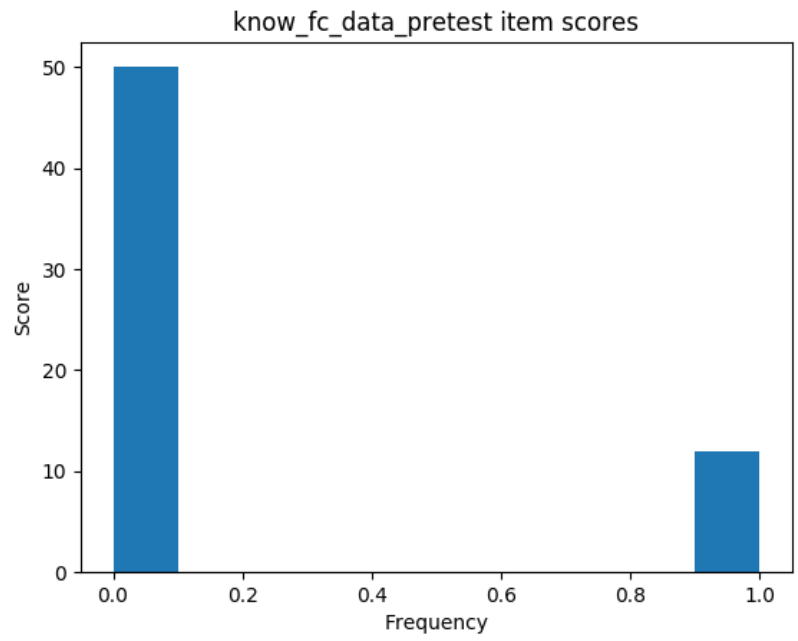


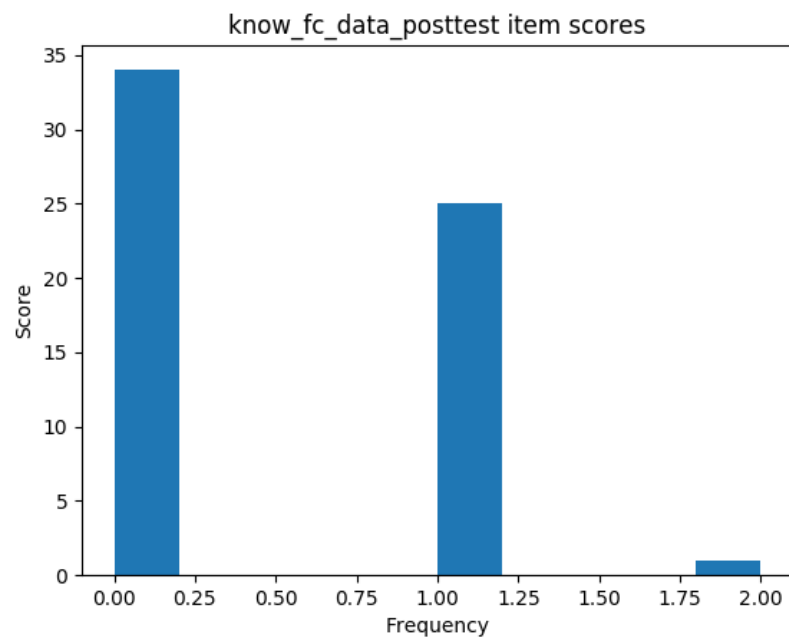
Reliability

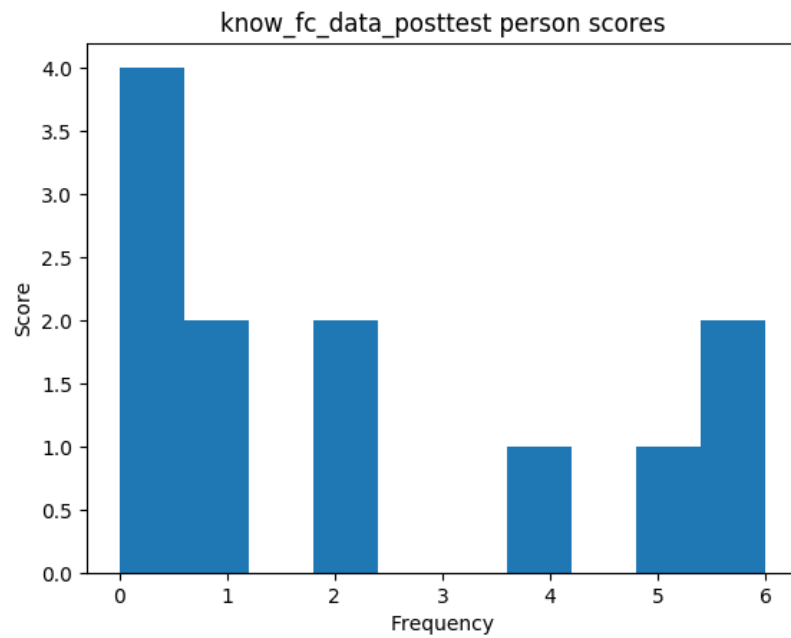
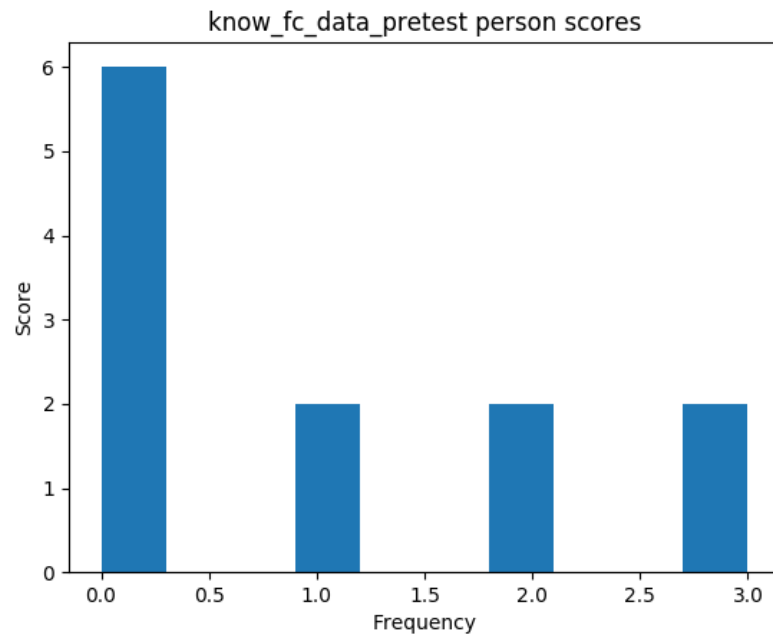
Knowledge questions

