c)$	1	3	



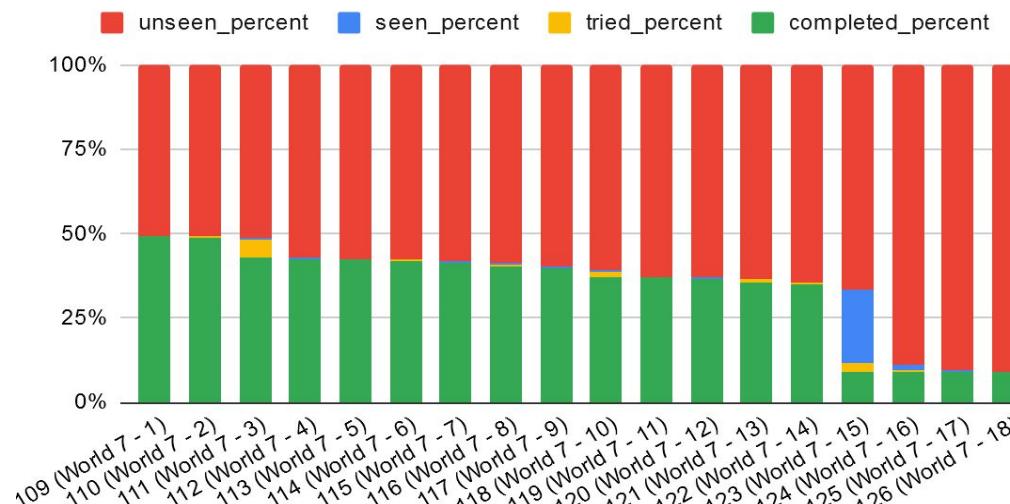
World 7 - Order of Operations

Overall Completion

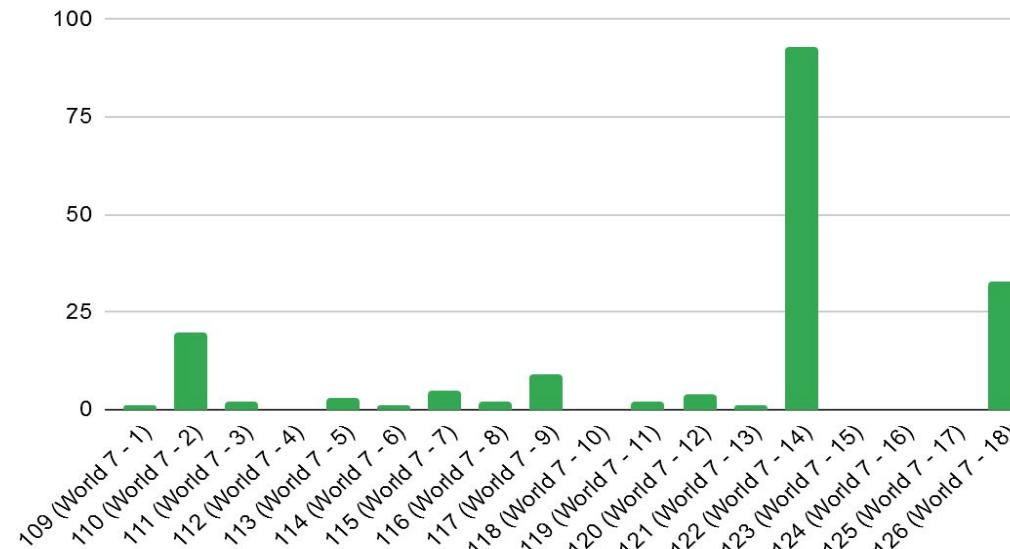
World 7



World 7

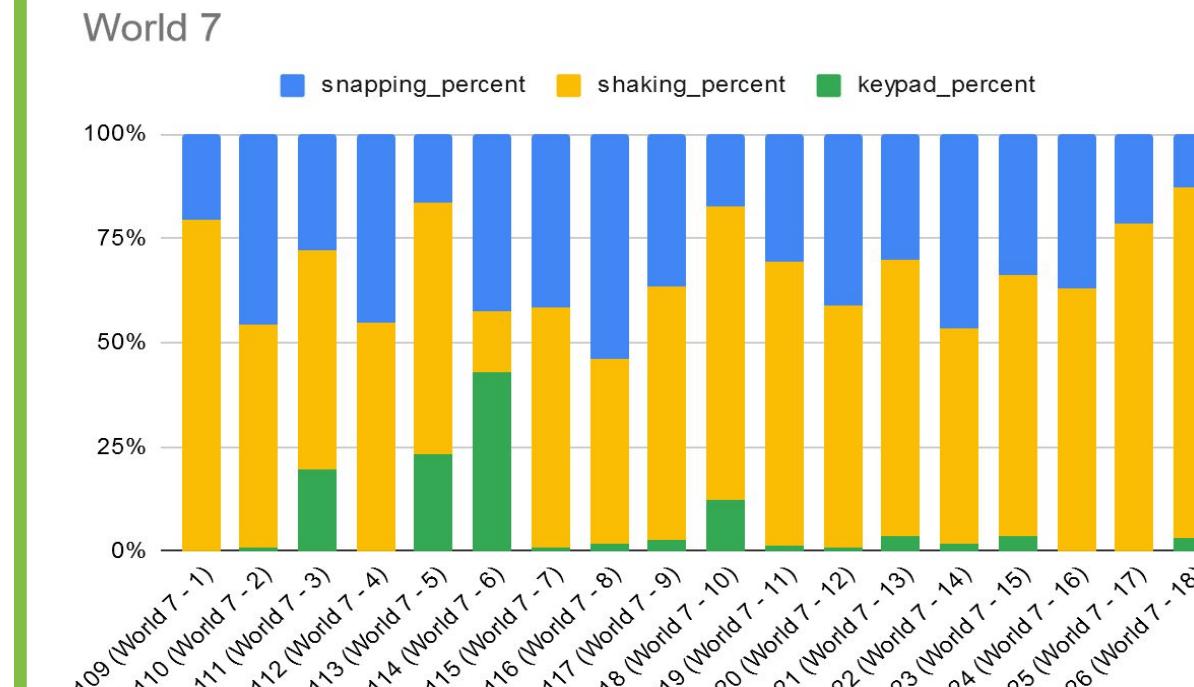
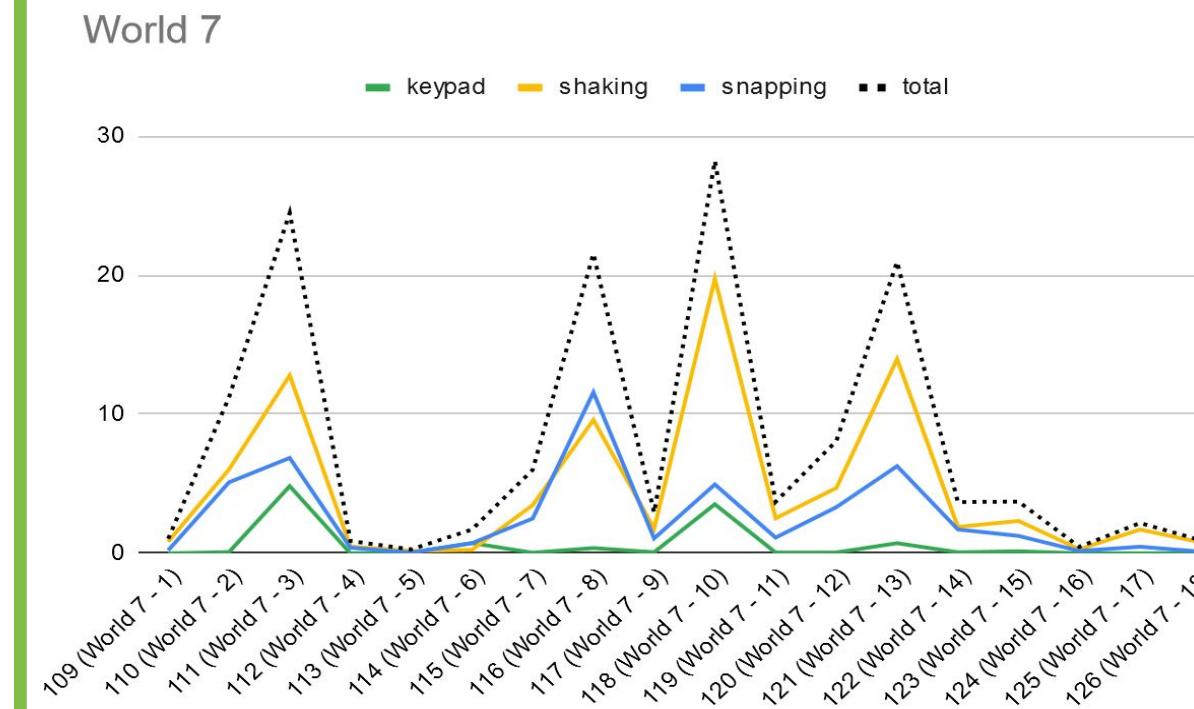


