



I-CREST 2023 : 076-103

# CONSTRUCTION OF AN ITEM BANK USING RASCH ANALYSIS

DEPT. OF MATHEMATICS | CFS IIUM



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**INTRODUCTION**

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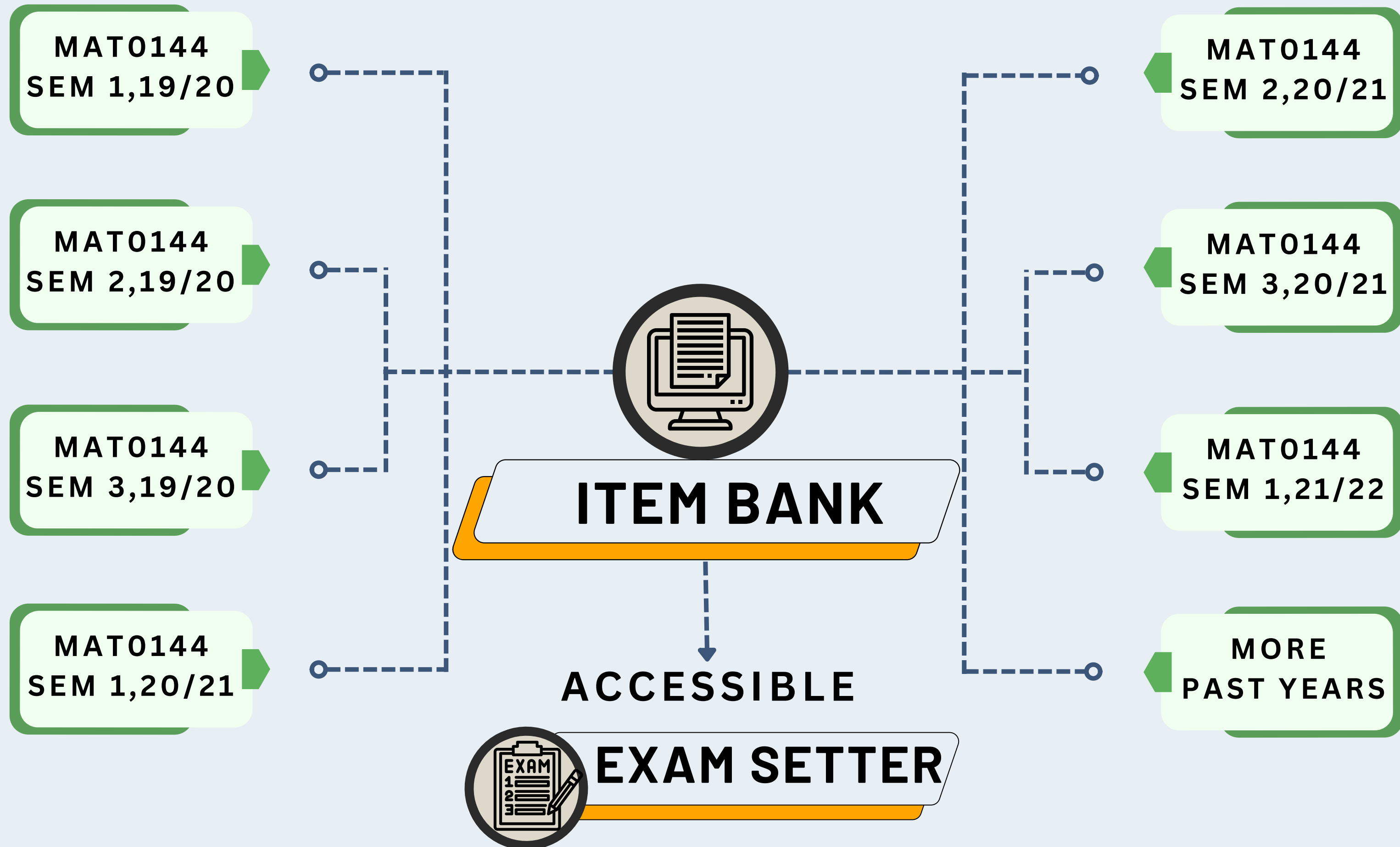
**METHODOLOGY**