	sample	min	max	mean	variance	skew	kurtosis	normal-t
ctt:pretest	12	0	3	1.00	1.45	0.65	-1.12	2.318
ctt:posttest	12	0	6	2.25	5.66	0.58	-1.24	2.577
ctt:abs_learn_gain	12	-3	6	1.25	7.11	0.62	-0.28	1.533
ctt:rel_learn_gain	12	-0.05	0.1	0.02	0.00	0.56	-0.30	1.276
irt:pretest	12	-1	1	0.04	0.70	0.13	-1.20	1.263
irt:posttest	12	-2	3	0.13	2.18	0.12	-0.70	0.073
irt:abs_learn_gain	12	-1	1	0.09	0.46	0.14	-0.07	0.566
irt:rel_learn_gain	12	-0.02	0.02	0.00	0.00	0.20	-0.04	0.683
adjusted irt:pretest	12	1	2	1.82	0.13	0.04	-1.36	2.239
adjusted irt:posttest	12	1	3	1.84	0.17	0.06	-1.06	0.638
adjusted irt:abs_learn_gain	12	-0.1	0.3	0.02	0.01	1.04	0.18	4.412
adjusted irt:rel_learn_gain	12	-0.002	0.005	0.00	0.00	1.04	0.17	4.389

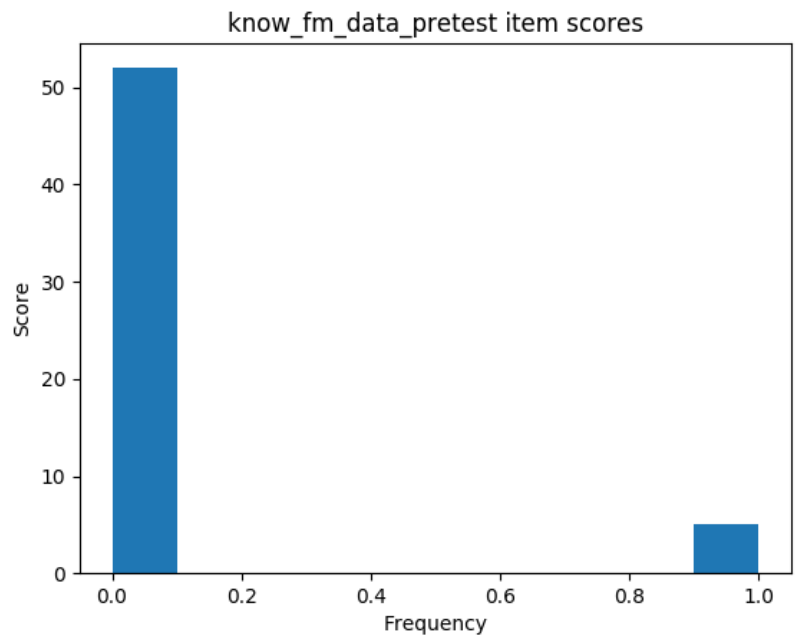


Flashcard conditions

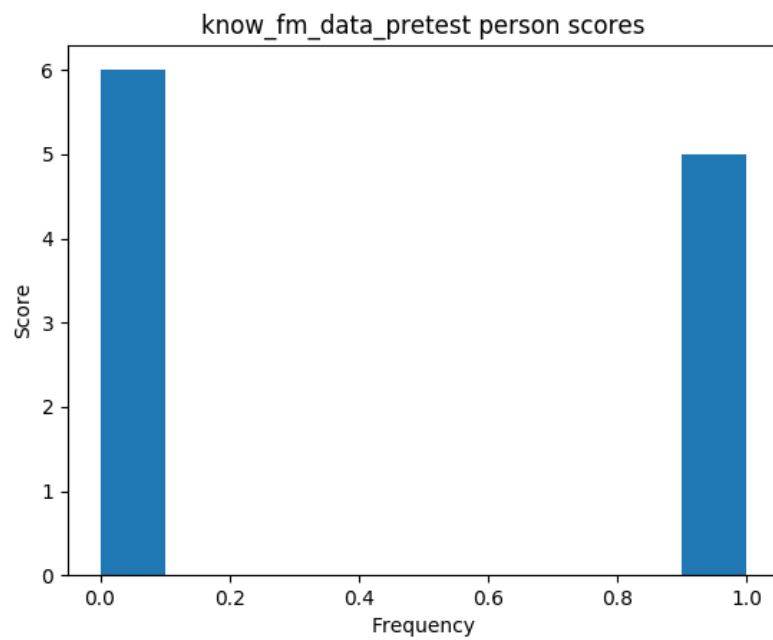
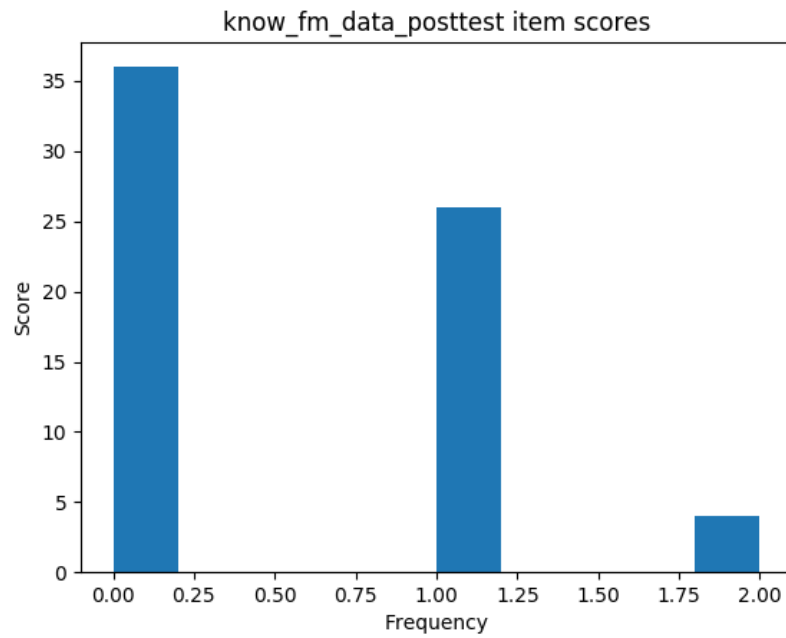