World 7



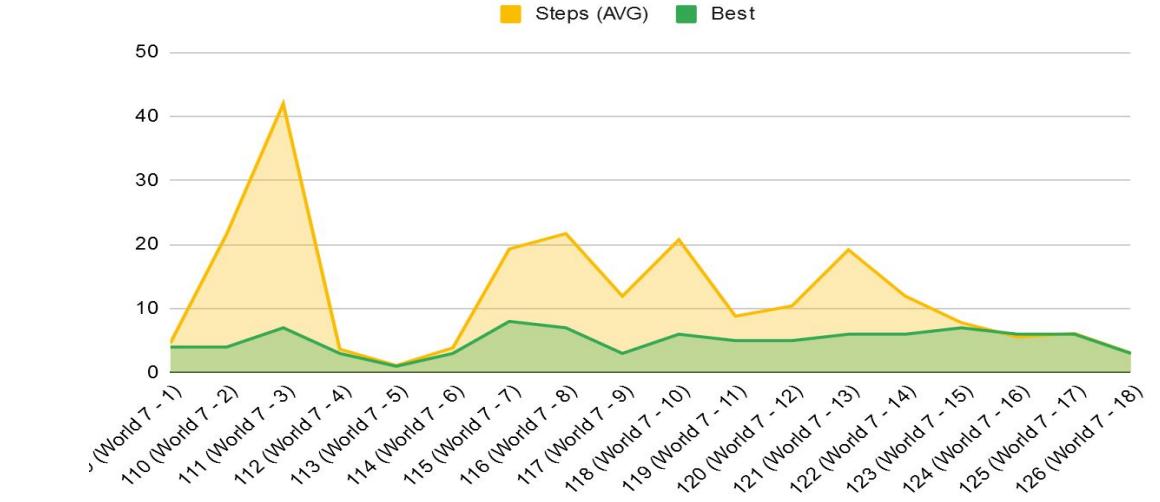
Error Type

World 7

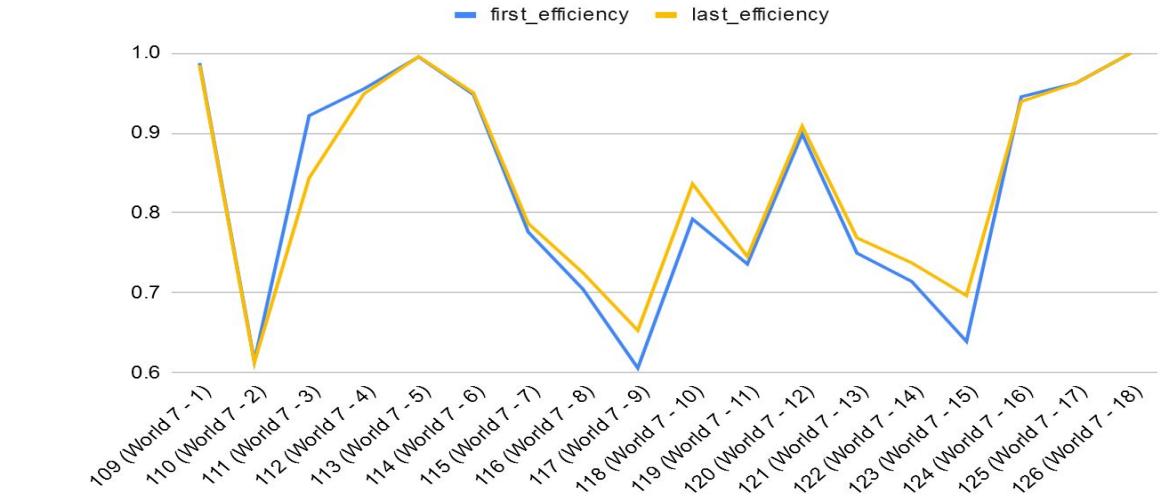


Steps & Efficiency

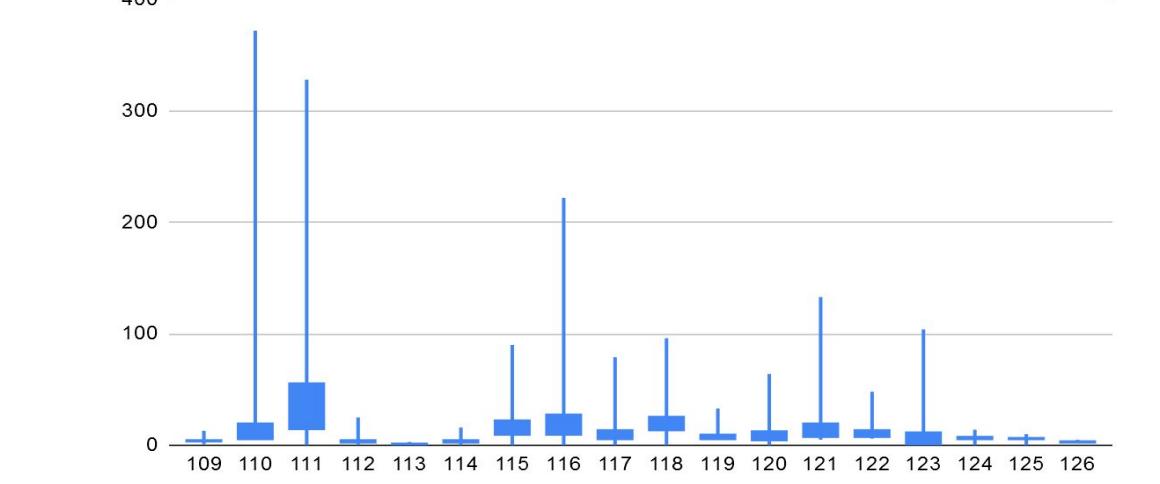
World 7



World 7



World 7



World 7 - Order of Operations



Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
109 (World 7 - 1)	109 (World 7 - 1)	176	49.03%	0.28%	0.00%	50.70%	0.00	0.00%	0.83	79.46%	0.21	20.54%	1.05	0.99	0.99	4.59	4
110 (World 7 - 2)	110 (World 7 - 2)	175	48.75%	0.28%	0.00%	50.97%	0.09	0.76%	6.03	53.75%	5.10	45.49%	11.22	0.61	0.61	21.65	4
111 (World 7 - 3)	111 (World 7 - 3)	155	43.18%	5.29%	0.28%	51.25%	4.83	19.72%	12.79	52.26%	6.86	28.01%	24.48	0.92	0.84	41.95	7
112 (World 7 - 4)	112 (World 7 - 4)	153	42.62%	0.00%	0.56%	56.82%	0.00	0.00%	0.48	54.74%	0.40	45.26%	0.88	0.96	0.95	3.66	3
113 (World 7 - 5)	113 (World 7 - 5)	153	42.62%	0.00%	0.00%	57.38%	0.07	23.26%	0.17	60.47%	0.05	16.28%	0.28	1.00	1.00	1.12	1
114 (World 7 - 6)	114 (World 7 - 6)	150	41.78%	0.56%	0.28%	57.38%	0.73	42.91%	0.25	14.56%	0.73	42.53%	1.71	0.95	0.95	3.87	3
115 (World 7 - 7)	115 (World 7 - 7)	149	41.50%	0.00%	0.28%	58.22%	0.04	0.67%	3.46	57.67%	2.50	41.67%	6.00	0.78	0.79	19.31	8
116 (World 7 - 8)	116 (World 7 - 8)	144	40.11%	0.84%	0.56%	58.50%	0.38	1.74%	9.59	44.52%	11.58	53.74%	21.54	0.70	0.73	21.70	7
117 (World 7 - 9)	117 (World 7 - 9)	142	39.55%	0.28%	0.28%	59.89%	0.08	2.61%	1.78	60.81%	1.07	36.58%	2.92	0.61	0.65	11.93	3
118 (World 7 - 10)	118 (World 7 - 10)	133	37.05%	1.67%	0.56%	60.72%	3.52	12.49%	19.74	69.97%	4.95	17.54%	28.22	0.79	0.84	20.74	6
119 (World 7 - 11)	119 (World 7 - 11)	133	37.05%	0.00%	0.00%	62.95%	0.05	1.42%	2.52	68.09%	1.13	30.49%	3.70	0.74	0.75	8.82	5
120 (World 7 - 12)	120 (World 7 - 12)	131	36.49%	0.28%	0.28%	62.95%	0.06	0.74%	4.70	58.19%	3.32	41.06%	8.08	0.90	0.91	10.41	5
121 (World 7 - 13)	121 (World 7 - 13)	127	35.38%	1.11%	0.00%	63.51%	0.73	3.46%	13.97	66.64%	6.27	29.90%	20.96	0.75	0.77	19.18	6
122 (World 7 - 14)	122 (World 7 - 14)	126	35.10%	0.28%	0.00%	64.62%	0.07	1.92%	1.90	51.50%	1.72	46.58%	3.69	0.71	0.74	11.97	6
123 (World 7 - 15)	123 (World 7 - 15)	33	9.19%	2.51%	21.73%	66.57%	0.14	3.81%	2.33	62.56%	1.25	33.63%	3.72	0.64	0.70	7.79	7
124 (World 7 - 16)	124 (World 7 - 16)	33	9.19%	0.28%	1.95%	88.58%	0.00	0.00%	0.29	63.16%	0.17	36.84%	0.46	0.95	0.94	5.56	6
125 (World 7 - 17)	125 (World 7 - 17)	33	9.19%	0.00%	0.28%	90.53%	0.00	0.00%	1.71	78.38%	0.47	21.62%	2.18	0.96	0.96	6.12	6
126 (World 7 - 18)	126 (World 7 - 18)	33	9.19%	0.00%	0.00%	90.81%	0.03	3.23%	0.79	83.87%	0.12	12.90%	0.94	1.00	1.00	3.06	3



World 7

Order of Operations

World 7 - Order of Operations

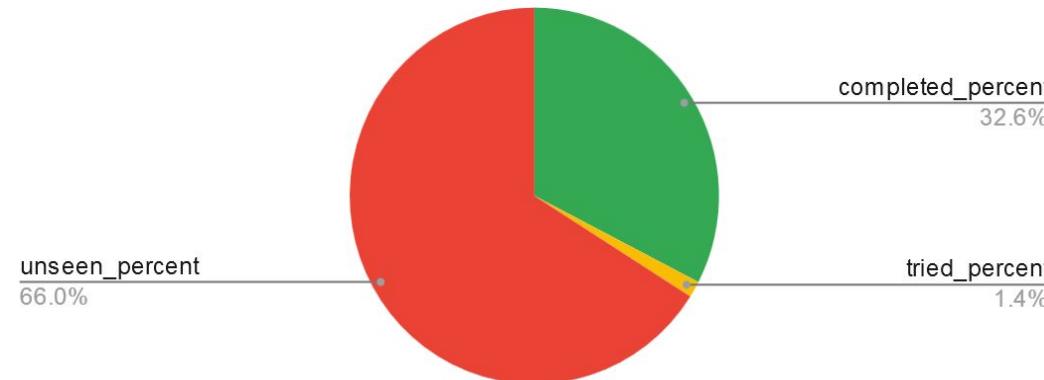
Unique ID	#	Problem	Goal	Best Steps	Video
109	1	$10-7-4+3*7$	20	4	
110	2	$12(18-8) + 60c/5$	$12c+120$	4	
111	3	$39/(2+1)-2*(4+1)$	$-7+1+9$	7	
112	4	$6+(3+3)/3-y$	$8-y$	3	
113	5	$38*45$	$(30+8)*45$	1	
114	6	$16*29$	$(30-1)*4*4$	3	
115	7	$4*(1+4)*(-100+1+45+55)/(3+2)+6$	$6+4$	8	
116	8	$x*2*a*(98+0-48-49)/(a+a)*y$	$y*x$	7	
117	9	$4-2+((2*4)/2)*2$	$12-2$	3	
118	10	$-z+y*((x-a*-a-x)/y)+z$	$-a*-a$	6	
119	11	$2+2*((2+2*2-2)/2)-2$	$2*2$	5	
120	12	$6*2*(13-(4a+2a)/3)$	$12*(-2a+13)$	5	
121	13	$1/b*b*-b+b+b*b+b-b$	$b*b$	6	
122	14	$(4-4-3*-3)-7+7*2*1/2$	$-3*-3$	6	
123	15	$2*(y+y)*(-102+1+50+52)/(y+y)*y$	$y+y$	7	
124	16	$(23 - 17)*((14-5+6)*12)/(40+5)$	$6*4$	6	
125	17	$32+43 - (100+5*5)/(17-12)$	50	6	
126	18	$(a-60-15+76-2)/2-1$	$(a-1)/2-1$	3	



