

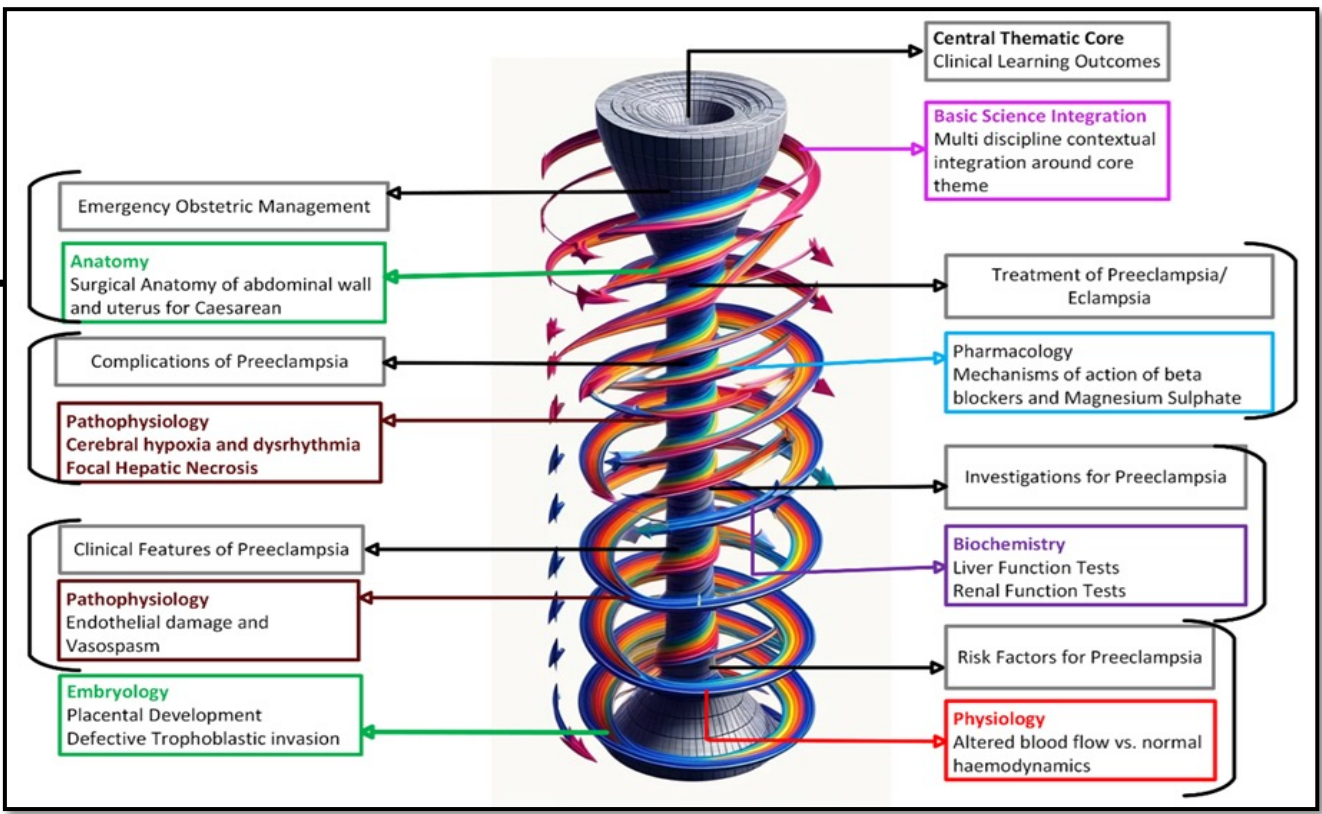
Contextual Vertical Integration Manages Cognitive Load in O&G Curriculum: RCT Series