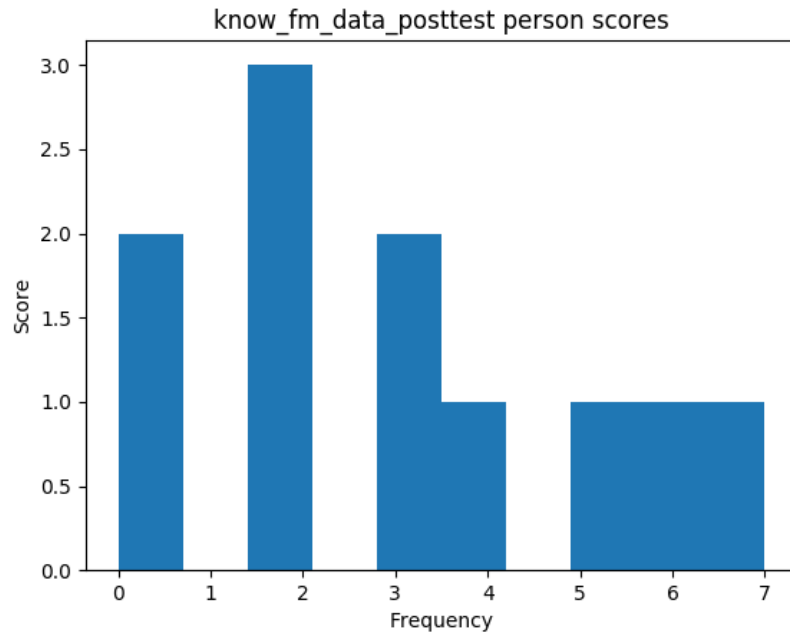


	sample	min	max	mean	variance	skew	kurtosis	normal-t	n
ctt:pretest	11	0	1	0.45	0.27	0.18	-1.97	13.123	
ctt:posttest	11	0	7	3.09	5.09	0.27	-0.85	0.353	
ctt:abs_learn_gain	11	0	7	2.64	5.45	0.66	-0.75	1.441	
ctt:rel_learn_gain	11	0	0.1	0.04	0.00	0.65	-0.76	1.396	
irt:pretest	11	-2	2	0.04	1.24	-0.01	-0.95	0.261	
irt:posttest	11	-0.4	0.5	0.01	0.06	0.03	-0.56	0.020	
irt:abs_learn_gain	11	-1	1	-0.02	0.76	0.02	-1.03	0.438	
irt:rel_learn_gain	11	-0.02	0.02	-0.00	0.00	-0.03	-1.02	0.432	
adjusted irt:pretest	11	-2	2	0.04	1.24	-0.01	-0.95	0.261	
adjusted irt:posttest	11	-0.4	0.5	0.01	0.06	0.03	-0.56	0.020	
adjusted irt:abs_learn_gain	11	-1	1	-0.02	0.76	0.02	-1.03	0.438	
adjusted irt:rel_learn_gain	11	-0.02	0.02	-0.00	0.00	-0.03	-1.02	0.432	

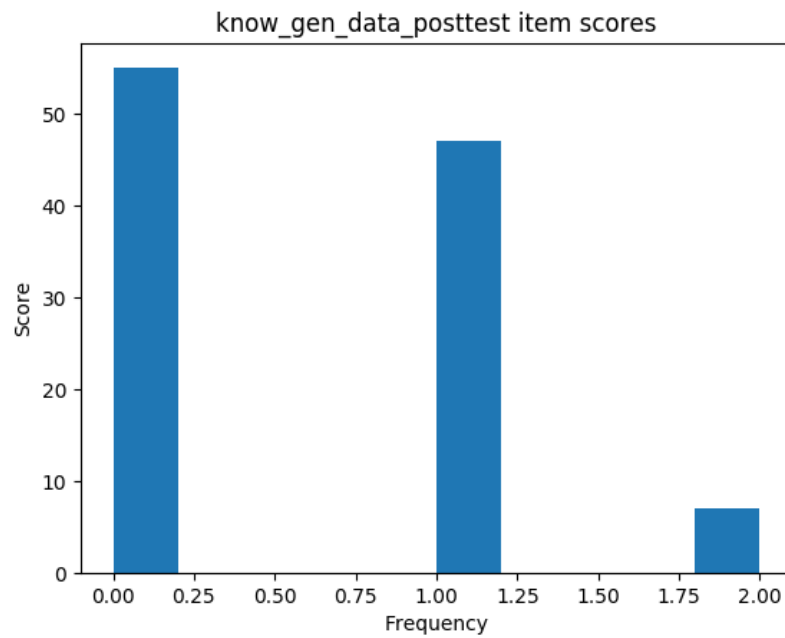
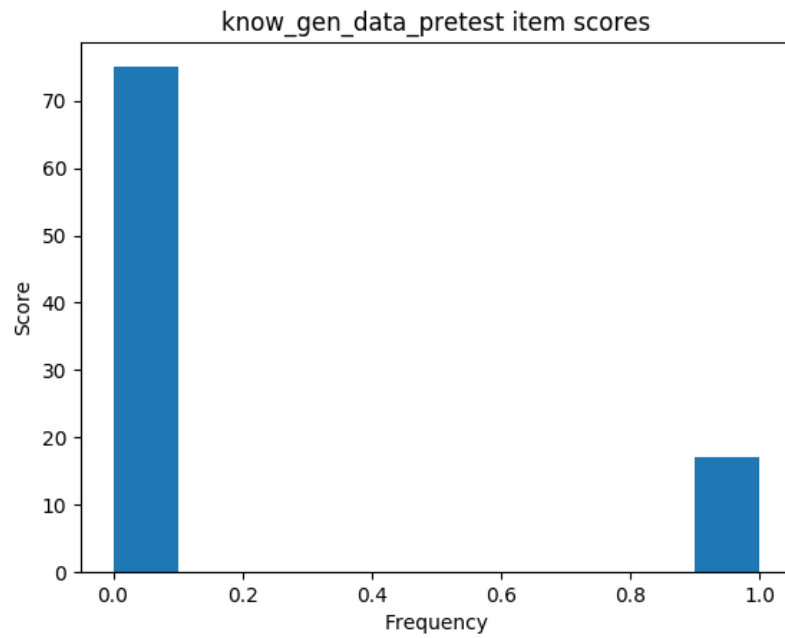