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**CONCLUSION**



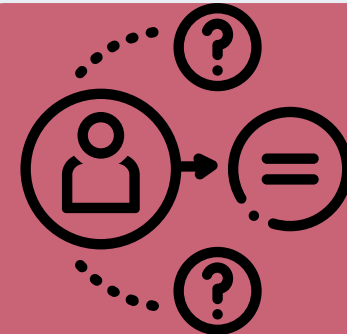
# WHAT IS RASCH MODEL



Statistical method used in psychometrics to analyze test data



Improves the precision of a constructed instrument



Computes respondent performance.



Meaningful scoring and comparison of both items and individuals.

# RESEARCH QUESTIONS

- How is an item bank be constructed using Rasch analysis for the assessment of the course?
- What is the difficulty level of each item in the item bank, and how do they align with the course learning objectives?
- How reliable and valid are the items in the constructed item bank for assessing students' understanding and proficiency in the course?
- Are there any items that do not fit well with the Rasch model and need modification or removal?
- How is the constructed item bank be used to assess and monitor students' progress and provide meaningful feedback in the course?

# OBJECTIVES

01

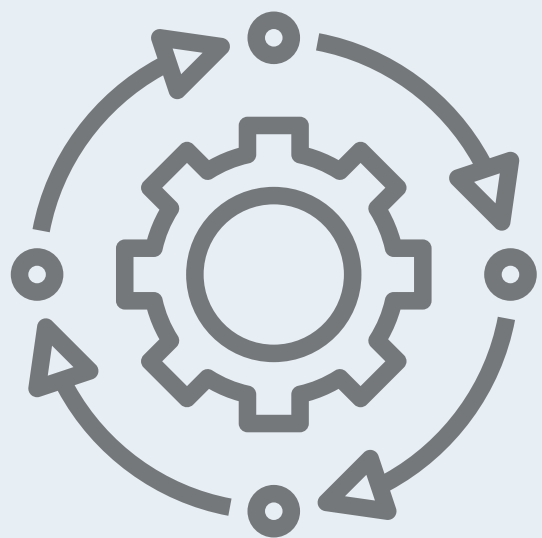
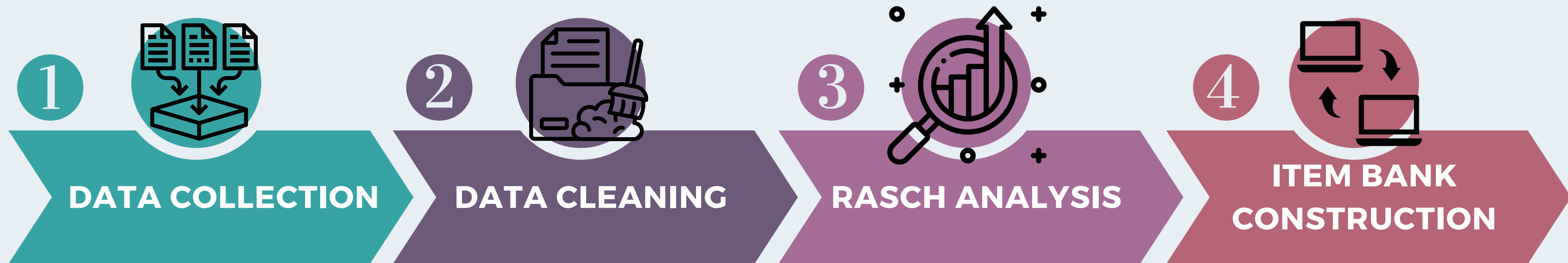
**To assess the validity and reliability of the final examination paper.**