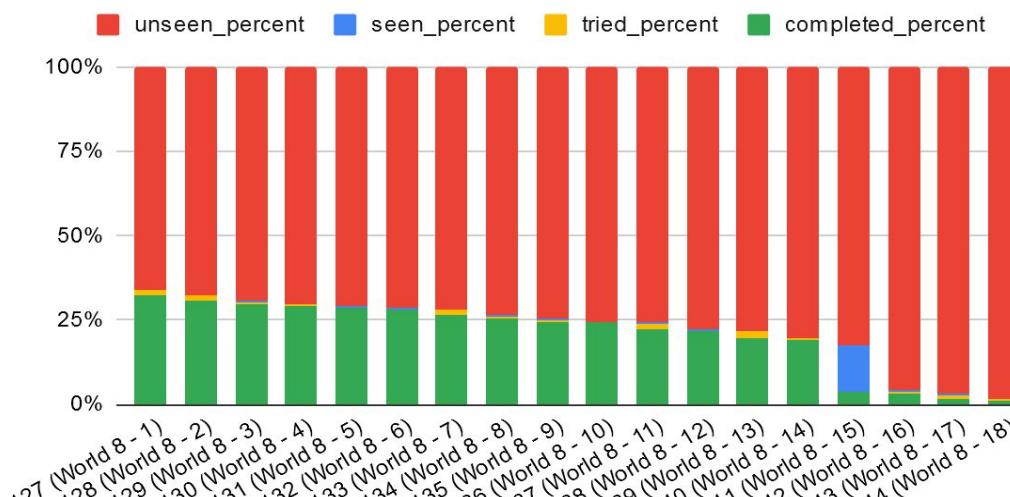
World 8 - Equation + and -

Overall Completion

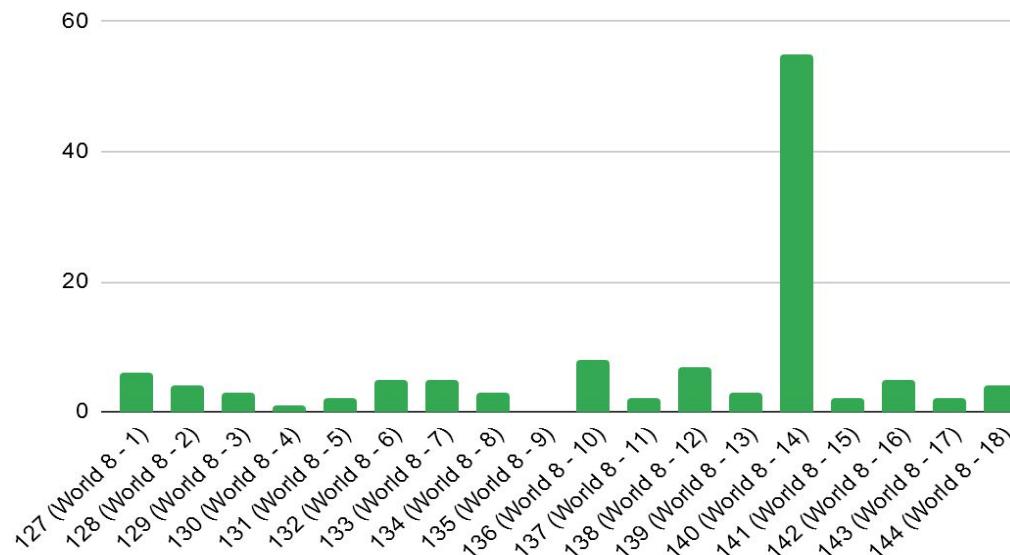
World 8



World 8

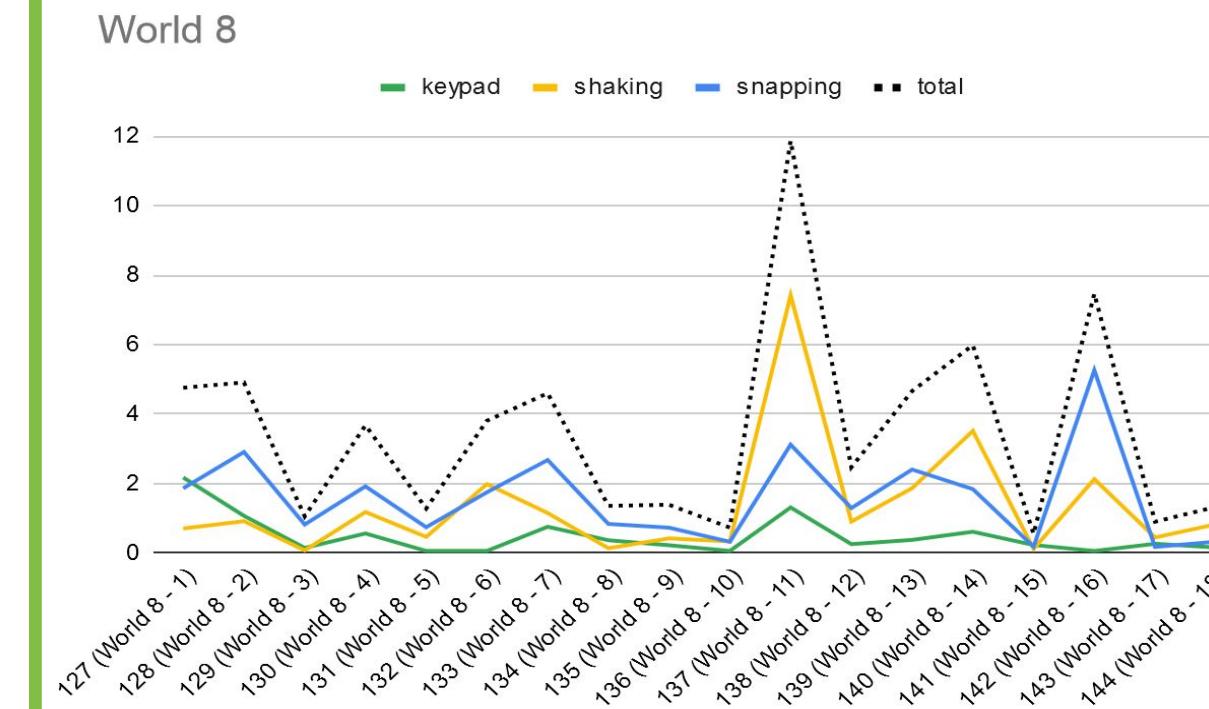


World 8

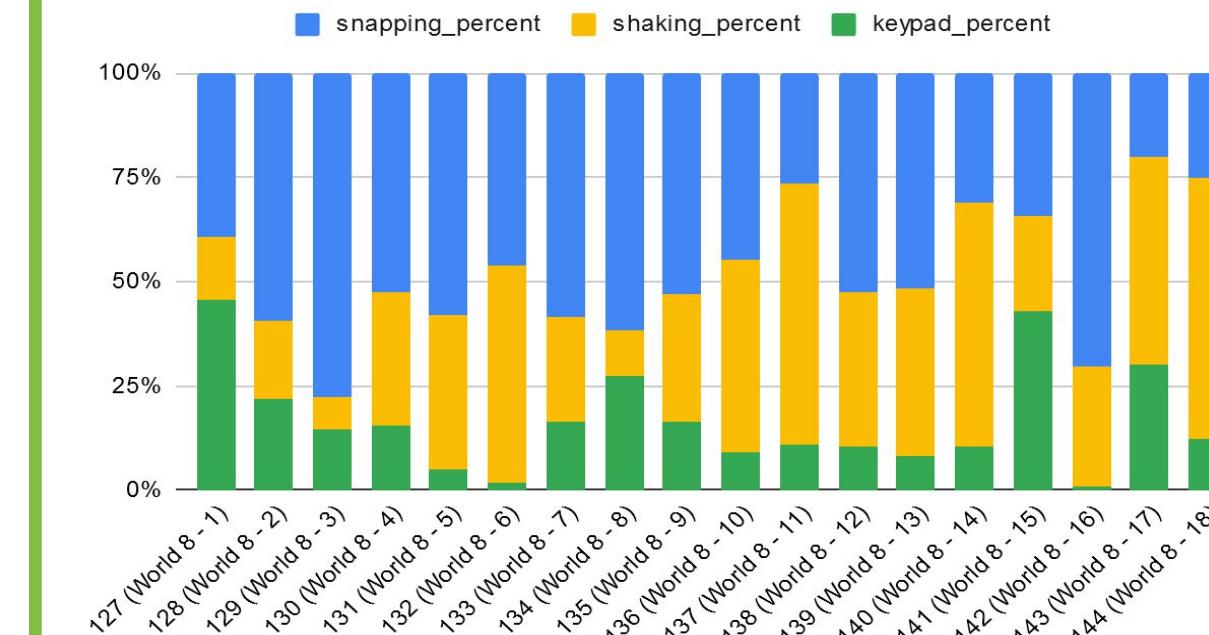


Error Type

World 8

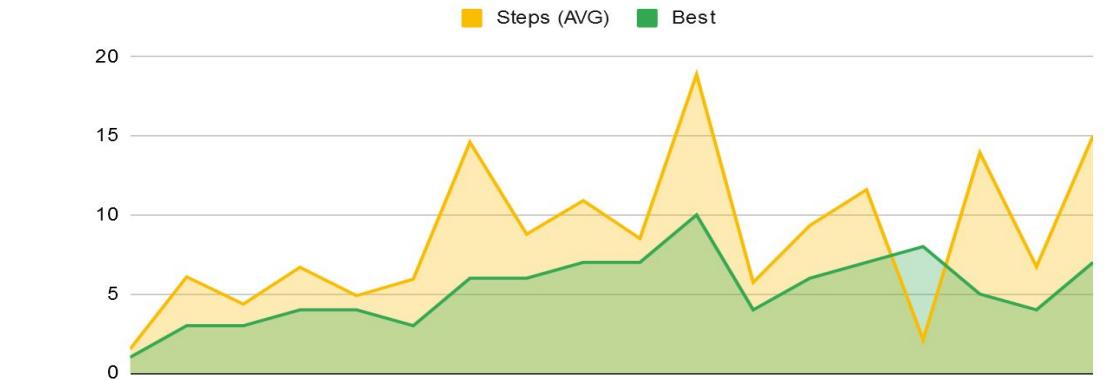


World 8

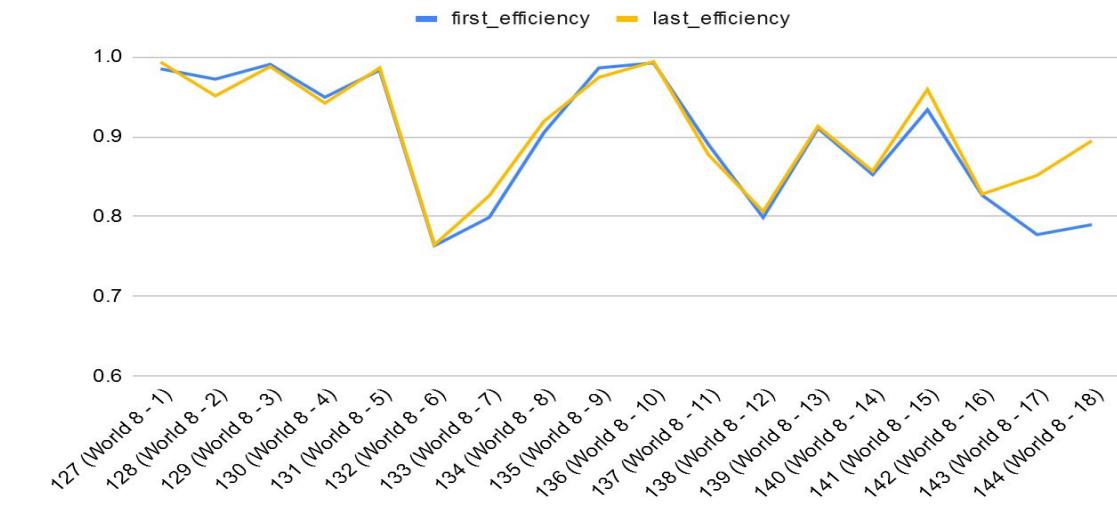


Steps & Efficiency

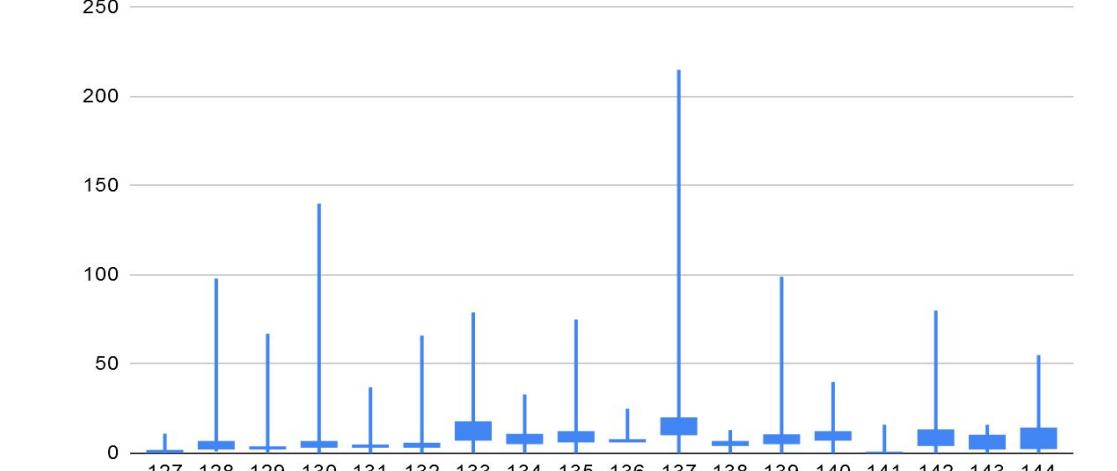
World 8



World 8



World 8



World 8 - Equation + and -



Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
127 (World 8 - 1)	127 (World 8 - 1)	117	32.59%	1.39%	0.00%	66.02%	2.18	45.78%	0.71	14.97%	1.87	39.24%	4.76	0.99	0.99	1.52	1
128 (World 8 - 2)	128 (World 8 - 2)	111	30.92%	1.67%	0.00%	67.41%	1.08	21.91%	0.92	18.78%	2.91	59.30%	4.91	0.97	0.95	6.09	3
129 (World 8 - 3)	129 (World 8 - 3)	107	29.81%	0.56%	0.28%	69.36%	0.15	14.53%	0.08	7.69%	0.83	77.78%	1.06	0.99	0.99	4.36	3
130 (World 8 - 4)	130 (World 8 - 4)	104	28.97%	0.84%	0.00%	70.19%	0.57	15.48%	1.19	32.23%	1.93	52.28%	3.68	0.95	0.94	6.69	4
131 (World 8 - 5)	131 (World 8 - 5)	103	28.69%	0.00%	0.28%	71.03%	0.07	5.22%	0.47	36.57%	0.75	58.21%	1.29	0.98	0.99	4.89	4
132 (World 8 - 6)	132 (World 8 - 6)	101	28.13%	0.00%	0.28%	71.59%	0.07	1.80%	1.99	52.19%	1.75	46.02%	3.81	0.76	0.76	5.94	3
133 (World 8 - 7)	133 (World 8 - 7)	96	26.74%	1.11%	0.28%	71.87%	0.76	16.56%	1.16	25.16%	2.68	58.28%	4.60	0.80	0.83	14.59	6
134 (World 8 - 8)	134 (World 8 - 8)	91	25.35%	0.84%	0.56%	73.26%	0.38	27.48%	0.15	10.69%	0.84	61.83%	1.36	0.91	0.92	8.78	6
135 (World 8 - 9)	135 (World 8 - 9)	88	24.51%	0.56%	0.28%	74.65%	0.23	16.54%	0.43	30.71%	0.74	52.76%	1.40	0.99	0.97	10.90	7
136 (World 8 - 10)	136 (World 8 - 10)	88	24.51%	0.00%	0.00%	75.49%	0.07	9.23%	0.34	46.15%	0.33	44.62%	0.74	0.99	0.99	8.51	7
137 (World 8 - 11)	137 (World 8 - 11)	80	22.28%	1.39%	0.84%	75.49%	1.32	11.11%	7.42	62.55%	3.13	26.34%	11.86	0.89	0.88	18.88	10
138 (World 8 - 12)	138 (World 8 - 12)	78	21.73%	0.28%	0.28%	77.72%	0.26	10.61%	0.91	36.87%	1.30	52.53%	2.48	0.80	0.81	5.74	4
139 (World 8 - 13)	139 (World 8 - 13)	71	19.78%	1.95%	0.00%	78.27%	0.38	8.24%	1.87	40.11%	2.41	51.65%	4.67	0.91	0.91	9.33	6
140 (World 8 - 14)	140 (World 8 - 14)	68	18.94%	0.84%	0.00%	80.22%	0.62	10.35%	3.52	58.82%	1.85	30.82%	5.99	0.85	0.86	11.59	7
141 (World 8 - 15)	141 (World 8 - 15)	13	3.62%	0.28%	13.65%	82.45%	0.24	42.86%	0.13	22.86%	0.19	34.29%	0.56	0.93	0.96	2.11	8
142 (World 8 - 16)	142 (World 8 - 16)	11	3.06%	0.56%	0.56%	95.82%	0.07	0.89%	2.13	28.57%	5.27	70.54%	7.47	0.83	0.83	13.93	5
143 (World 8 - 17)	143 (World 8 - 17)	6	1.67%	1.11%	0.28%	96.94%	0.27	30.00%	0.45	50.00%	0.18	20.00%	0.91	0.78	0.85	6.73	4
144 (World 8 - 18)	144 (World 8 - 18)	4	1.11%	0.28%	0.28%	98.33%	0.17	12.50%	0.83	62.50%	0.33	25.00%	1.33	0.79	0.90	15.00	7



World 8

Equation + and -

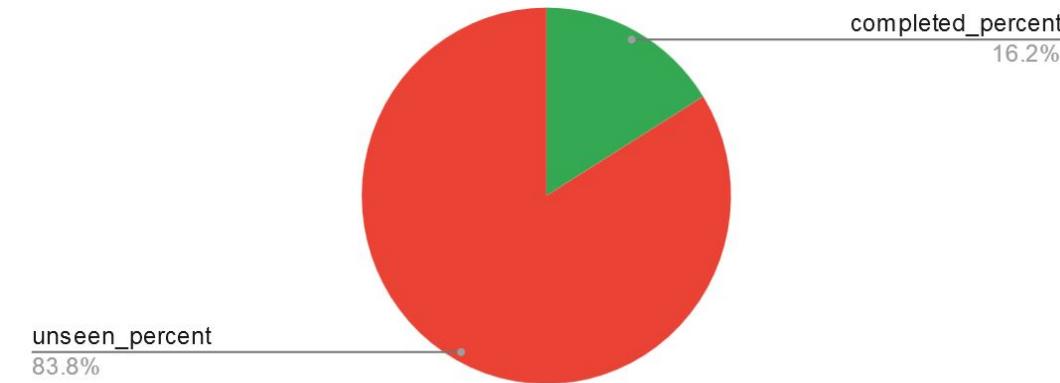
World 8 - Equation + and -				
Unique ID	#	Problem	Goal	Best Steps Video
127	1	$4=4$	$4+1=4+1$	1
128	2	$18 = 15 + 3$	$18 - 3 = 15$	3
129	3	$42 - 5 = 37$	$42 = 37+5$	3
130	4	$r+10 = 22$	$r = 12$	4
131	5	$14 = r - 18$	$32 = r$	4
132	6	$14 = 62 - c$	$c+14 = 62$	3
133	7	$8+8-2=12+2$	$6+4+2=12$	6
134	8	$9-1=2+4+2$	$9=5+3+1$	6
135	9	$-6+2+3=9-14+4$	$2=2$	7
136	10	$8+6+4=25-5-2$	$-1=-1$	7
137	11	$23+y-17 = 1+2+3+y$	$3=3$	10
138	12	$y-x=22+8$	$y=x+30$	4
139	13	$15+d-4=r+50$	$d=r+3*13$	6
140	14	$z+12+4=24+z-8$	$16+y=16+y$	7
141	15	$4+4+4=y+3$	$3+3+3=y$	8
142	16	$x-5=5+5$	$x=4+5+6$	5
143	17	$a+25=7+17+105$	$a-40=24+40$	4
144	18	$d-15+20=62-57+d$	$5-b=5-b$	7