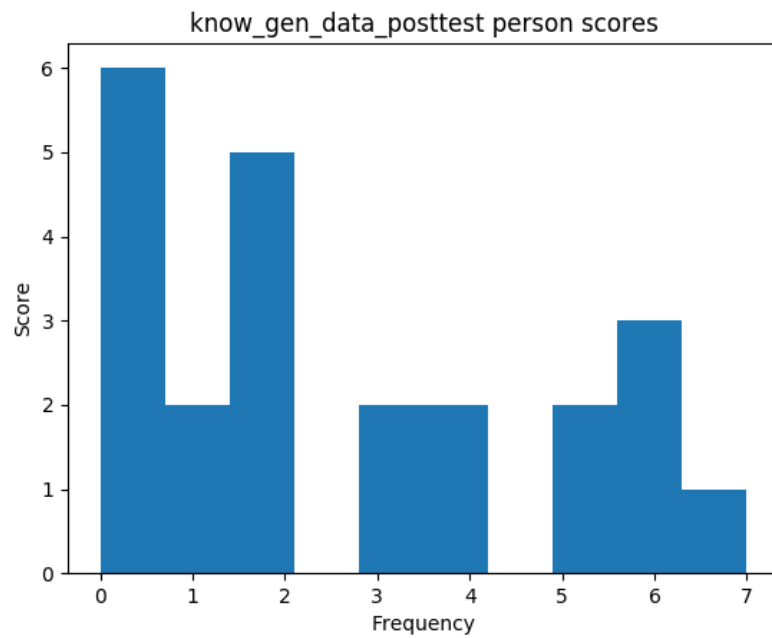
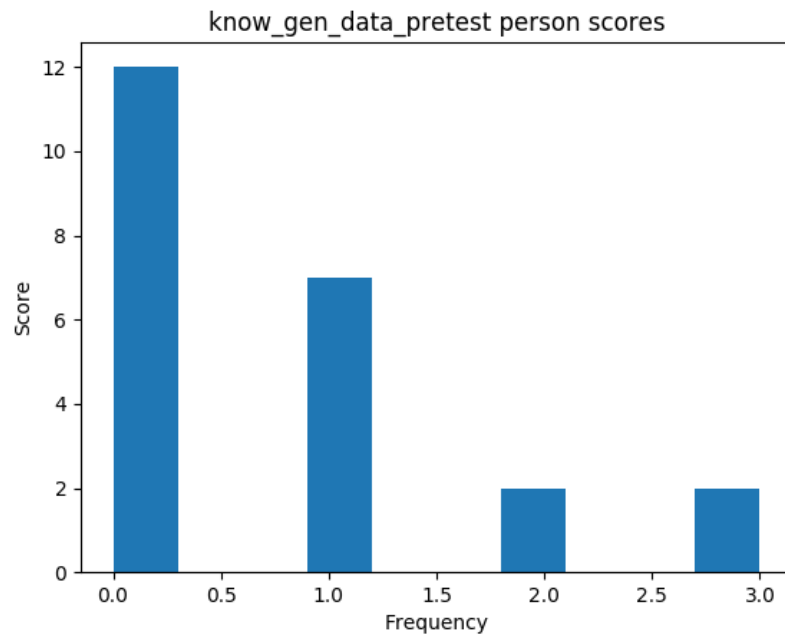
Flashmap conditions





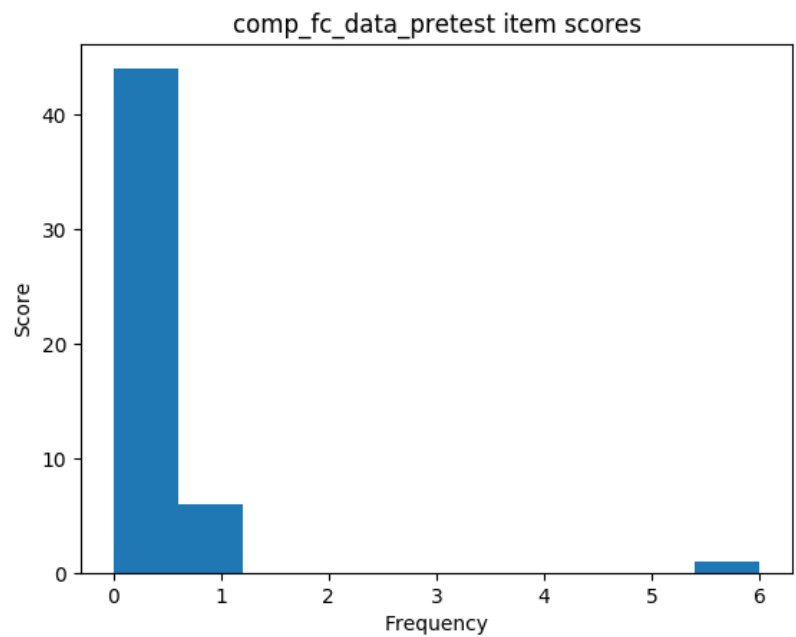
	sample	min	max	mean	variance	skew	kurtosis	normal-t	n
ctt:pretest	23	0	3	0.74	0.93	1.16	0.36	6.938	
ctt:posttest	23	0	7	2.65	5.33	0.39	-1.13	3.595	
ctt:abs_learn_gain	23	-3	7	1.91	6.54	0.47	-0.46	1.170	
ctt:rel_learn_gain	23	-0.03	0.06	0.02	0.00	0.44	-0.45	1.048	
irt:pretest	23	-1	1	0.04	0.44	0.05	-0.97	1.415	
irt:posttest	23	-2	2	0.14	1.28	-0.35	-0.78	1.203	
irt:abs_learn_gain	23	-1	0.8	0.11	0.25	-1.01	0.66	6.334	
irt:rel_learn_gain	23	-0.01	0.007	0.00	0.00	-0.99	0.62	6.102	
adjusted irt:pretest	23	-1	1	0.04	0.44	0.05	-0.97	1.415	
adjusted irt:posttest	23	-2	2	0.14	1.28	-0.35	-0.78	1.203	
adjusted irt:abs_learn_gain	23	-1	0.8	0.11	0.25	-1.01	0.66	6.334	
adjusted irt:rel_learn_gain	23	-0.01	0.007	0.00	0.00	-0.99	0.62	6.102	