Mohammed Ismail Khan*, Porfyrios Korompelis**, Dominic Blake**

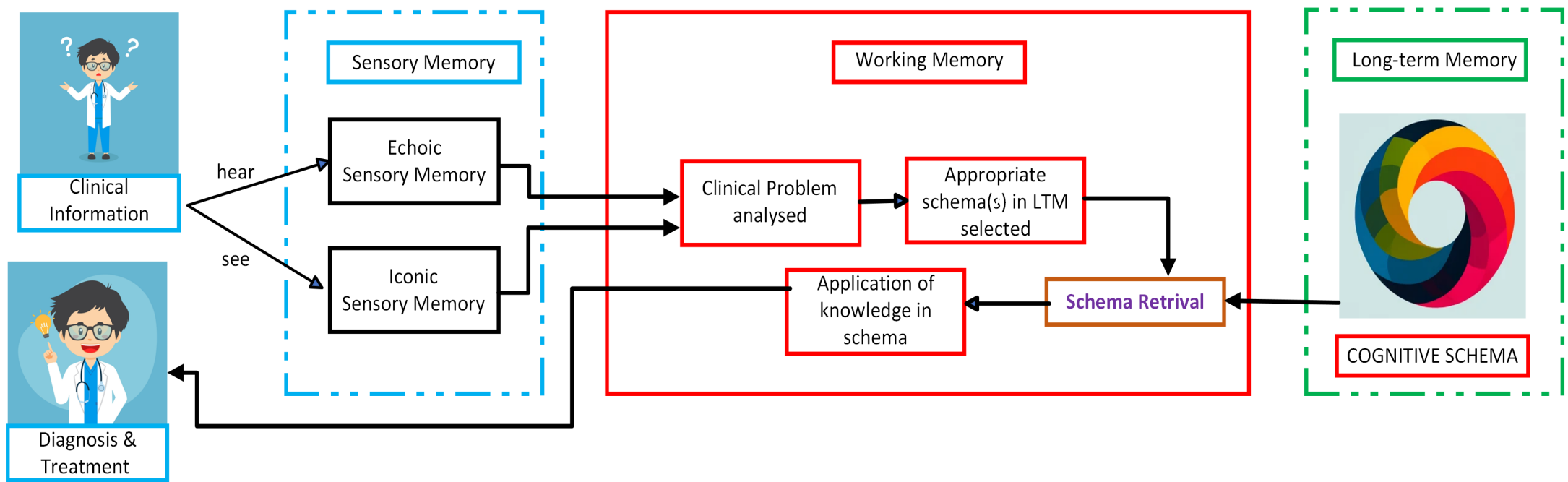
*O&G Trainee **Consultant - Northern Gynaecologic Oncology Centre, Queen Elizabeth Hospital, Gateshead

INTRODUCTION

- **Vertical Integration** in medical education refers to the instructional design which links clinical curriculum with basic sciences [1]
- **Contextual Vertical Integration (CVI)** is micro-level vertical integration which establishes a relationship between clinical knowledge and it's basic science foundation using an explanatory narrative [2,3].
- An example of CVI for Hypertensive Disorders of Pregnancy is shown in the Figure above.
- **Sweller's Cognitive Load Theory (CLT)** describes the framework for understanding the interplay between the psychological construct of **cognitive load (CL)** and the neurophysiology of learning [4, 5].
- It guides teachers to optimise cognitive load to facilitate learning.
- **ICL** represents the proportion of working memory resources that deal with the perceived complexity of the topic and **ECL** represents the load on working memory due to instructional design – **these prevent schema acquisition** in long-term memory (figure below).
- **GCL** is the allocation of working memory resources towards understanding a topic and correlating it with pre-existing knowledge hence **promotes schema formation** (figure below).



- **Intrinsic and Extraneous cognitive loads (ICL, ECL) impede learning**, and **Germane load (GCL) promotes learning** through schema formation.
- Formation of schema is essential to retrieve information from long-term memory to solve clinical problems (Figure below).