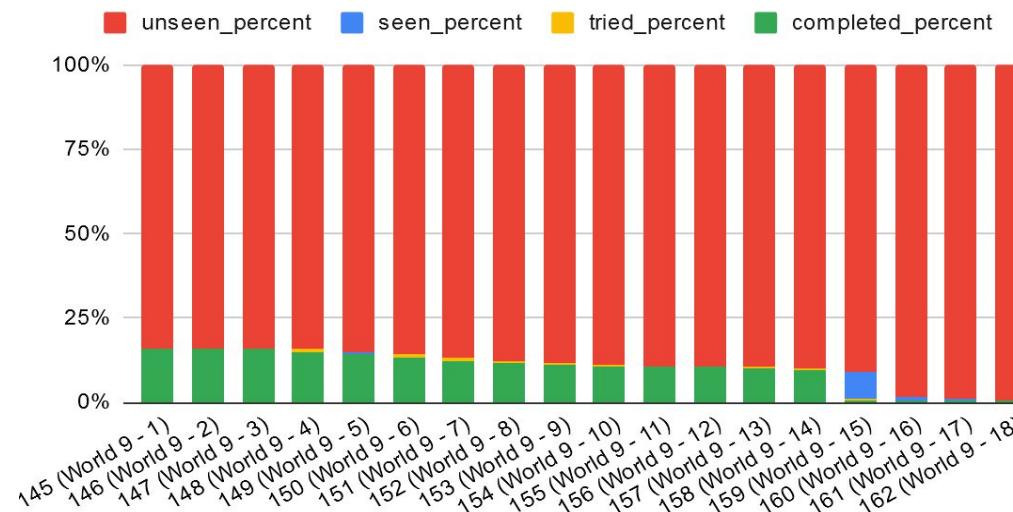
World 9 - Inverse Operations + and -

Overall Completion

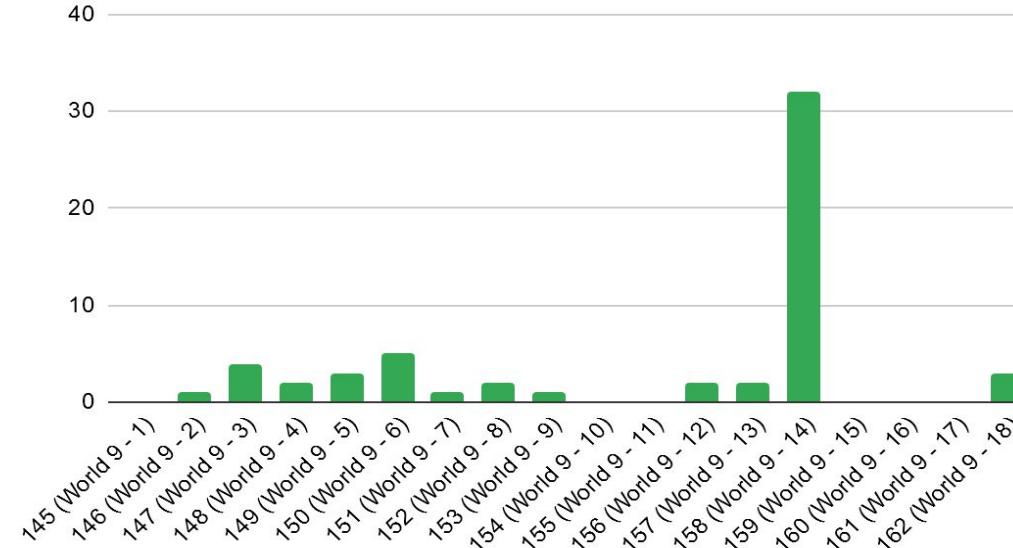
World 9



World 9

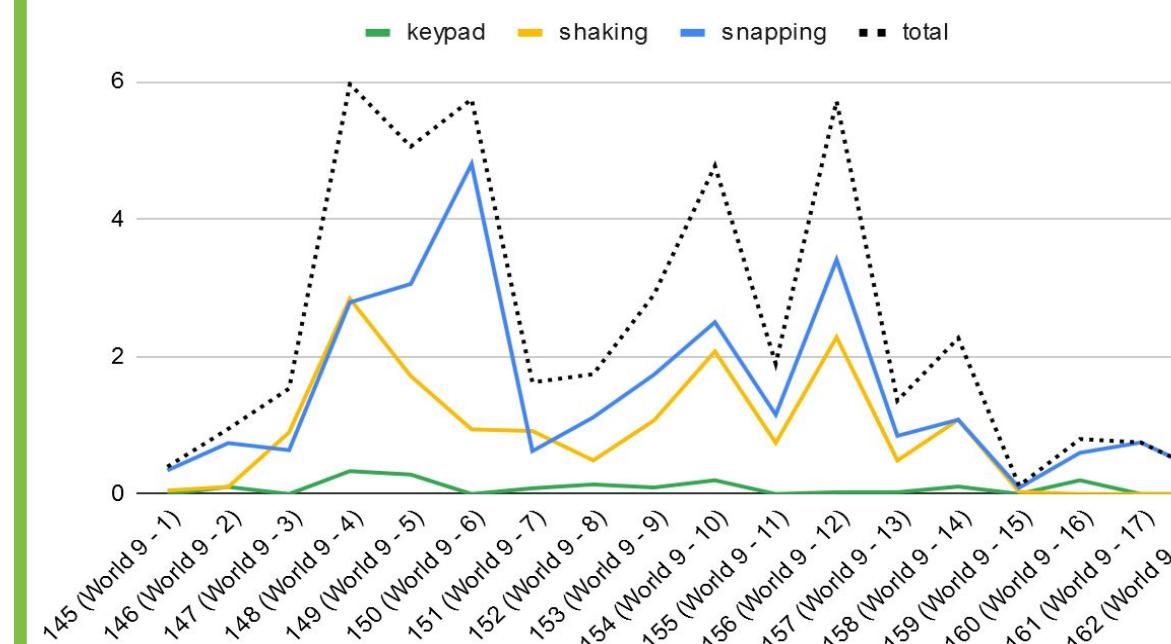


World 9

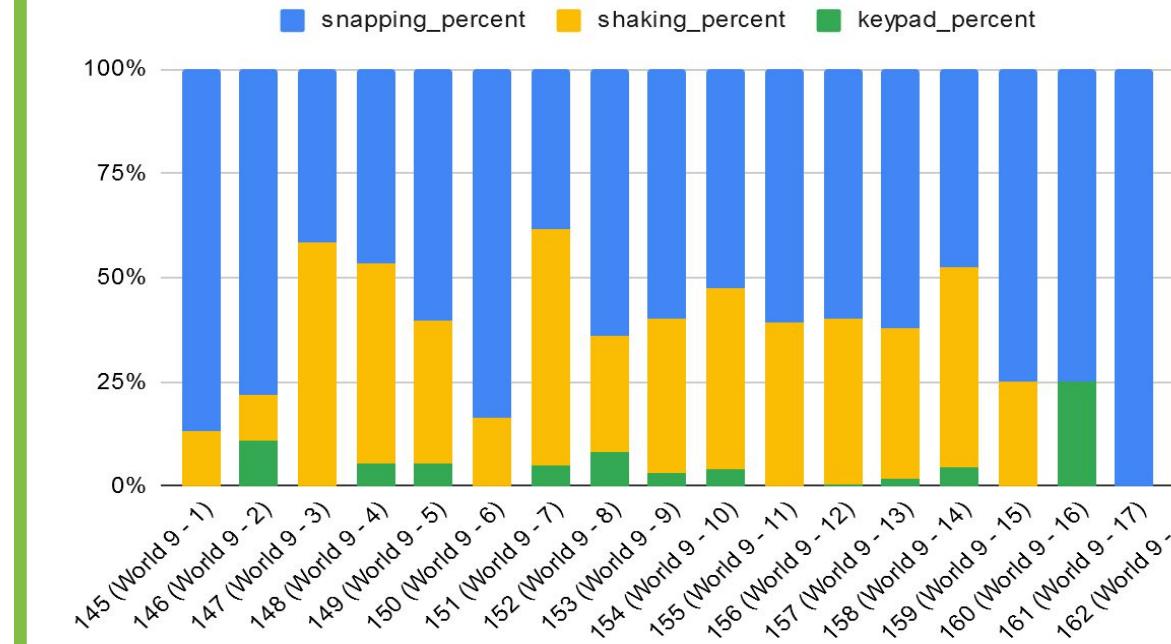


Error Type

World 9

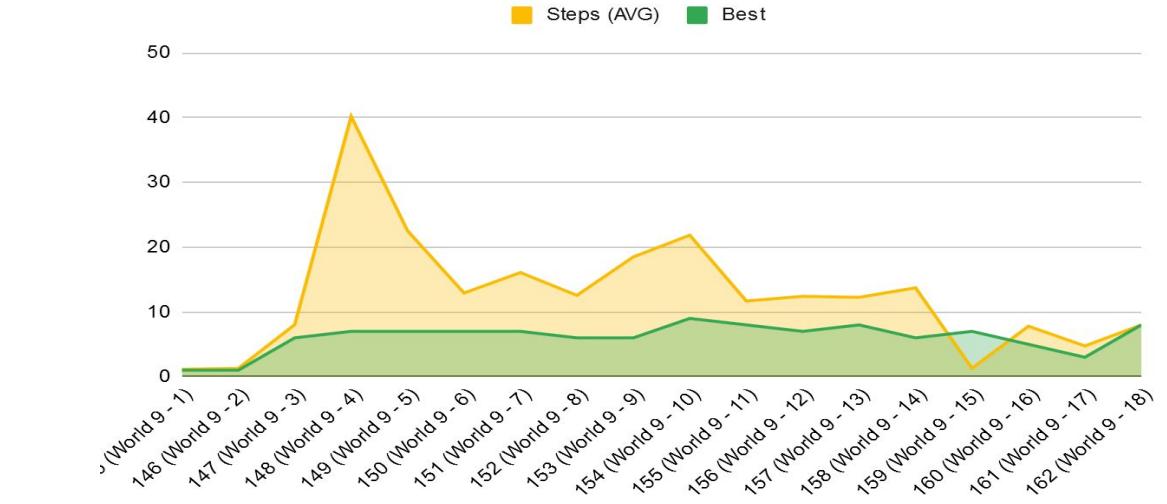


World 9

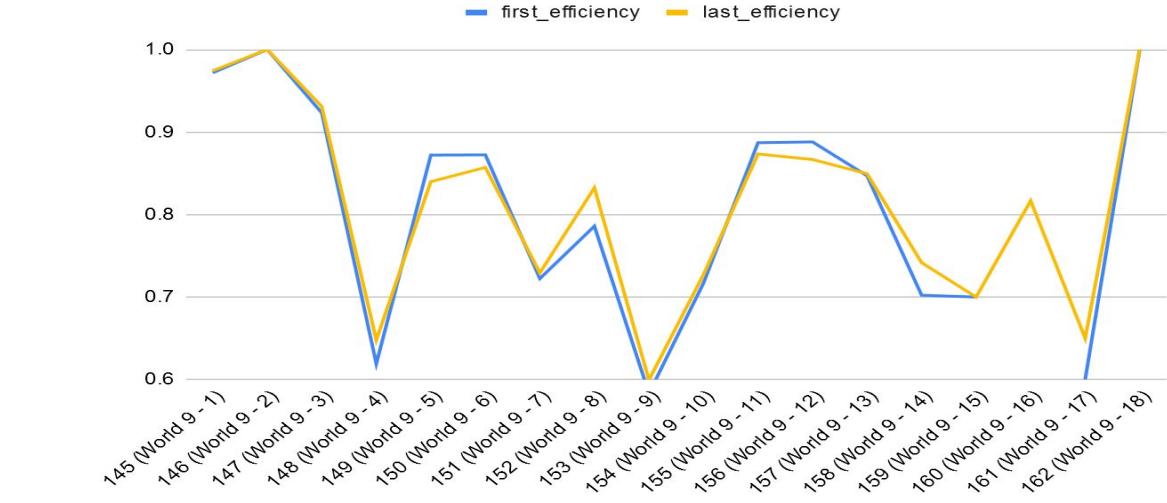


Steps & Efficiency

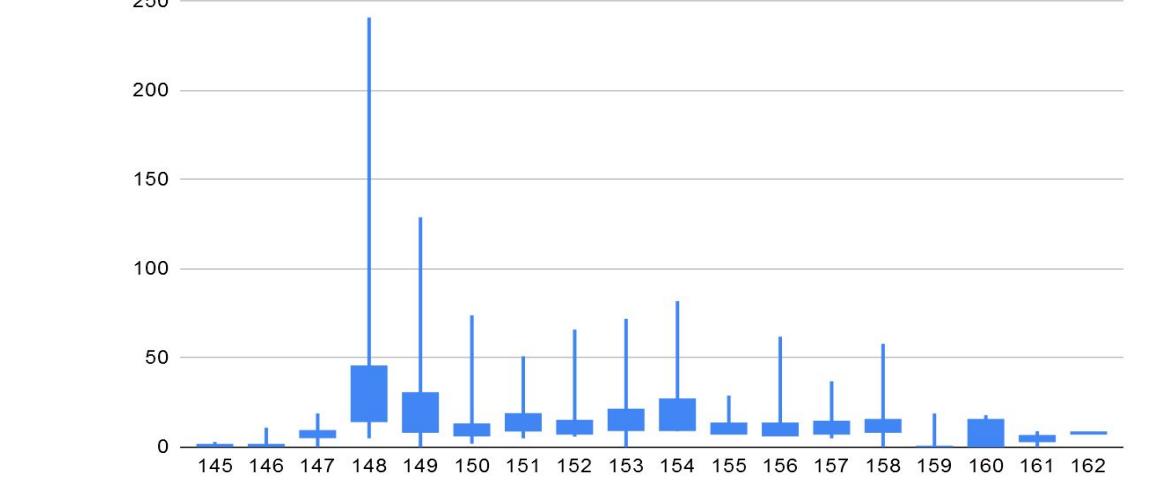
World 9



World 9



World 9



World 9 - Inverse Operations + and -



Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
145 (World 9 - 1)	58	16.16%	0.00%	0.00%	83.84%	0.00	0.00%	0.05	13.04%	0.34	86.96%	0.40	0.97	0.97	1.16	1	
146 (World 9 - 2)	58	16.16%	0.00%	0.00%	83.84%	0.10	10.91%	0.10	10.91%	0.74	78.18%	0.95	1.00	1.00	1.28	1	
147 (World 9 - 3)	57	15.88%	0.00%	0.28%	83.84%	0.00	0.00%	0.90	58.43%	0.64	41.57%	1.53	0.92	0.93	8.03	6	
148 (World 9 - 4)	53	14.76%	1.11%	0.00%	84.12%	0.33	5.59%	2.84	47.65%	2.79	46.76%	5.96	0.62	0.65	40.19	7	
149 (World 9 - 5)	51	14.21%	0.28%	0.28%	85.24%	0.28	5.60%	1.72	33.96%	3.06	60.45%	5.06	0.87	0.84	22.53	7	
150 (World 9 - 6)	48	13.37%	0.84%	0.00%	85.79%	0.00	0.00%	0.94	16.38%	4.80	83.62%	5.75	0.87	0.86	12.92	7	
151 (World 9 - 7)	43	11.98%	1.39%	0.00%	86.63%	0.08	5.13%	0.92	56.41%	0.63	38.46%	1.63	0.72	0.73	16.08	7	
152 (World 9 - 8)	42	11.70%	0.28%	0.00%	88.02%	0.14	8.00%	0.49	28.00%	1.12	64.00%	1.74	0.79	0.83	12.56	6	
153 (World 9 - 9)	40	11.14%	0.56%	0.00%	88.30%	0.10	3.28%	1.07	36.89%	1.74	59.84%	2.90	0.58	0.60	18.50	6	
154 (World 9 - 10)	39	10.86%	0.28%	0.00%	88.86%	0.20	4.19%	2.08	43.46%	2.50	52.36%	4.78	0.72	0.73	21.85	9	
155 (World 9 - 11)	39	10.86%	0.00%	0.00%	89.14%	0.00	0.00%	0.74	39.19%	1.15	60.81%	1.90	0.89	0.87	11.69	8	
156 (World 9 - 12)	39	10.86%	0.00%	0.00%	89.14%	0.03	0.45%	2.28	39.91%	3.41	59.64%	5.72	0.89	0.87	12.41	7	
157 (World 9 - 13)	37	10.31%	0.56%	0.00%	89.14%	0.03	1.89%	0.49	35.85%	0.85	62.26%	1.36	0.85	0.85	12.26	8	
158 (World 9 - 14)	35	9.75%	0.28%	0.28%	89.69%	0.11	4.76%	1.08	47.62%	1.08	47.62%	2.27	0.70	0.74	13.73	6	
159 (World 9 - 15)	3	0.84%	0.28%	8.08%	90.81%	0.00	0.00%	0.03	25.00%	0.09	75.00%	0.12	0.70	0.70	1.30	7	
160 (World 9 - 16)	3	0.84%	0.00%	0.56%	98.61%	0.20	25.00%	0.00	0.00%	0.60	75.00%	0.80	0.82	7.80	5		
161 (World 9 - 17)	3	0.84%	0.00%	0.28%	98.89%	0.00	0.00%	0.00	0.00%	0.75	100.00%	0.75	0.60	0.65	4.75	3	
162 (World 9 - 18)	3	0.84%	0.00%	0.00%	99.16%	0.00	0.00%	0.00	0.00%	0.33	100.00%	0.33	1.00	1.00	8.00	8	

World 9 - Inverse Operations + and -

Unique ID	#	Problem	Goal	Best Steps	Video
145	1	$2+4=6$	$2-2+4=6-2$	1	
146	2	$4=7-3$	$4+3=7-3+3$	1	
147	3	$10+z-3=7+99$	$z=99$	6	
148	4	$11+89=-101+22+78+50+51$	$11-22=-11$	7	
149	5	$66+34=58-102+102+42$	$8=42-34$	7	
150	6	$99+45+55-99=50+50$	$-5=-5$	7	
151	7	$-91-9+44+33=77-21-79$	$-12=-21+9$	7	
152	8	$100+55-73=18+55+9$	$100-27=73$	6	
153	9	$54+45-y=-y+100-1$	$55+45=100$	6	
154	10	$z-19+38=z+80-61$	$-99=-99$	9	
155	11	$128-98+49+49-29=34+65$	$63=63$	8	
156	12	$86+14-68=-68+101-1$	$87=87$	7	
157	13	$18+18+110=72-36+55+55$	$54=54$	8	
158	14	$a+37+63-a=201-101$	$138=201-63$	6	
159	15	$75+25=32+b-b+68$	$-43=-43$	7	
160	16	$42-6-6=30-10+10$	$42+10=30+22$	5	
161	17	$20=20$	$10=10+10-10$	3	
162	18	$8+8-8+8-8=17-9$	$16=16$	8	