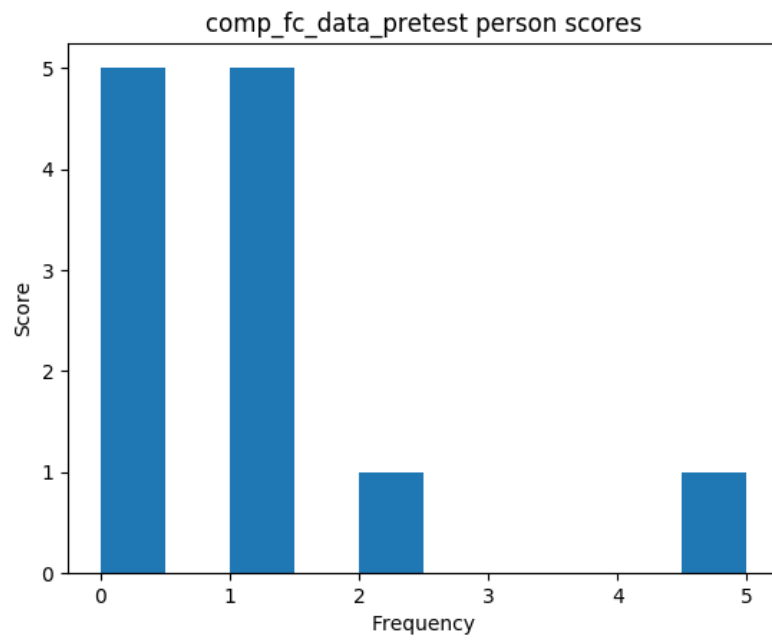
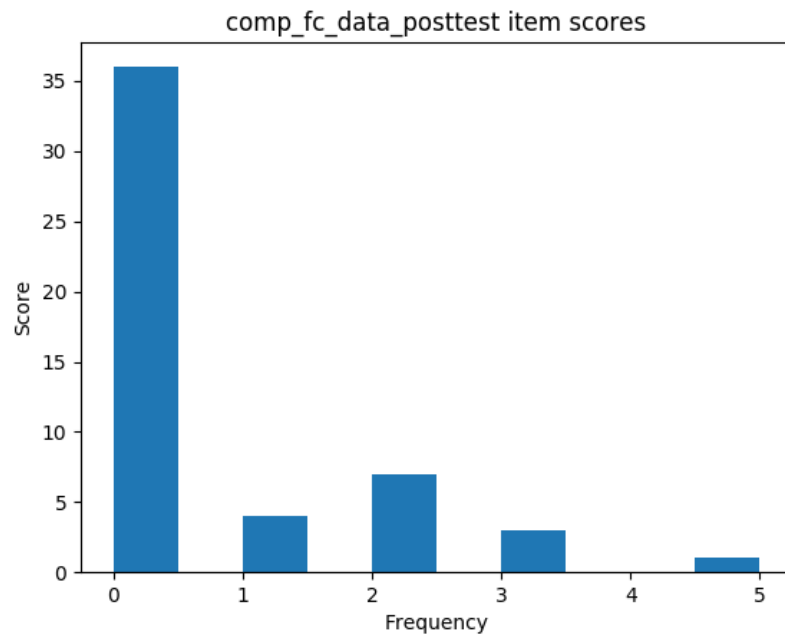