02

**To present the construction of an item bank using RASCH analysis.**



# METHODOLOGY



## ITEM BANK CONSTRUCTION

# STEP 1

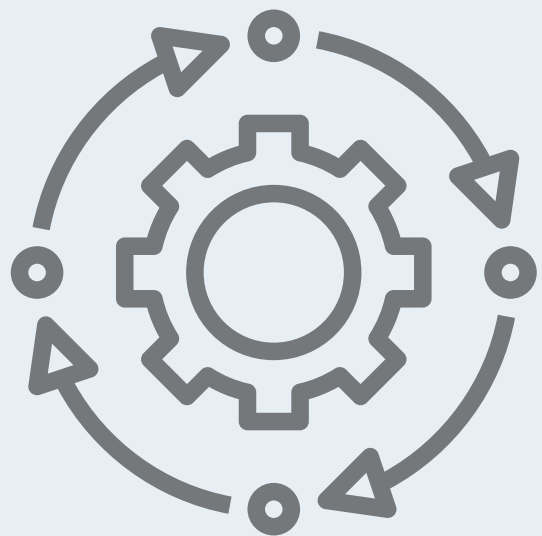


## Final Examination Questions

- **MAT0144 Semester 3, 2021/2022**

## Sample :

- **348 students' result**
- **21 items**





# STEP 2

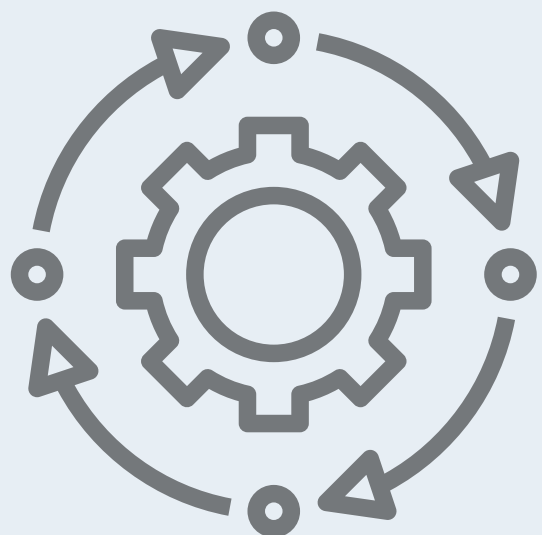


**1) Organize marks of 21 items based on 348 students (person) in item analysis template (excel format)**

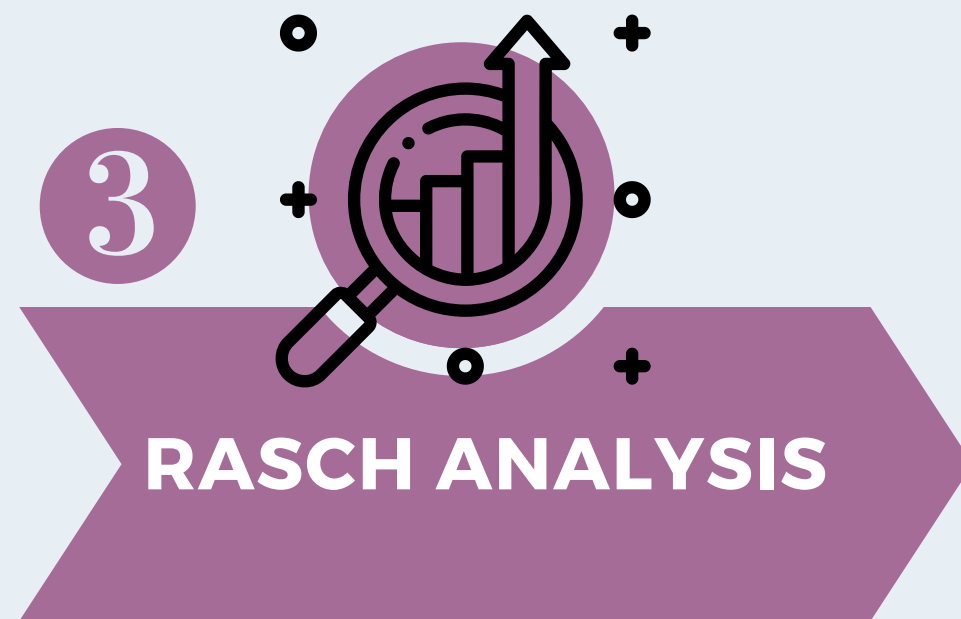
**2) Filter and Remove Extreme Marks (zero)**