World 9

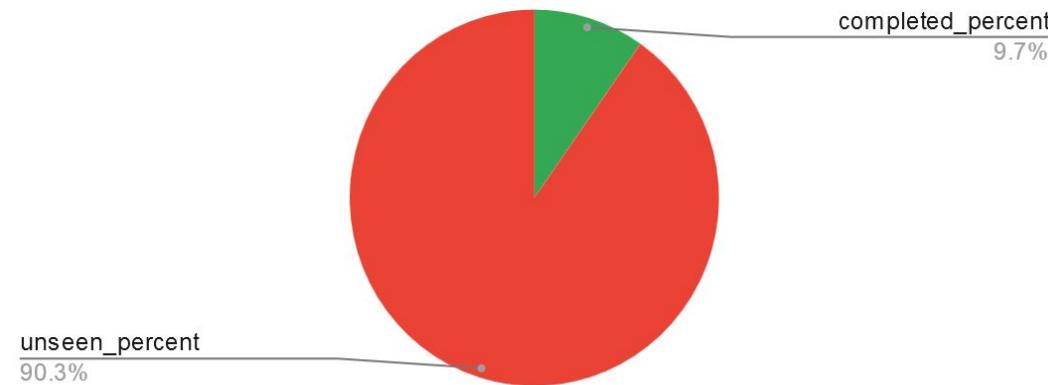
Inverse Operations + and -



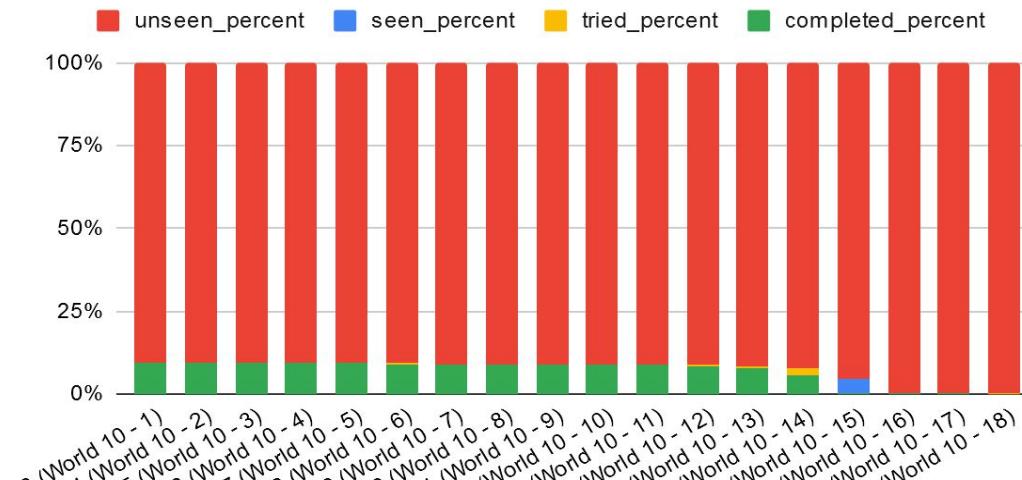
World 10 - Distribution

Overall Completion

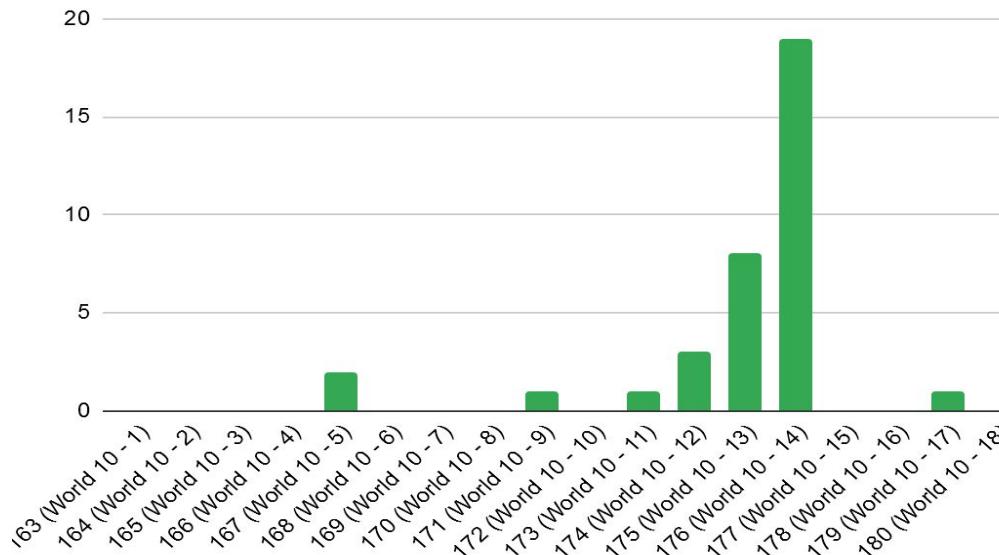
World 10



World 10

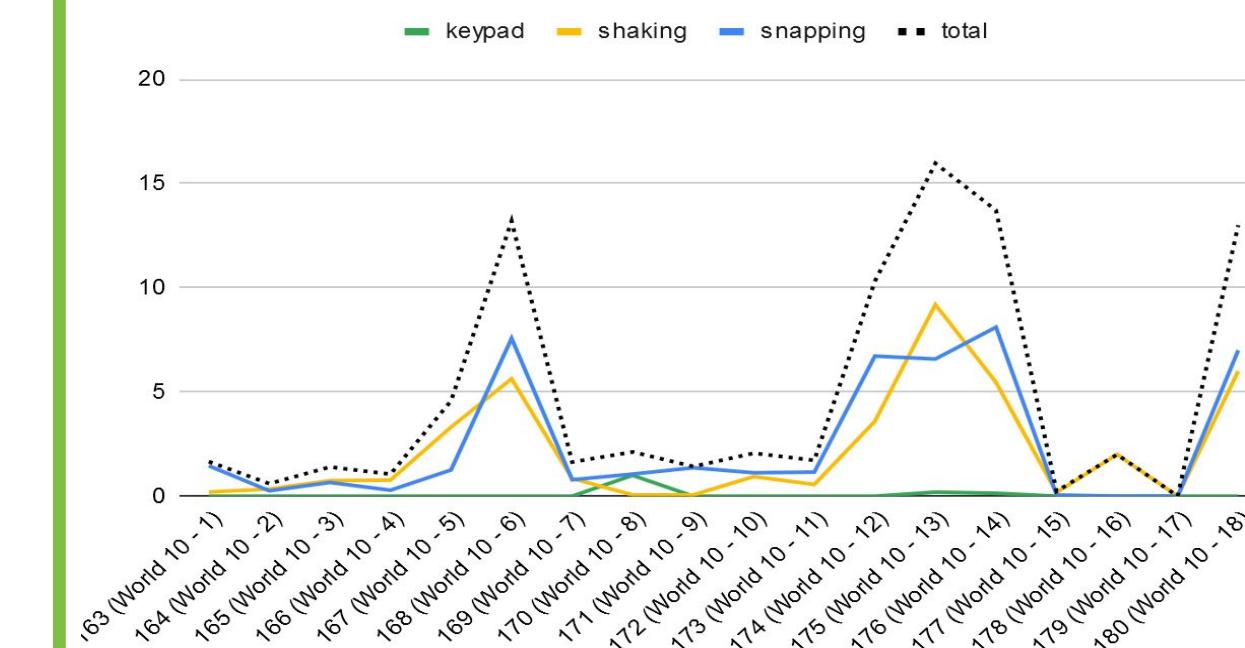


World 10

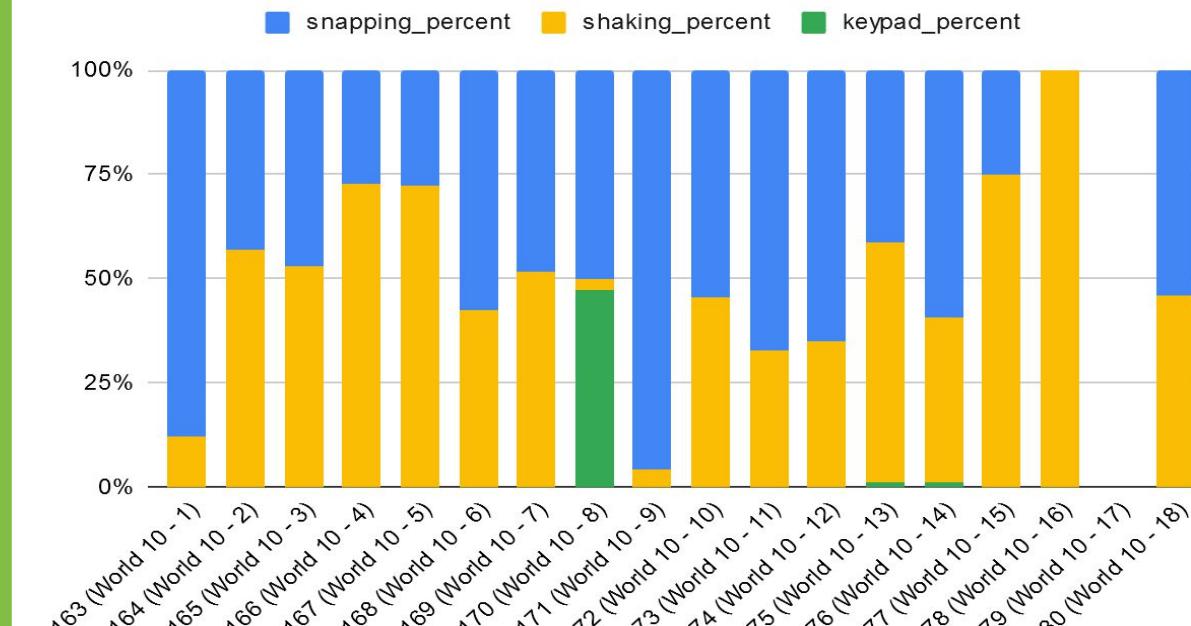


Error Type

World 10



World 10

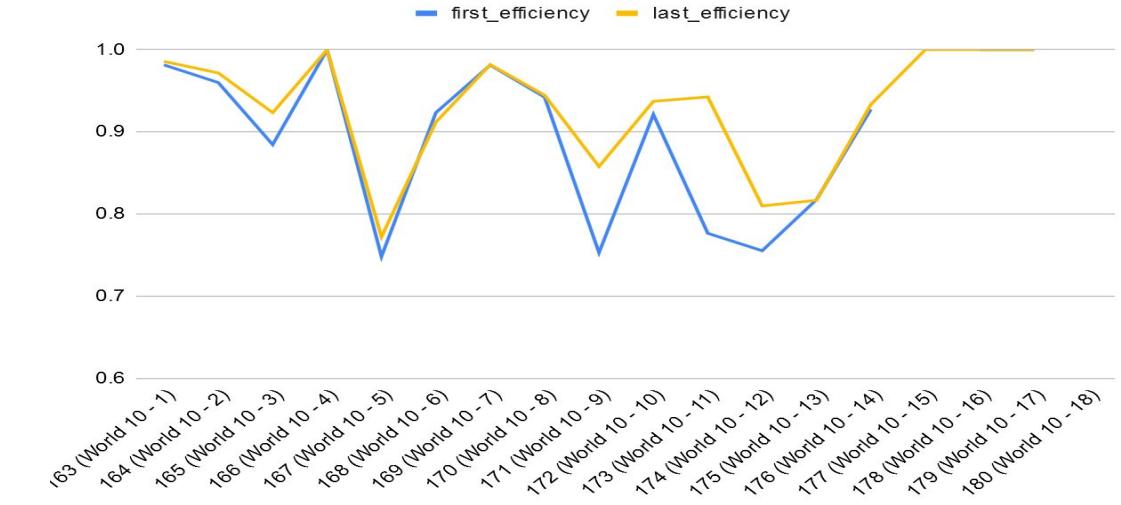


Steps & Efficiency

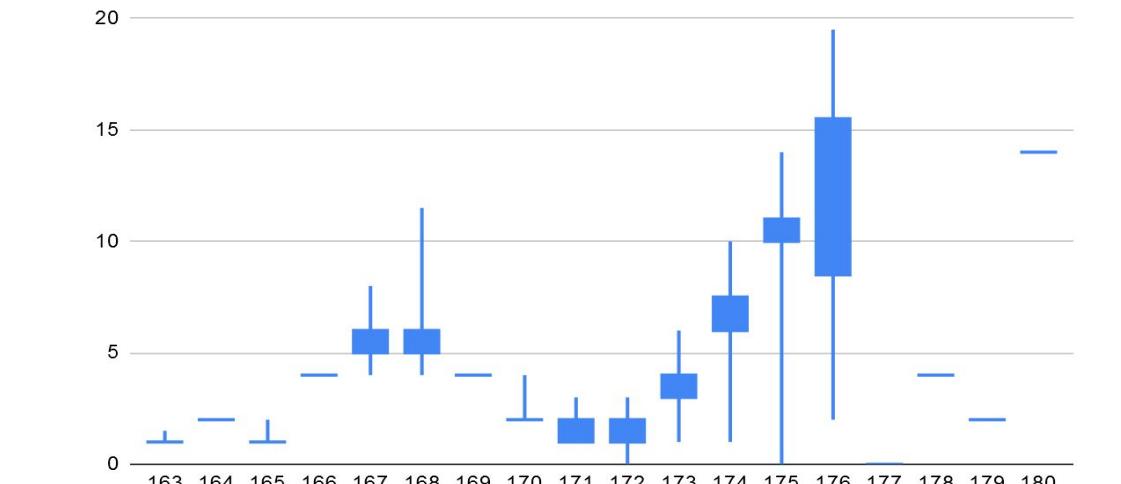
World 10



World 10



World 10



World 10 - Distribution



Unique ID	Completion					Errors								Efficiency		Steps	
	Unique ID	Number of Students	Completed	Tried	Opened	Did Not Open	Keypad	Keypad %	Shaking	Shaking %	Snapping	Snapping %	total	First Attempt	Last Attempt	Average Steps	Best Possible Steps
163 (World 10 - 1)	163 (World 10 - 1)	35	9.75%	0.00%	0.00%	90.25%	0.00	0.00%	0.20	12.07%	1.46	87.93%	1.66	0.98	0.99	1.57	1
164 (World 10 - 2)	164 (World 10 - 2)	35	9.75%	0.00%	0.00%	90.25%	0.00	0.00%	0.34	57.14%	0.26	42.86%	0.60	0.96	0.97	2.26	2
165 (World 10 - 3)	165 (World 10 - 3)	35	9.75%	0.00%	0.00%	90.25%	0.00	0.00%	0.74	53.06%	0.66	46.94%	1.40	0.88	0.92	1.66	1
166 (World 10 - 4)	166 (World 10 - 4)	35	9.75%	0.00%	0.00%	90.25%	0.00	0.00%	0.77	72.97%	0.29	27.03%	1.06	1.00	1.00	4.14	4
167 (World 10 - 5)	167 (World 10 - 5)	35	9.75%	0.00%	0.00%	90.25%	0.00	0.00%	3.31	72.50%	1.26	27.50%	4.57	0.75	0.77	7.14	4
168 (World 10 - 6)	168 (World 10 - 6)	33	9.19%	0.56%	0.00%	90.25%	0.00	0.00%	5.63	42.64%	7.57	57.36%	13.20	0.92	0.91	10.06	5
169 (World 10 - 7)	169 (World 10 - 7)	33	9.19%	0.00%	0.00%	90.81%	0.00	0.00%	0.85	51.85%	0.79	48.15%	1.64	0.98	0.98	4.21	4
170 (World 10 - 8)	170 (World 10 - 8)	33	9.19%	0.00%	0.00%	90.81%	1.00	47.14%	0.06	2.86%	1.06	50.00%	2.12	0.94	0.94	2.94	2
171 (World 10 - 9)	171 (World 10 - 9)	33	9.19%	0.00%	0.00%	90.81%	0.00	0.00%	0.06	4.26%	1.36	95.74%	1.42	0.75	0.86	2.70	1
172 (World 10 - 10)	172 (World 10 - 10)	32	8.91%	0.00%	0.28%	90.81%	0.00	0.00%	0.94	45.59%	1.12	54.41%	2.06	0.92	0.94	2.79	1
173 (World 10 - 11)	173 (World 10 - 11)	32	8.91%	0.00%	0.00%	91.09%	0.00	0.00%	0.56	32.73%	1.16	67.27%	1.72	0.78	0.94	4.38	1
174 (World 10 - 12)	174 (World 10 - 12)	31	8.64%	0.28%	0.00%	91.09%	0.00	0.00%	3.59	34.85%	6.72	65.15%	10.31	0.76	0.81	9.41	5
175 (World 10 - 13)	175 (World 10 - 13)	28	7.80%	0.56%	0.28%	91.36%	0.19	1.21%	9.19	57.58%	6.58	41.21%	15.97	0.82	0.82	13.90	8
176 (World 10 - 14)	176 (World 10 - 14)	20	5.57%	2.23%	0.00%	92.20%	0.14	1.04%	5.46	39.84%	8.11	59.11%	13.71	0.93	0.93	16.07	5
177 (World 10 - 15)	177 (World 10 - 15)	1	0.28%	0.00%	4.46%	95.26%	0.00	0.00%	0.18	75.00%	0.06	25.00%	0.24		1.00	0.76	4
178 (World 10 - 16)	178 (World 10 - 16)	1	0.28%	0.00%	0.00%	99.72%	0.00	0.00%	2.00	100.00%	0.00	0.00%	2.00	1.00	1.00	4.00	4
179 (World 10 - 17)	179 (World 10 - 17)	1	0.28%	0.00%	0.00%	99.72%	0.00		0.00		0.00		0.00	1.00	1.00	2.00	2
180 (World 10 - 18)	180 (World 10 - 18)	0	0.00%	0.28%	0.00%	99.72%	0.00	0.00%	6.00	46.15%	7.00	53.85%	13.00			14.00	7