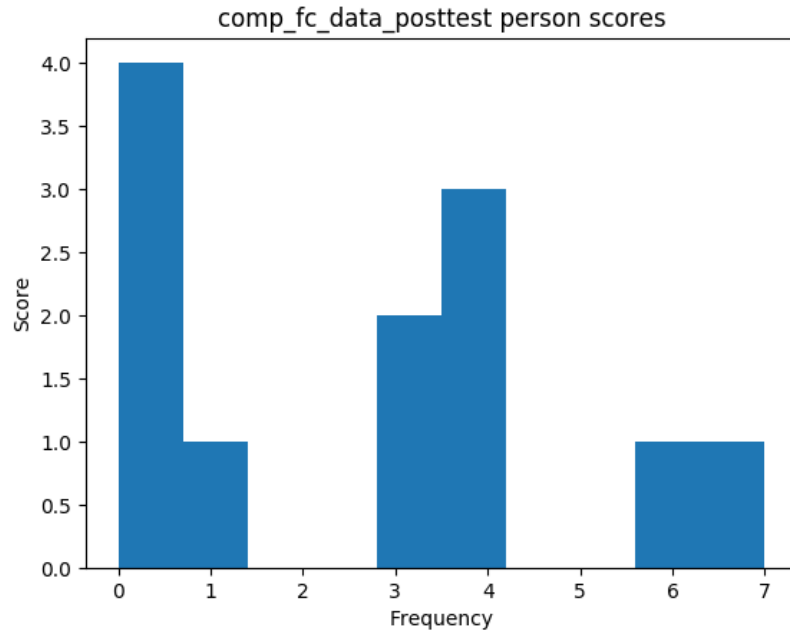
Comprehension questions

	sample	min	max	mean	variance	skew	kurtosis	normal-t
ctt:pretest	12	0	5	1.00	2.00	2.01	3.50	19.031
ctt:posttest	12	0	7	2.67	6.06	0.29	-1.12	1.155
ctt:abs_learn_gain	12	-1	5	1.67	5.88	0.21	-1.61	5.347
ctt:rel_learn_gain	12	-0.02	0.1	0.03	0.00	0.22	-1.57	4.821
irt:pretest	12	-1	1	0.00	0.46	0.34	-1.01	0.896
irt:posttest	12	-1	1	0.02	0.54	-0.46	-0.78	0.806
irt:abs_learn_gain	12	-0.6	0.5	0.01	0.15	-0.17	-1.48	3.486
irt:rel_learn_gain	12	-0.01	0.009	0.00	0.00	-0.17	-1.46	3.363
adjusted irt:pretest	12	1	2	1.75	0.07	0.23	-0.77	0.254
adjusted irt:posttest	12	1	2	1.73	0.18	-0.21	-1.01	0.650
adjusted irt:abs_learn_gain	12	-0.4	0.4	-0.02	0.07	0.21	-1.35	2.324
adjusted irt:rel_learn_gain	12	-0.008	0.007	-0.00	0.00	0.22	-1.35	2.358

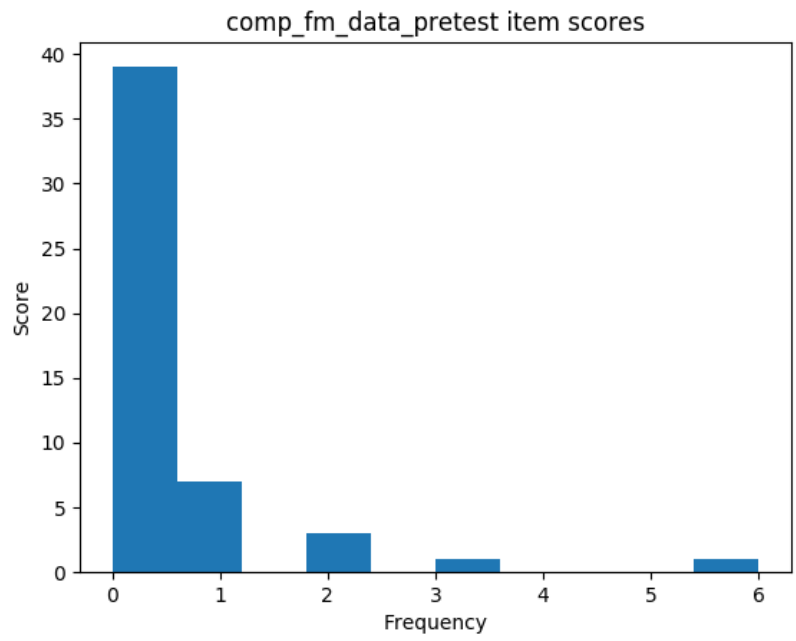


Flashcard conditions

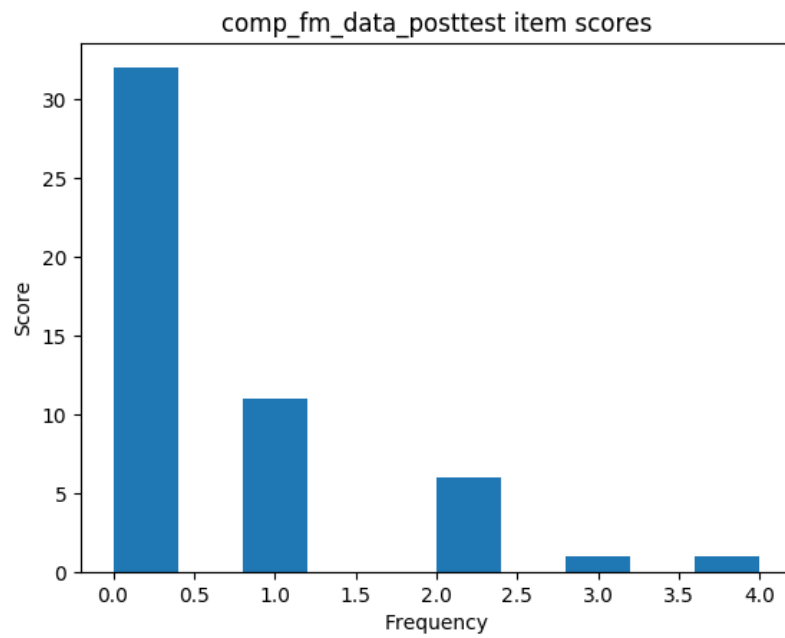


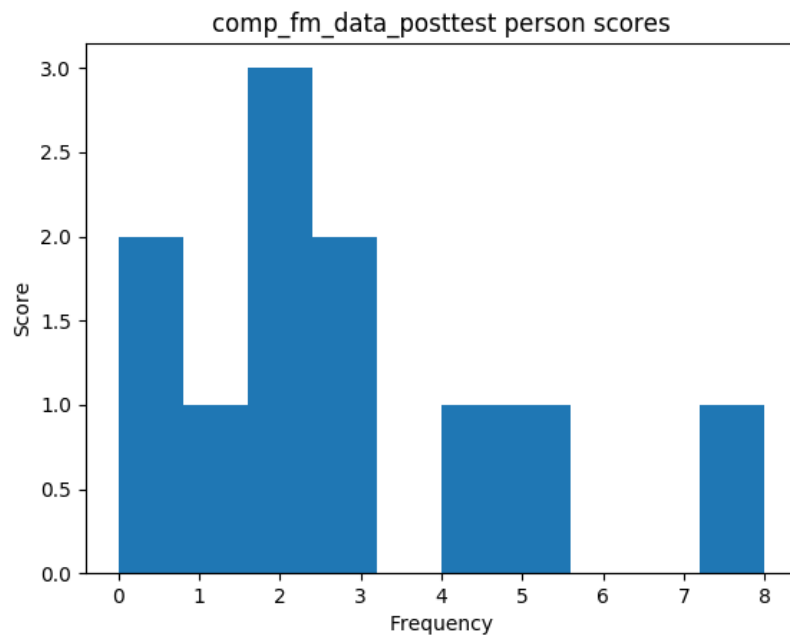
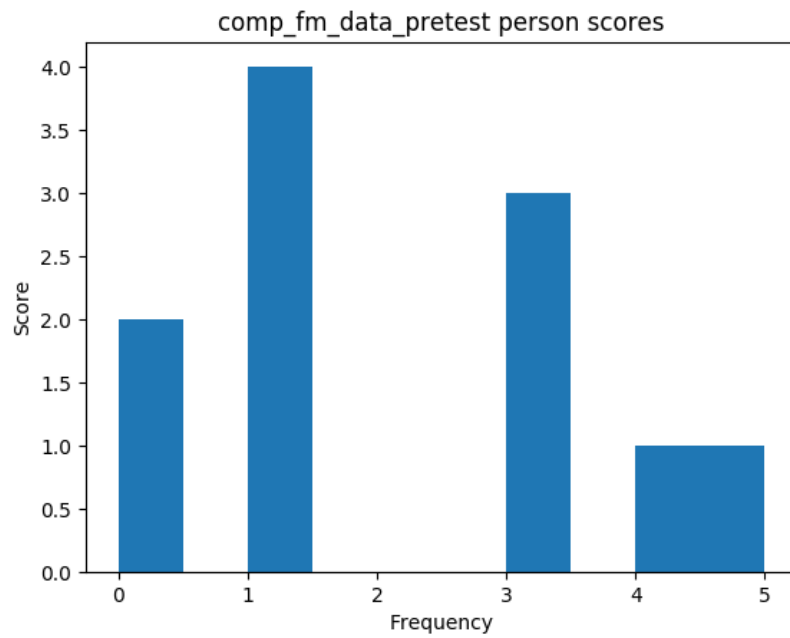