**Finalized Sample Taken:**

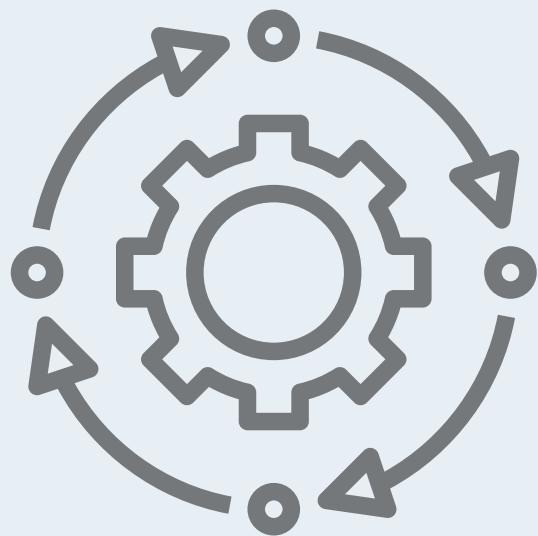
- **344 students' result**
- **21 items**



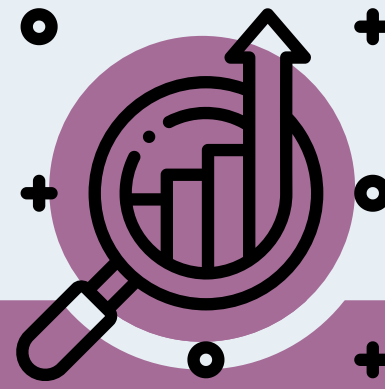
# STEP 3



- 1) Run RASCH analysis in WINSTEPS Version 3.72.1**
- 2) Extract relevant outputs**