World 10

Distribution

World 10 - Distribution

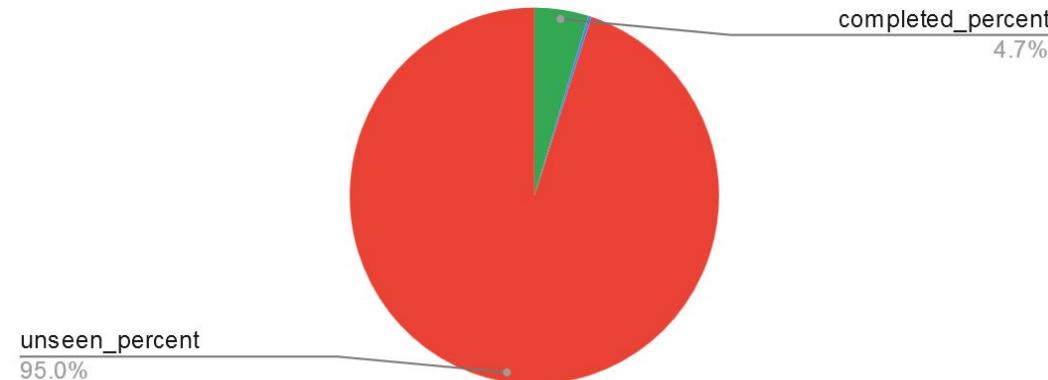
Unique ID	#	Problem	Goal	Best Steps	Video
163	1	$(12-21)*(4+2)$	$(4+2)*(12-21)$	1	
164	2	$2*(30+x)$	$60+2x$	2	
165	3	$(6+8)x$	$6x+8x$	1	
166	4	$4(2a+5b+3c)$	$8a+20b+12c$	4	
167	5	$(7+3x-2)*7$	$21x+35$	4	
168	6	$3h-2(1+4h)$	$-5h-2$	5	
169	7	$3(2h-9) - 5$	$6h-32$	4	
170	8	$16*29$	$16*30 - 16*1$	2	
171	9	$(4+6)*(12+8)$	$4*(12+8)+ 6*(12+8)$	1	
172	10	$(10-30)*(5x+7)$	$10*(5x+7)-30*(5x+7)$	1	
173	11	$(3-a)*(4+6)$	$4*(3-a)+6*(3-a)$	1	
174	12	$(b+9)*(c-4)$	$bc+9c-4b-36$	5	
175	13	$(4x-5)*(6y+7)$	$24xy+28x-30y-35$	8 (5)	
176	14	$(9+27)*(3+6a)$	$3*(9+18a)+27*(3+6a)$	5	
177	15	$(6b+12)*(5+3)$	$5*(6b+12)+18b+36$	4	
178	16	$3*4*5=5*(3+4+5)$	$60=5*7+5*5$	4	
179	17	$(12 - 3 - 9)*5$	$0*5$	2	
180	18	$(16-8-24)*(2b/4)$	$-2*4b$	7	