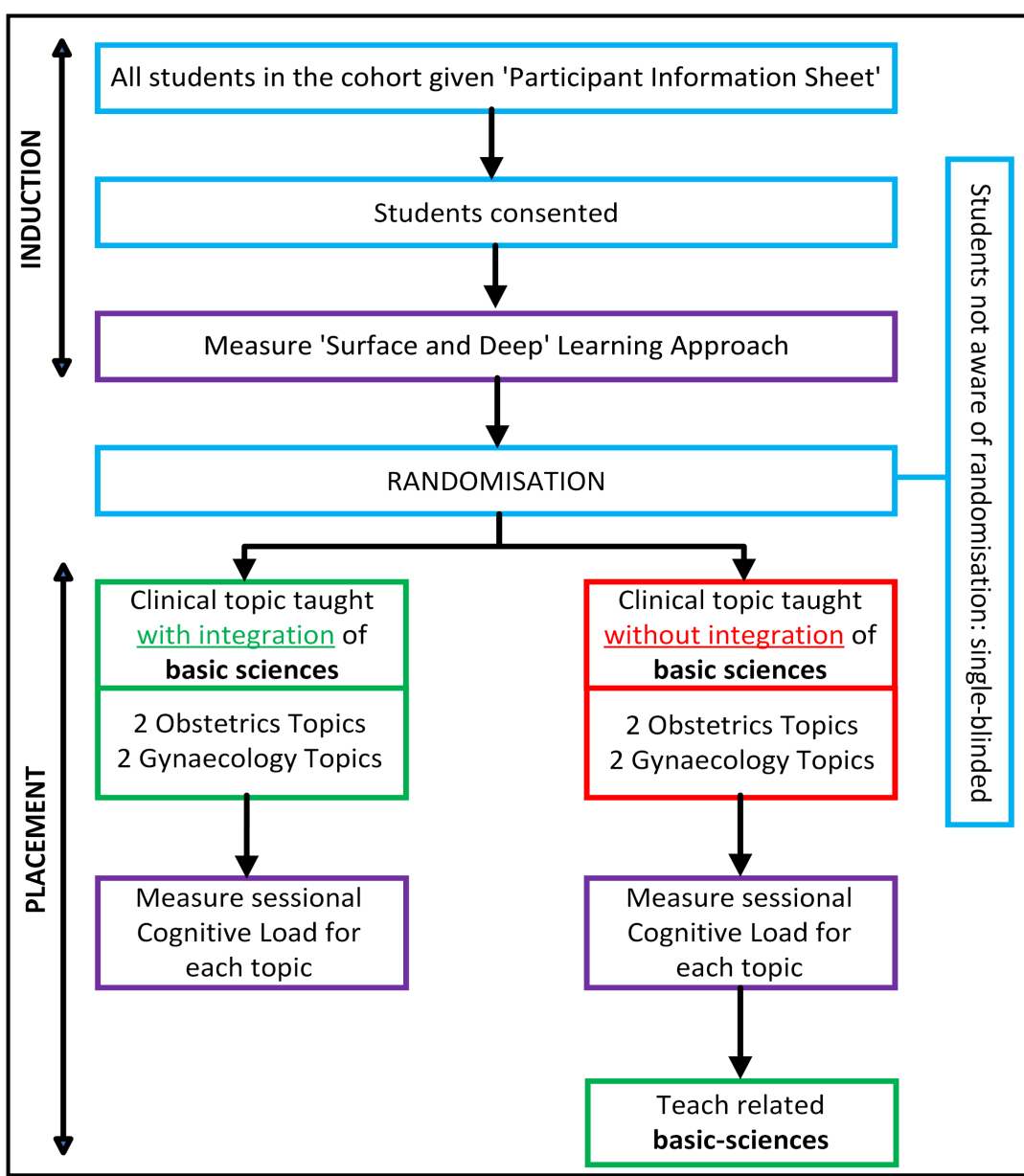


- The **primary objective** of the study was to evaluate the differences in ICL, ECL & GCL between students taught with and without integration. The **secondary objective** involved studying the relationships between I/E/GCL.

METHODS

This study comprises **eight single-blinded, randomised controlled trials (RCTs)** involving 3rd-year medical students from Newcastle University on their O&G clinical placement.

- In each RCT, students were **randomised** to clinical teaching **with or without integration**.
- Self-reported ICL, ECL & GCL were measured using **Klepsch's instrument**, a reliable and valid psychological instrument for CL measurement [6,7].
- The study evaluated the effects of CVI on 4 Obs and 4 Gynae topics to ensure **adequate sampling of the curriculum** to enhance the study's generalisability.