3



## RASCH ANALYSIS OUTPUTS

ITEM STATISTICS: MISFIT ORDER

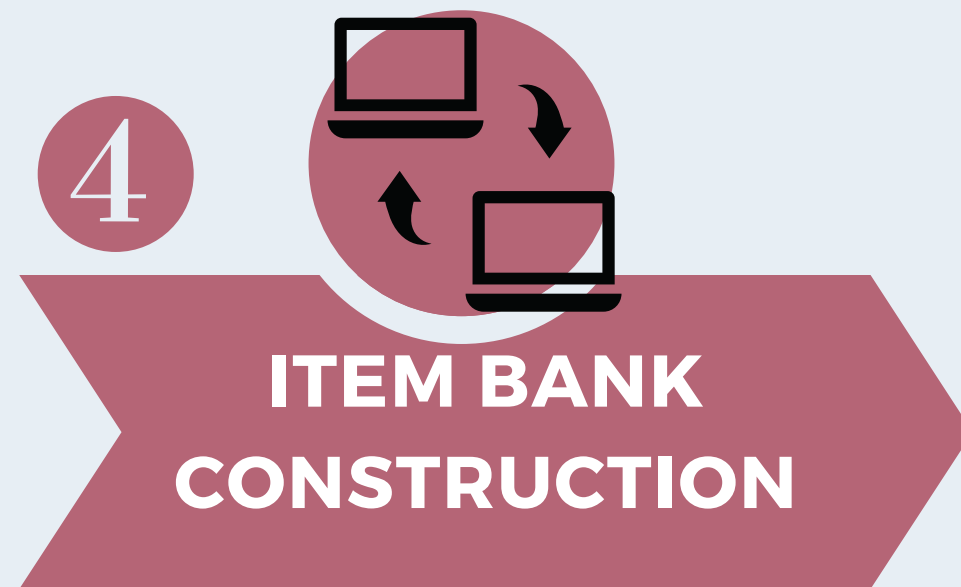
ENTRY NUMBER	TOTAL SCORE	TOTAL COUNT	MODEL MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD	PT-MEASURE CORR.	EXACT MATCH EXP.	EXACT MATCH OBS%	EXACT MATCH EXP%	ITEM
12	378	344	-.14	.06	1.13	1.6	2.46	9.1	A .35	.57	33.4	42.9	5ai
21	6	344	3.62	.40	1.77	1.5	.41	-1.2	B .17	.09	99.1	98.3	7b
13	267	344	.26	.06	1.71	6.9	1.64	3.9	C .47	.52	42.7	50.0	5aii
17	1801	344	-3.18	.05	1.65	6.9	1.44	4.0	D .70	.76	29.9	35.4	6ai
15	226	344	.43	.07	1.31	3.2	1.30	1.9	E .45	.49	51.7	53.6	5bii
6	214	344	.49	.07	1.29	3.0	.96	-.2	F .52	.48	53.8	54.8	3aii
1	314	344	.08	.06	1.22	2.5	1.05	.5	G .60	.54	36.9	46.3	1a
4	881	344	-1.43	.05	1.15	1.9	1.18	2.1	H .75	.69	29.4	34.5	2b
5	604	344	-.79	.05	.94	-.7	1.11	1.1	I .59	.64	41.3	37.7	3ai
16	432	344	-.31	.06	1.03	.5	.96	-.3	J .60	.60	41.0	40.3	5biii
8	146	344	.85	.08	1.02	.2	.95	-.2	K .45	.41	66.0	66.1	4ai
14	436	344	-.32	.06	.85	-2.0	1.00	.1	j .52	.60	41.3	40.8	5bi
11	465	344	-.41	.05	.84	-2.1	1.00	.0	i .60	.61	39.8	39.3	4bii,4biii
19	382	344	-.15	.06	.96	-.4	.87	-1.2	h .60	.58	48.5	42.2	6b
18	357	344	-.07	.06	.82	-2.3	.96	-.3	g .50	.57	44.2	44.0	6aii
9	77	344	1.41	.10	.88	-.8	.53	-2.2	f .42	.32	80.5	80.3	4aii
20	176	344	.68	.07	.85	-1.6	.60	-2.7	e .53	.45	75.6	60.6	7a
7	565	344	-.69	.05	.77	-3.1	.75	-2.8	d .68	.63	39.5	38.6	3b
3	442	344	-.34	.05	.64	-5.1	.68	-3.4	c .67	.60	48.8	40.7	2a
10	591	344	-.76	.05	.60	-5.7	.66	-4.1	b .71	.64	43.3	37.8	4bi
2	156	344	.79	.08	.61	-4.4	.49	-3.4	a .58	.42	70.3	64.2	1b
MEAN	424.6	344.0	.00	.08	1.05	.0	1.00	.0			50.3	49.9	
S.D.	366.5	.0	1.23	.07	.33	3.3	.45	3.0			17.6	15.9	

SUMMARY OF 21 MEASURED ITEM

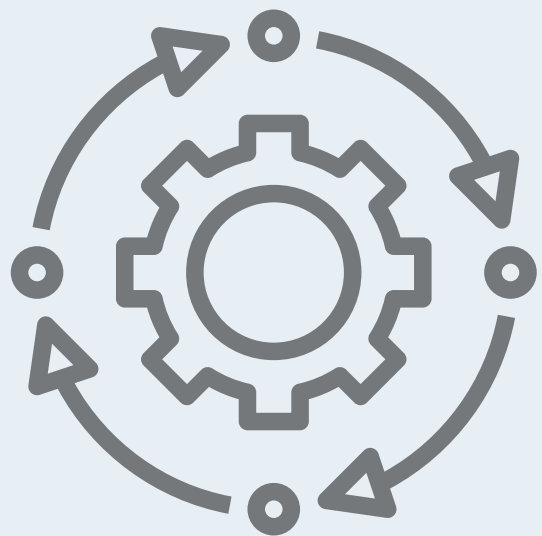
	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	424.6	344.0	.00	.08	1.05	.0	1.00	.0
S.D.	366.5	.0	1.23	.07	.33	3.3	.45	3.0
MAX.	1801.0	344.0	3.62	.40	1.77	6.9	2.46	9.1
MIN.	6.0	344.0	-3.18	.05	.60	-5.7	.41	-4.1
REAL RMSE	.13	TRUE SD	1.22	SEPARATION	9.28	ITEM	RELIABILITY	.99
MODEL RMSE	.11	TRUE SD	1.23	SEPARATION	11.56	ITEM	RELIABILITY	.99
S.E. OF ITEM MEAN = .28								