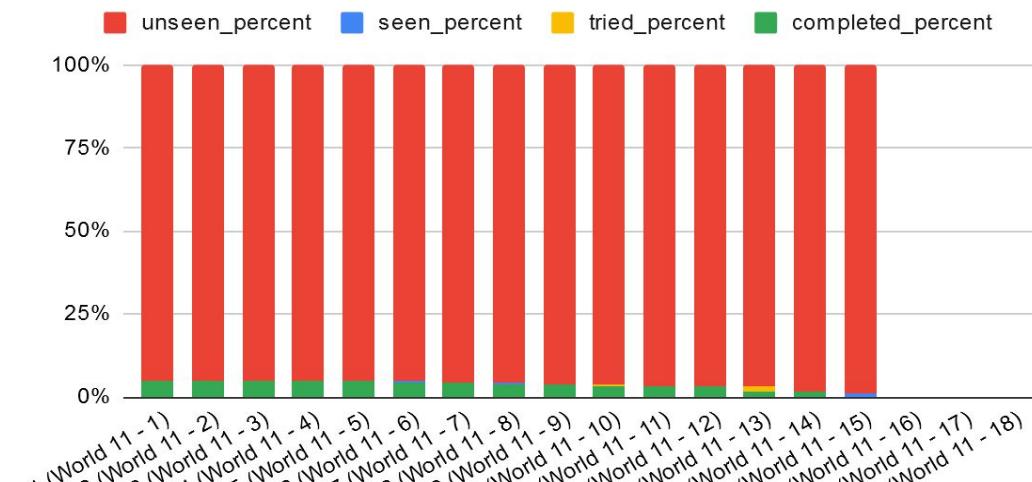
World 11 - Factoring

Overall Completion

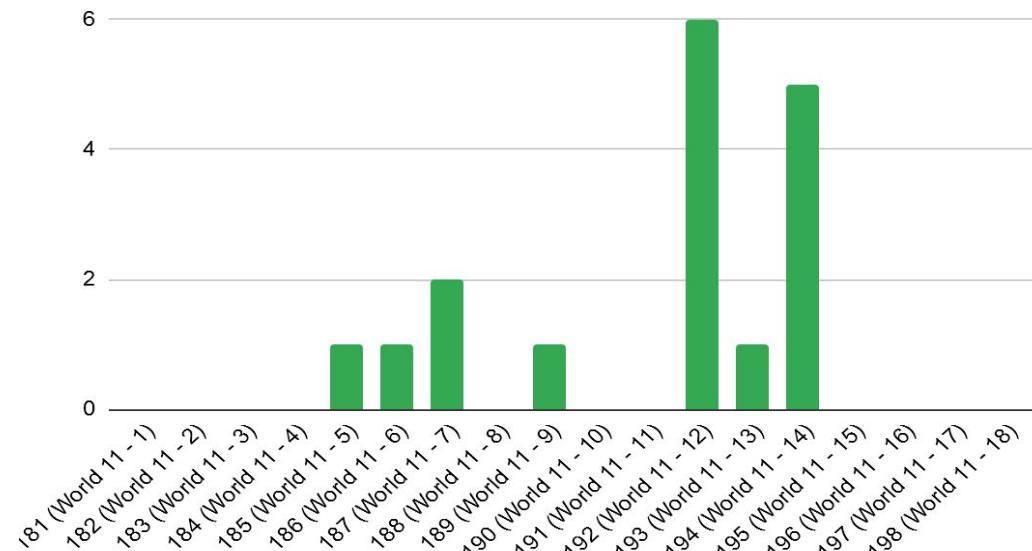
World 11



World 11

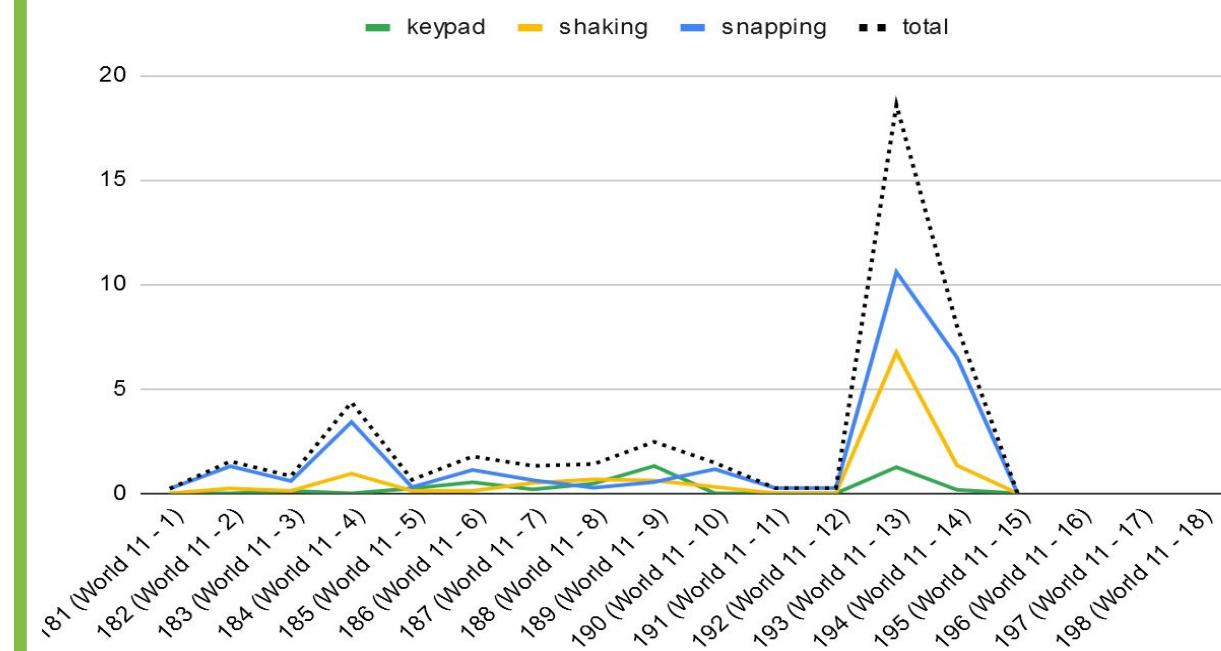


World 11

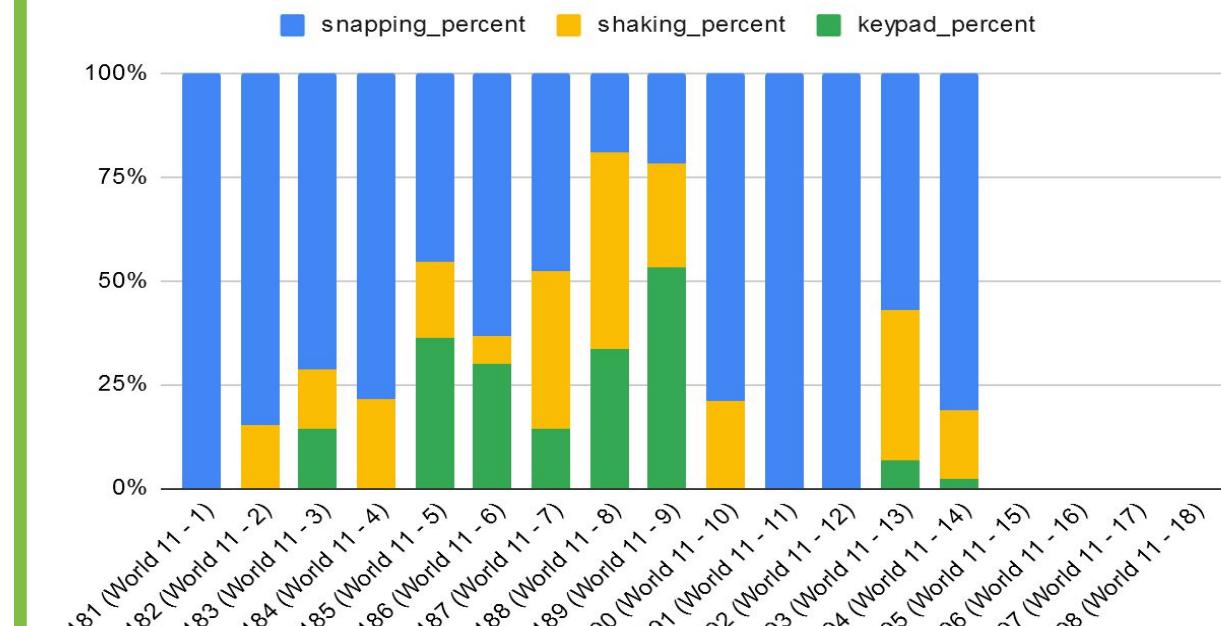


Error Type

World 11



World 11

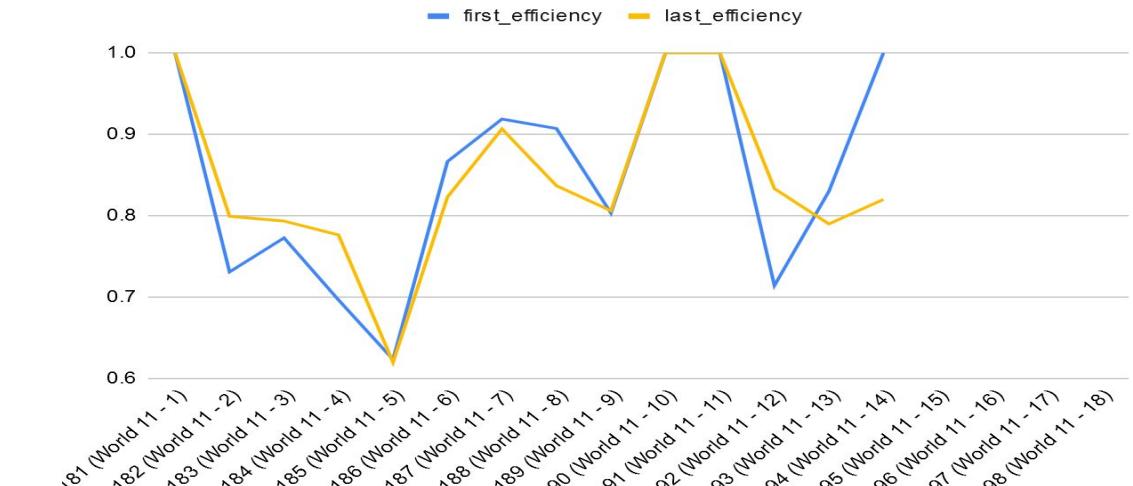


Steps & Efficiency

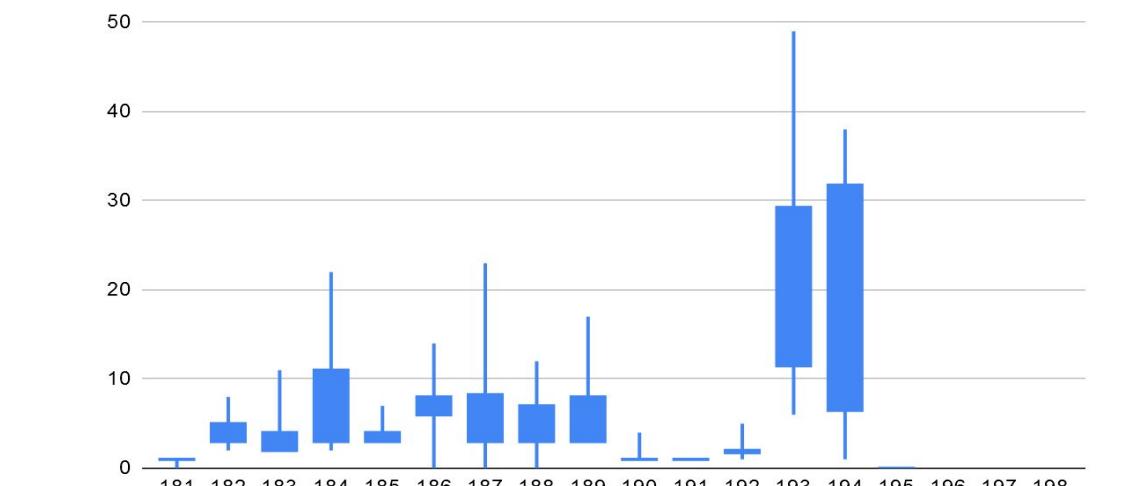
World 11



World 11



World 11



World 11 - Factoring





World 11

Factoring

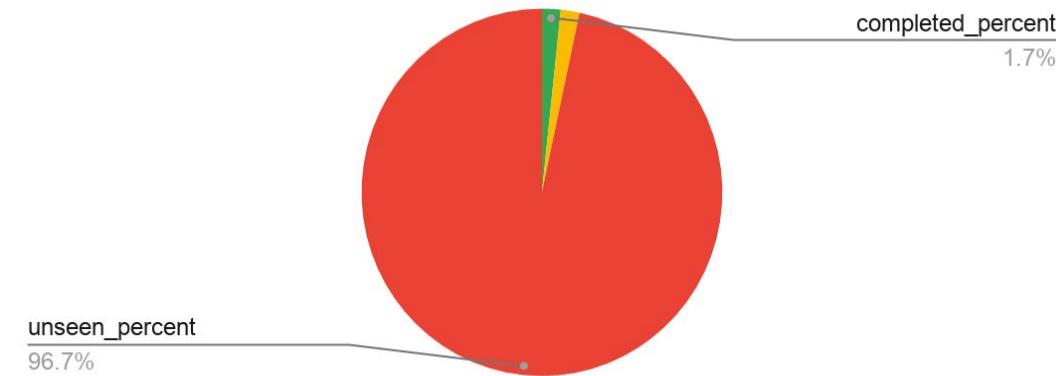
World 11 - Factoring					
Unique ID	#	Problem	Goal	Best Steps	Video
181	1	$3*7+3*4$	$3*(7+4)$	1	
182	2	$3*2y + 21$	$(2y+7)3$	2	
183	3	$10-25t$	$5(2-5t)$	2	
184	4	$2*(12+6a)$	$2*6*(2+a)$	2	
185	5	$14+ 18$	$2*(7+9)$	2	
186	6	$7+14+21$	$7*(1+2+3)$	4	
187	7	$24x+36$	$3(8x+12)$	3	
188	8	$9*12+9*23$	$9*7*5$	3	
189	9	$9*b+27*c$	$(3b+9c)*3$	3	
190	10	$3*(a+4) - 2b*(a+4)$	$(3-2b)*(a+4)$	1	
191	11	$10*(5x+7)-30*(5x+7)$	$(10-30)*(5x+7)$	1	
192	12	$4*(3-a)+6*(3-a)$	$(3-a)*(4+6)$	1	
193	13	$3*(9+18a)+27*(3+6a)$	$(9+27)*(3+6a)$	5	
194	14	$5*(6b+12)+1*(18b+36)$	$(6b+12)*(5+3)$	5	
195	15	$24x+32-8y+40$	$8(3x-y+9)$	5	
196	16	$13x +45 - 20 + 7x$	$(4x+5)5$	4	
197	17	$24xy+28x-30y-35$	$(4x-5)*(6y+7)$	10	
198	18	$6bc+27c-24b-108$	$(2b+9)*(3c-12)$	7	