	sample	min	max	mean	variance	skew	kurtosis	normal-t
ctt:pretest	11	0	5	2.00	2.80	0.40	-1.09	1.167
ctt:posttest	11	0	8	2.73	5.42	0.94	0.46	4.392
ctt:abs_learn_gain	11	-2	4	0.73	3.02	0.44	-0.47	0.701
ctt:rel_learn_gain	11	-0.04	0.08	0.01	0.00	0.40	-0.53	0.552
irt:pretest	11	-0.3	0.5	0.01	0.05	0.86	0.03	3.081
irt:posttest	11	-1e-78	2e-78	0.00	0.00	0.89	2.11	8.113
irt:abs_learn_gain	11	-0.5	0.3	-0.01	0.05	-0.86	0.03	3.081
irt:rel_learn_gain	11	-0.009	0.005	-0.00	0.00	-0.88	0.06	3.214
adjusted irt:pretest	11	-0.3	0.5	0.01	0.05	0.86	0.03	3.081
adjusted irt:posttest	11	-1e-78	2e-78	0.00	0.00	0.89	2.11	8.113
adjusted irt:abs_learn_gain	11	-0.5	0.3	-0.01	0.05	-0.86	0.03	3.081
adjusted irt:rel_learn_gain	11	-0.009	0.005	-0.00	0.00	-0.88	0.06	3.214

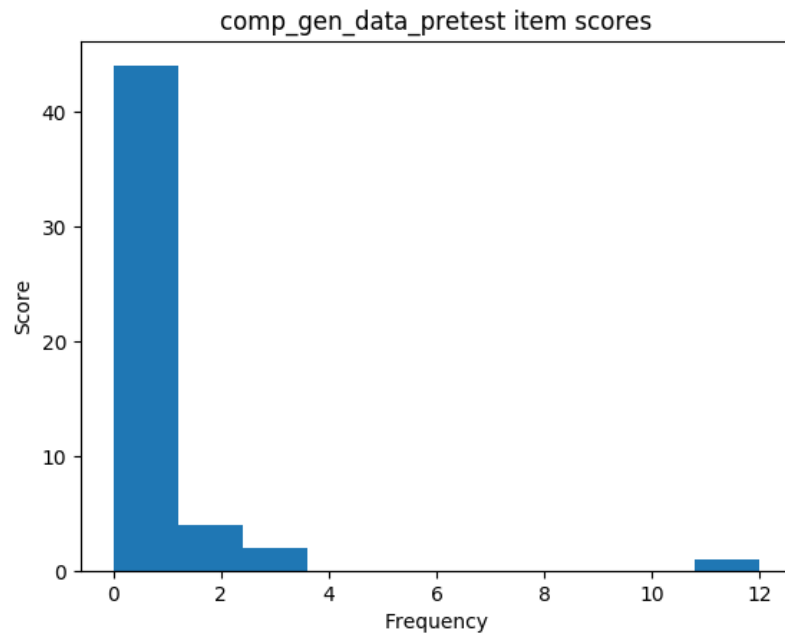


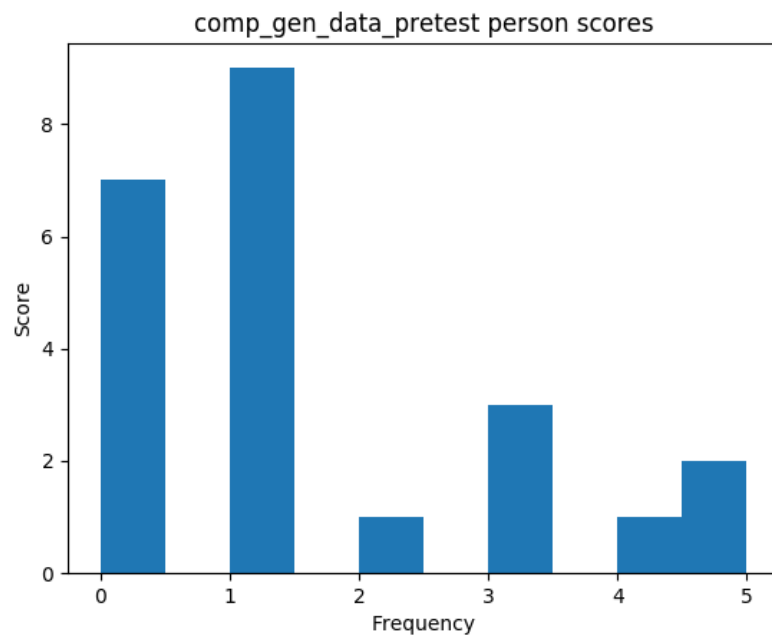
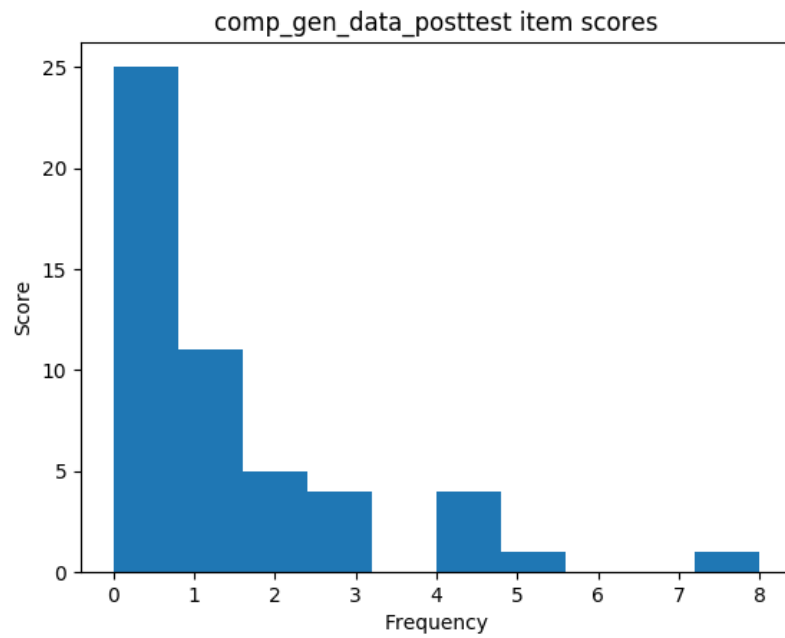
Flashmap conditions