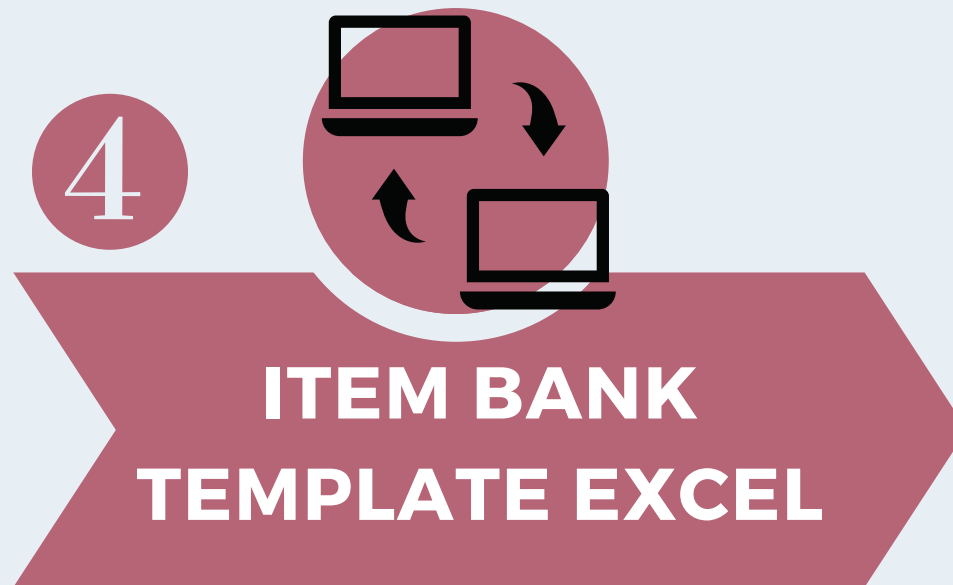


# STEP 4



- 1) Set up Item details in Item Bank Template Excel file**
- 2) Link each Item (Question and Answer) Word files in Item Bank**