World 12 - Equation +, -, ×, and ÷

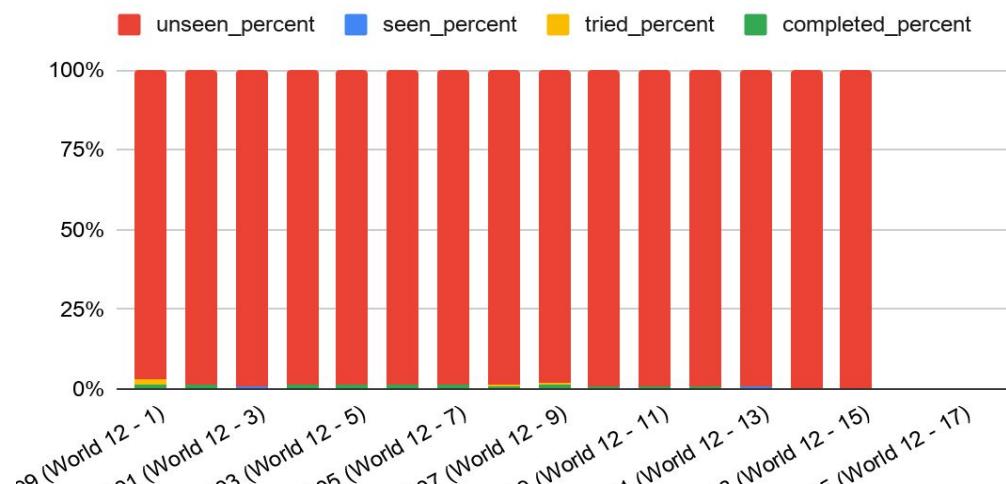


Overall Completion

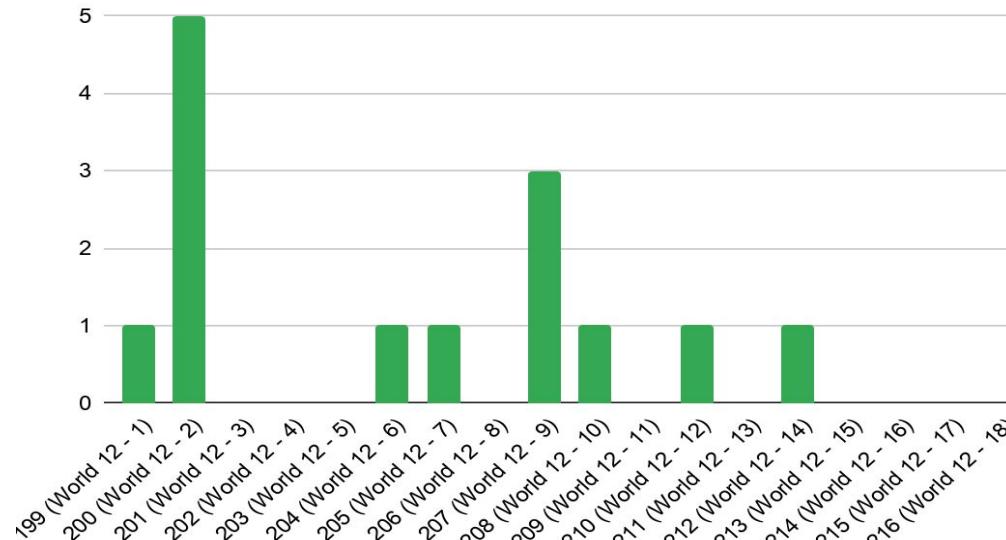
World 12



World 12

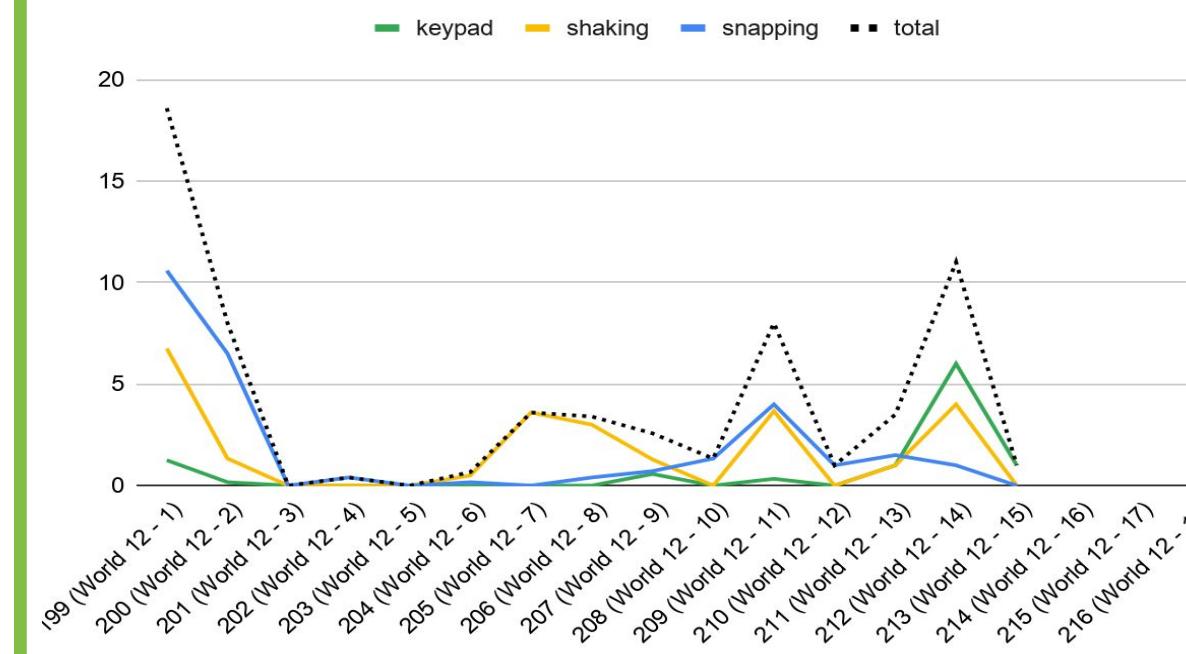


World 12

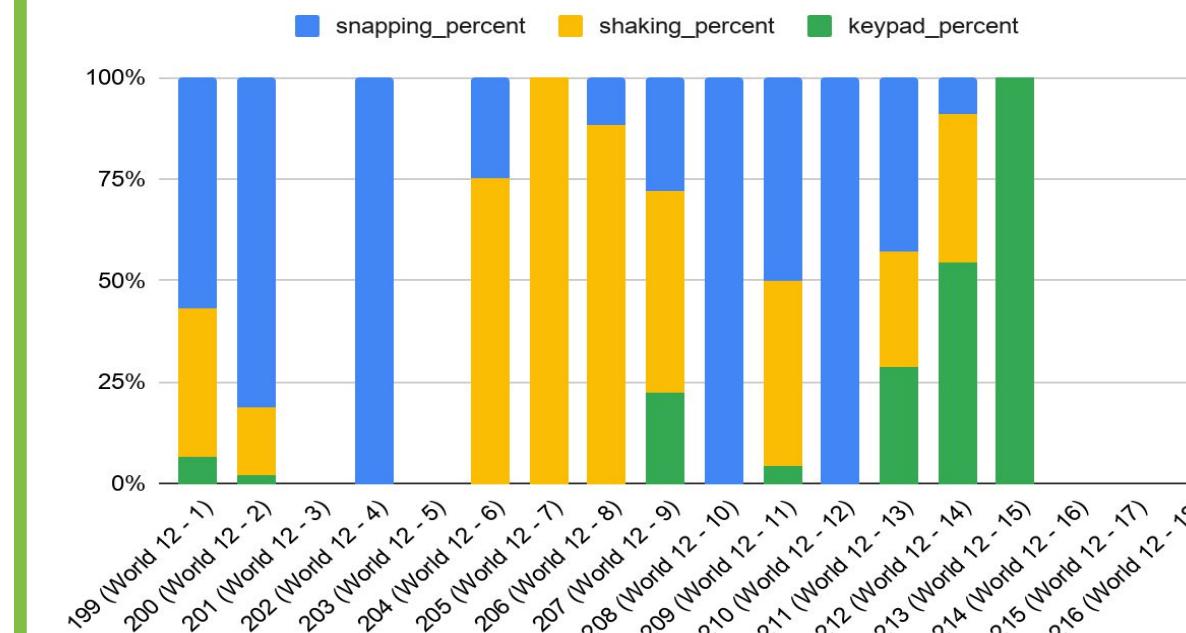


Error Type

World 12

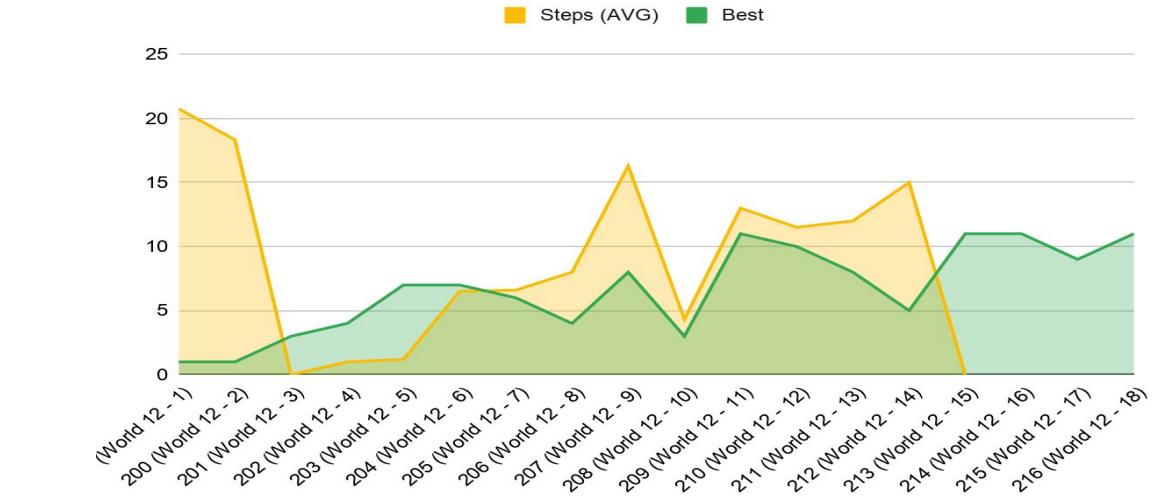


World 12

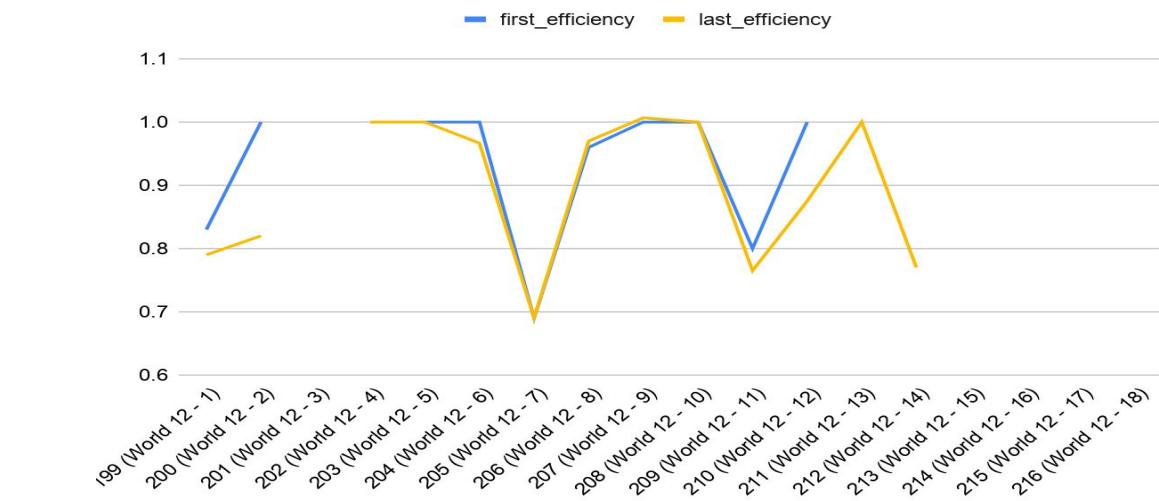


Steps & Efficiency

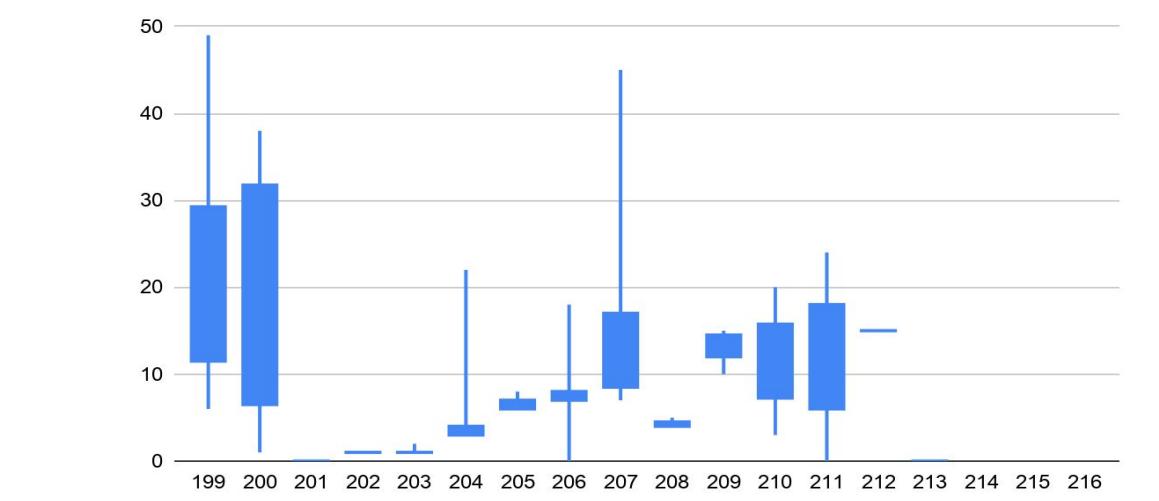
World 12



World 12



World 12



World 12 - Equation +, -, x, and ÷





World 12 - Equation +, -, x, and ÷

Unique ID	#	Problem	Goal	Best Steps	Video
199	1	$3=3$	$3*2=3*2$	1	
200	2	$18=18$	$18/6=18/6$	1	
201	3	$36 = 9x$	$4 = x$	3	
202	4	$y/14 = 5/2$	$y = 35$	4	
203	5	$11(x+10)=132$	$x=2$	7	
204	6	$21 = (m-5)7$	$8 = m$	7	
205	7	$22=14+10-2$	$(22+2)/6=4$	6	
206	8	$7(4x-12) = 14x+28$	$4x-12=14x/7+28/7$	4	
207	9	$45(x+10) = 45x + 450$	$10 = 10$	8	
208	10	$a+4 = a+4$	$(10*(a+4)+3)/9 = (10*(a+4)+3)/9$	3	
209	11	$6x - 2y = 30$	$y = 3x - 15$	11	
210	12	$5x + 7 + (2y-4)/3 = 9+2x$	$2y-4 = 3(2-3x)$	10	
211	13	$5 = (y-4)/(x+3)$	$5x + 19 = y$	8	
212	14	$(y+0)/(x-7) = 5$	$y = 5x-35$	5	
213	15	$20*y*50/10=25*y+25 - 100$	$4(y+1)=y+1$	11	
214	16	$15+33b-12=27*(22b)/6$	$15/b+33=12/b+99$	11	
215	17	$(16a)/8*3 = 18a+12-36$	$6-12/a = 18-36/a$	9	
216	18	$7-21+63x=(35x)/70*28$	$21(-1+3x)=-7+14x$	11	

World 12

Equation +, -, X, and ÷

World 13 - Inverse Operations



Overall Completion

Error Type

Steps & Efficiency

Not Enough Data

World 13 - Inverse Operations





World 13

Inverse Operations

World 13 - Inverse Operations					
Unique ID	#	Problem	Goal	Best Steps	Video
217	1	$11/(20*11)$	$1/20 * 11/11$	1	
218	2	$32/14-45*1/8$	$16*1/7-45/8$	4	
219	3	$9/(6-5)*(a-4)$	$9*(a-4)$	2	
220	4	$11*(4+2y)/6$	$11/1*(4+2y)/6$	1	
221	5	$22/5*15/18$	$(11*5)/(5*3)$	5	
222	6	$14/8*8/21$	$2/3$	4	
223	7	$6/2=3$	$6=3*2$	1	
224	8	$9=3*3$	$9/3=3$	1	
225	9	$(y+44)/7=34 - 26$	$y=12$	5	
226	10	$3(12-6)=9(y-1)$	$6=3(y-1)$	4	
227	11	$5+7+9=7*3+z$	$(5-z+16)/3=7$	3	
228	12	$5*11-6-a=-b+(3+4)*(14/2)$	$b-a=98/2-49$	7	
229	13	$24*3/((x+3)) = -4*13$	$18 = -13(x+3)$	7	
230	14	$(7z+8)/9 - 14 = -4z+10$	$1/9(7z+8) = 4(-z+6)$	5	
231	15	$a/21*42*63/a= 6*3*7$	$3/7=(6*3)/(6*7)$	9	
232	16	$8*2*(3y)/7=(6y)/7*2*4$	$8/4 = (2*2)/(1*2)$	9	
233	17	$5*6*4=24/x*x/4*20$	$(6*4)/(5*4)=6/5$	8	
234	18	$14*2*(3b)/5=7*(3b)/10*8$	$(14*2)/(4*2)=7/2$	7	



World 14 - Final Review

Overall Completion

Error Type

Steps & Efficiency

Not Enough Data

World 14 - Final Review



World 14 - Final Review

Unique ID	#	Problem	Goal	Best Steps	Video
235	1	$4*(8+2a)+6*(3+7a)$	$32+18+50a$	7	
236	2	$5(7x+4)-4(2x+20)$	$3(9x - 20)$	11	
237	3	$(2x-7)*(4y +8)$	$8xy-28y+16x-56$	7	
238	4	$2*(4+12+8)$	48	3	
239	5	$(12+3-15)*5$	0	3	
240	6	$(2+2)*(1-2)$	-4	3	
241	7	$(4+4)*(3+5)$	64	3	
242	8	$24+30+12+20$	$2*(12+15)+4*8$	5	
243	9	111-99-88+77+66-55	$33/3+1$	6	
244	10	$(24-18)/(7-4)*(44-(36+63)/9)$	$6*11$	7	
245	11	$((12*8)/3)-18-11=2*1+1$	$4*4*2 = 60 - 28$	10	
246	12	$x=2+2$	$2+2=x$	1	▶
247	13	$43 - 8 = c + 15$	$c + 20 = 43 - 3$	4	
248	14	$4+4 = 2*4-y$	$8*3 = (8-y)*3$	3	
249	15	$4*4+3=13+6*t$	$6=6*t$	4	
250	16	$x=x$	$(x-8)/(4+6)=(x-8)/(5*2)$	3	
251	17	$-62/((x+3)) * ((x+3))/128 + 7x/8$	$(56x - 31)/64$	12	
252	18	$7/4$	$7*4^{\wedge}1$	1	



World 14

Final Review

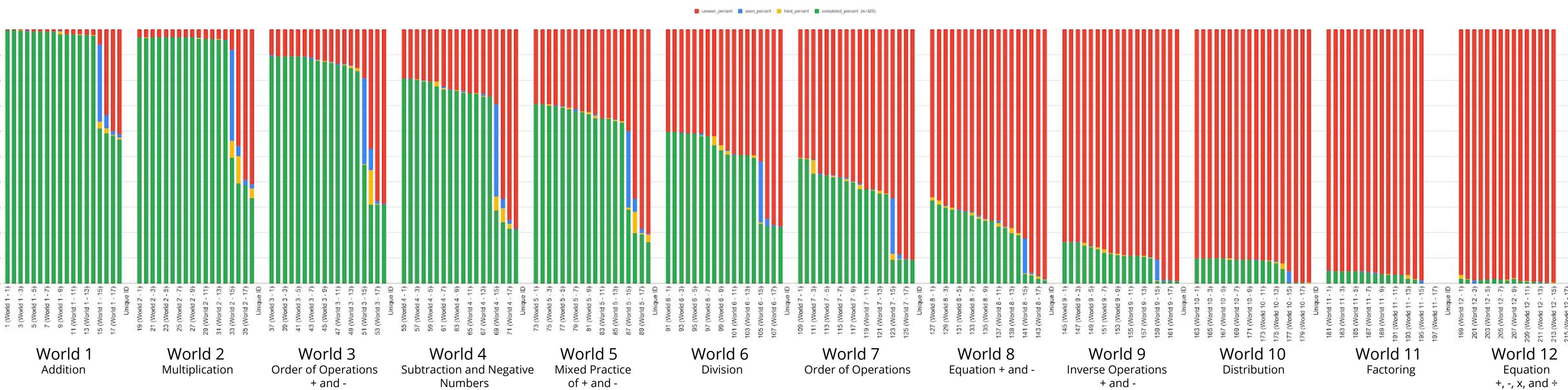


Problem Level Visualizations By Type



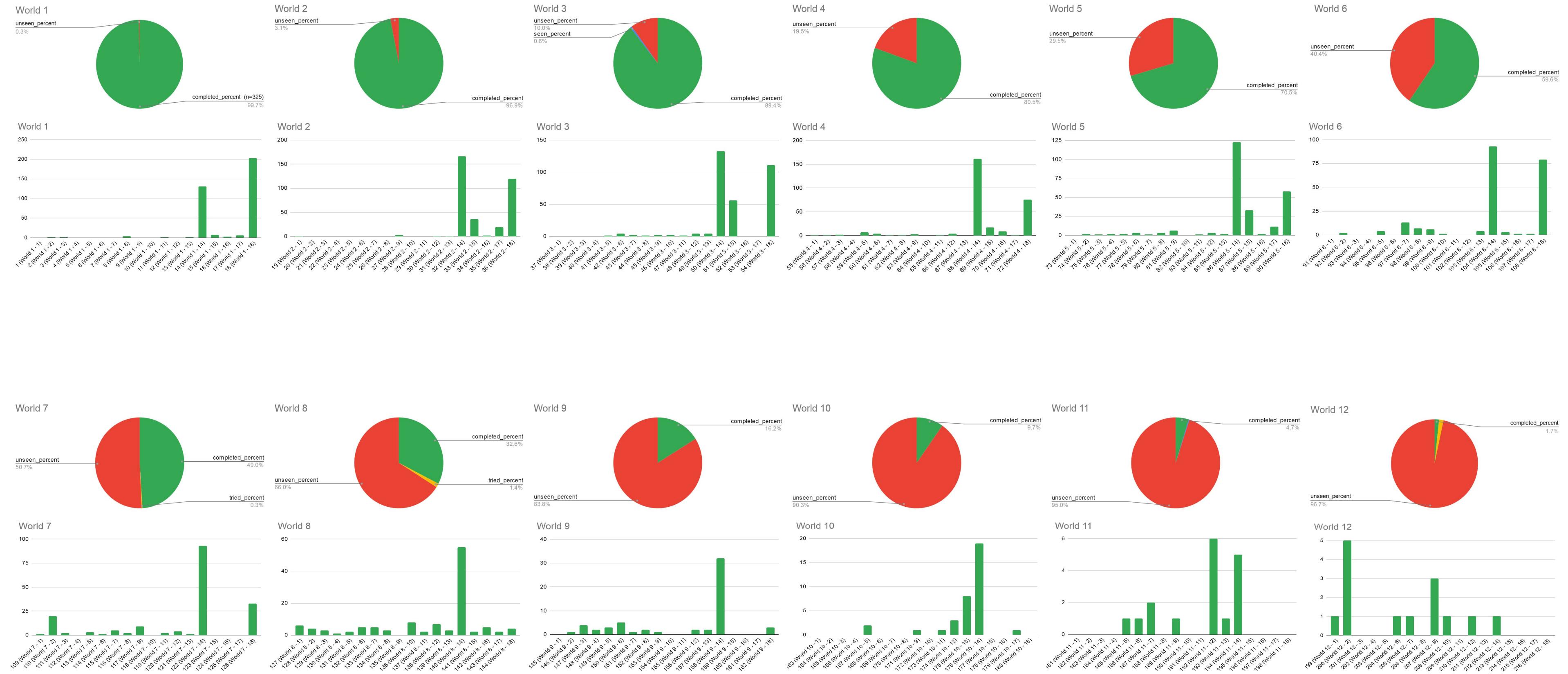
Completion Bar

ALL





Completion Pie & Histogram

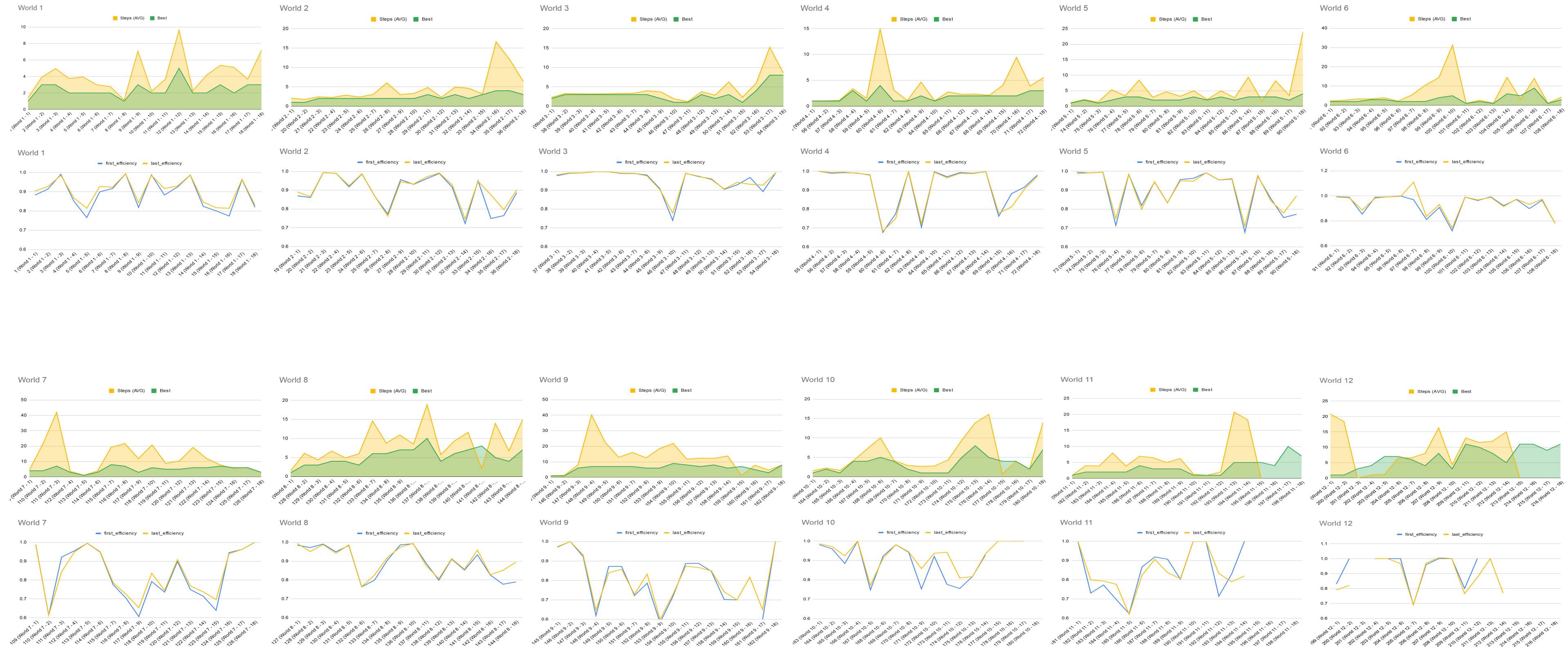




Error Frequency Lines & Stacked



Actual vs Best Steps Area & Efficiency First & Last





Steps Box-And-Whisker Plots