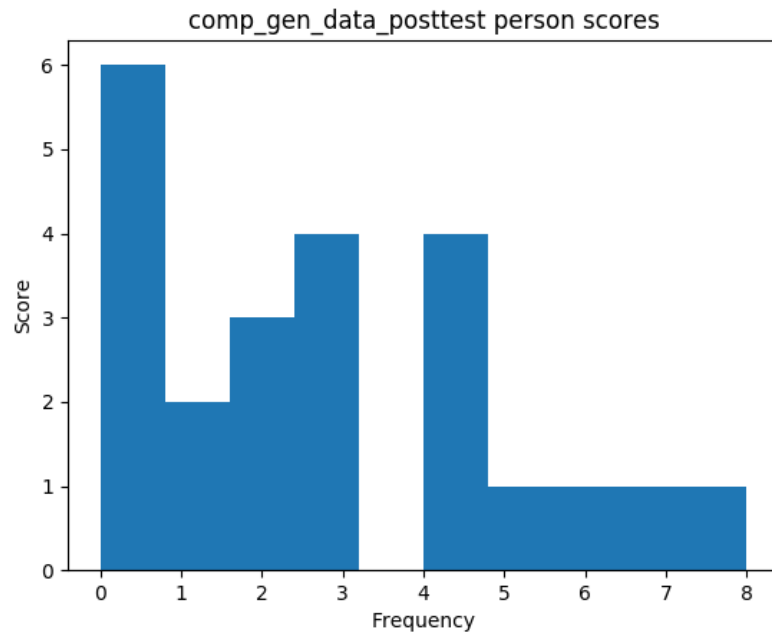




	sample	min	max	mean	variance	skew	kurtosis	normal-t	n
ctt:pretest	23	0	5	1.48	2.53	1.04	-0.05	5.259	
ctt:posttest	23	0	8	2.70	5.49	0.57	-0.44	1.705	
ctt:abs_learn_gain	23	-2	5	1.22	4.54	0.46	-1.09	3.439	
ctt:rel_learn_gain	23	-0.04	0.1	0.02	0.00	0.44	-1.08	3.219	
irt:pretest	23	-1	2	0.03	0.72	-0.11	-0.99	1.572	
irt:posttest	23	-0.9	0.7	0.02	0.17	-0.41	-0.45	0.902	
irt:abs_learn_gain	23	-0.8	0.8	-0.01	0.23	0.01	-1.06	2.095	
irt:rel_learn_gain	23	-0.02	0.02	-0.00	0.00	-0.04	-1.04	1.919	
adjusted irt:pretest	23	-1	2	0.03	0.72	-0.11	-0.99	1.572	
adjusted irt:posttest	23	-0.9	0.7	0.02	0.17	-0.41	-0.45	0.902	
adjusted irt:abs_learn_gain	23	-0.8	0.8	-0.01	0.23	0.01	-1.06	2.095	
adjusted irt:rel_learn_gain	23	-0.02	0.02	-0.00	0.00	-0.04	-1.04	1.919	







Comparisons

Knowledge questions

Between pre- and posttest

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
ctt	-1.624	0.1187	-1.624	0.1237
irt	-0.189	0.8521	-0.189	0.8525
adjusted irt	-0.108	0.9153	-0.108	0.9153

Flashcard condition

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
ctt	-3.775	0.0012	-3.775	0.0030
irt	0.071	0.9445	0.071	0.9450

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
adjusted irt	0.071	0.9445	0.071	0.9450

Flashmap condition

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
ctt	-3.668	0.0007	-3.668	0.0010
irt	-0.385	0.7022	-0.385	0.7026
adjusted irt	-0.385	0.7022	-0.385	0.7026

Combined

Between conditions

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
pretest	1.384	0.1810	1.427	0.173
posttest	-0.868	0.3953	-0.870	0.394
abs_learn_gain	-1.321	0.2008	-1.329	0.198
rel_learn_gain	-1.139	0.2673	-1.152	0.262

ctt

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test p
pretest	0.007	0.9948	0.007	0.994
posttest	0.264	0.7941	0.276	0.787
abs_learn_gain	0.361	0.7216	0.357	0.725
rel_learn_gain	0.439	0.6652	0.436	0.667

irt

	Mann-Whitney-U k	Mann-Whitney-U p	Welch's t-test k	Welch's t-test
pretest	5.261	0.0000	5.069	0.000
posttest	12.721	0.0000	12.990	0.000
abs_learn_gain	0.163	0.8721	0.156	0.879
rel_learn_gain	0.225	0.8244	0.215	0.833

adjusted irt