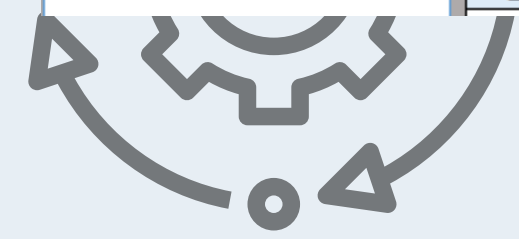


ITEM BANK STATISTICS : MAT0144

- CHAP
- 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7

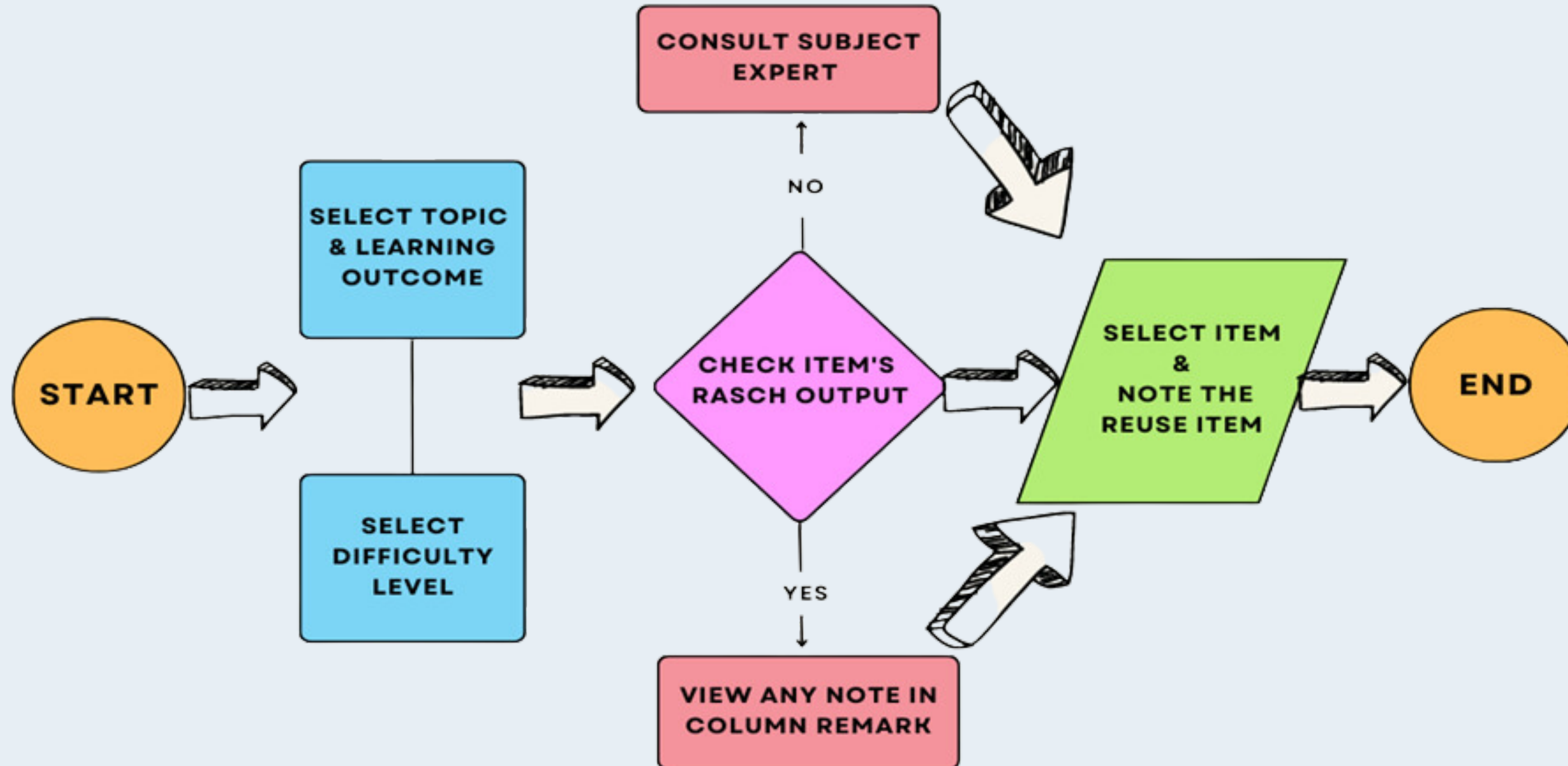
- DIFFICULTY LEVEL
- D
  - E
  - M

TABLE SPECIFICATION TEST (TST)					ITEM RASCH OUTPUT								
QUESTION CODE	CHAP	DIFFICULTY LEVEL	MARKS	SUMMARY	ITEM RELIABILITY	PERSON RELIABILITY	MEASURE	CORR (0.4,0.85)	INFIT (0.5,1.5)	OUTFIT (0.5,1.5)	RASCH DIFFICULTY LEVEL	REMARKS	REUSED
2122_S3_Q1a	1	E	3	<a href="#">Find percentile rank from grouped data</a>	0.99	0.87	0.08	0.6	1.22	1.05	M		2324_S2_Q1a
2122_S3_Q1b	1	E	2	<a href="#">Find frequency from grouped data</a>	0.99	0.87	0.79	0.58	0.61	0.49	M		
2122_S3_Q2a	3	E	3	<a href="#">find probability using Poisson Distribution(in between)</a>	0.99	0.87	-0.34	0.67	0.64	0.68	M		
2122_S3_Q2b	4	M	5	<a href="#">find probability using Normal Approx to the Poisson Dist (less than)</a>	0.99	0.87	-1.43	0.75	1.15	1.18	E		
2122_S3_Q3ai	4	M	4	<a href="#">find k using given probability normal distribution</a>	0.99	0.87	-0.79	0.59	0.94	1.11	M		
2122_S3_Q3aaii	5	M	4	<a href="#">Find n using CLT</a>	0.99	0.87	0.49	0.52	1.29	0.96	M		
2122_S3_Q3b	6	E	3	<a href="#">Find sample size for sample proportion</a>	0.99	0.87	-0.69	0.68	0.77	0.75	M		
2122_S3_Q4ai	6	E	2	<a href="#">find unbiased estimator for sigma unknown</a>	0.99	0.87	0.85	0.45	1.02	0.95	M		
2122_S3_Q4aaii	6	E	2	<a href="#">estimate standard error for mean (sigma unknown)</a>	0.99	0.87	1.41	0.42	0.88	0.53	D		
2122_S3_Q4bi	6	E	4	<a href="#">find CI for Mean (sigma unknown)</a>	0.99	0.87	-0.76	0.71	0.6	0.66	M		
2122_S3_Q4bii,iii	6	M	3	<a href="#">interpretation on claimed CI</a>	0.99	0.87	-0.41	0.6	0.84	1	M		
2122_S3_Q5ai	2	E	2	<a href="#">find P(A) using venn diagram</a>	0.99	0.87	-0.14	0.1	2.01	2.46	M	REVISE THE QUES	
2122_S3_Q5aaii	2	D	4	<a href="#">find P(A∩B) using addition rule</a>	0.99	0.87	0.26	0.47	1.71	1.64	M		

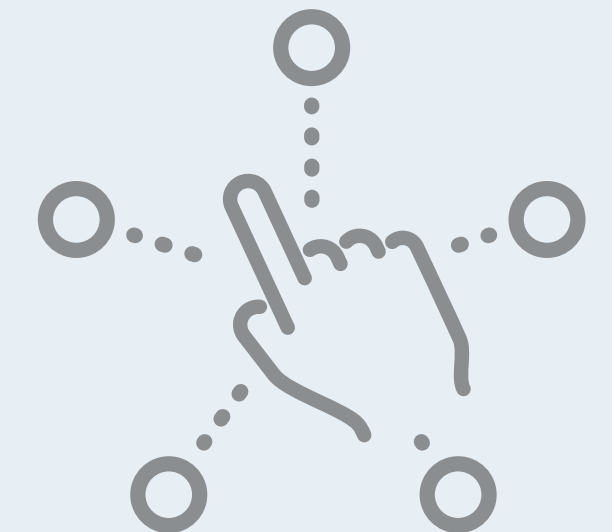




# METHODOLOGY



## ITEM BANK SELECTION PROCESS



# ITEM BANK SELECTION DEMONSTRATION

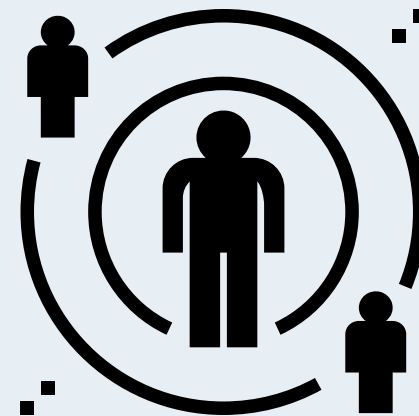


# THE IMPACT OF AN ITEM BANK

## ON EDUCATORS

### IMPACT

## ON STUDENTS



Improve validity & reliability

Saving time & effort

Enhanced test security

Comprehensive coverage

Learning progress monitoring

Students are fairly tested



# CONCLUSION

**TIME  
EFFICIENCY**



**CONSISTENT  
EVALUATION**



**COST  
EFFECTIVE**



**QUALITY  
ASSESSMENTS**