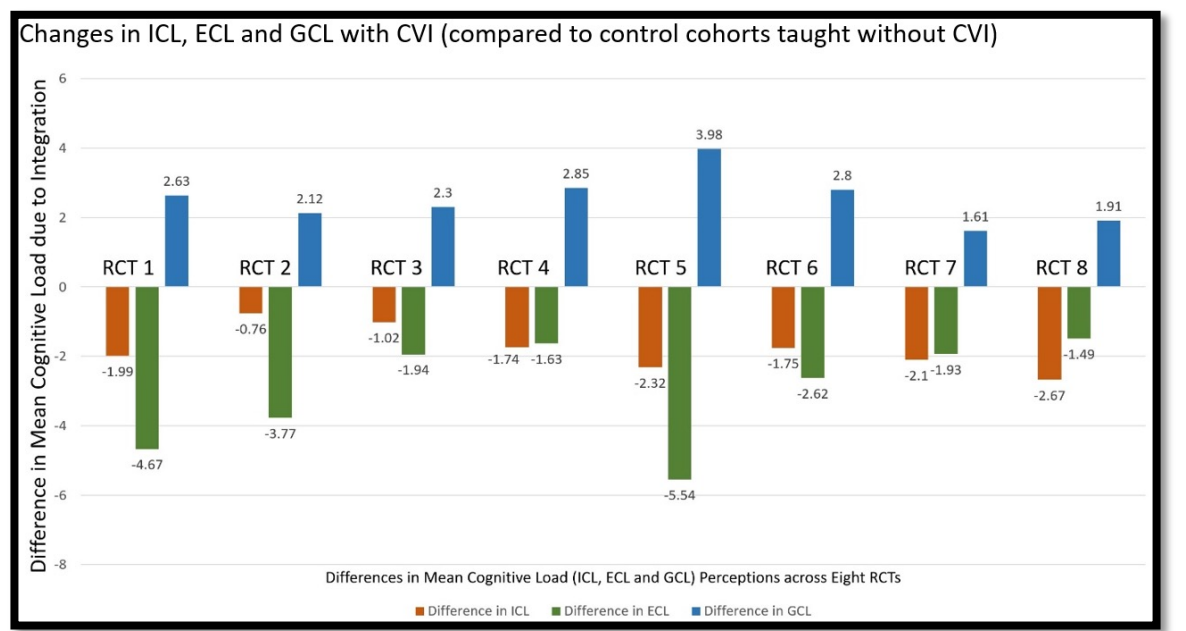
- Data was analysed using parametric statistical tests aligning with the quantitative consideration of psychological constructs in educational research [8, 9, 10].
- ICL, ECL & GCL differences between cohorts for each topic were analysed with unpaired t-tests, whereas differences within students were analysed using paired t-tests. Pearson's correlation was used to study relationships between different CLs.

RESULTS

- Students **taught with CVI** consistently had significantly **lower ICL and ECL** and a **higher GCL** with each topic (tables below)

Differences in ICL and ECL between students taught with and without CVI								
RCT No.	Topic	Sample Size (N)	Integration	Intrinsic Cognitive Load (M ± SD)	p-value [two-tailed]	95% Confidence interval	Extraneous Cognitive Load (M ± SD)	p-value [two-tailed]
RCT 1	Multifetal Gestation	61	Integrated	9.08 ± 1.70	<.001	-6.03 to -6.03	7.64 ± 2.72	<.001
			Non-Integrated	11.07 ± 1.55			12.31 ± 2.72	
RCT 2	Hypertensive Disorder of Pregnancy	61	Integrated	9.40 ± 1.93	0.026	-1.52 to 0.01	8.38 ± 2.23	<.001
			Non-Integrated	10.16 ± 1.90			12.15 ± 3.18	
RCT 3	Postpartum Haemorrhage	61	Integrated	7.84 ± 2.46	0.007	-1.82 to -0.21	6.56 ± 1.89	<.001
			Non-Integrated	8.86 ± 2.46			8.50 ± 1.99	
RCT 4	Labour and Delivery	61	Integrated	8.21 ± 1.81	<.001	-2.07 to -0.67	6.81 ± 1.58	<.001
			Non-Integrated	9.59 ± 1.71			8.44 ± 1.42	
RCT 5	Urogynaecology	61	Integrated	7.98 ± 1.60	<.001	-3.00 to -1.63	7.07 ± 1.90	<.001
			Non-Integrated	10.30 ± 1.80			12.61 ± 2.08	
RCT 6	Polycystic Ovarian Syndrome	61	Integrated	9.30 ± 1.96	<.001	-2.50 to -1.00	10.21 ± 2.98	<.001
			Non-Integrated	11.05 ± 1.76			12.83 ± 2.42	
RCT 7	Pelvic Inflammatory Disease	61	Integrated	6.29 ± 1.27	<.001	-2.73 to -1.48	6.48 ± 1.77	<.001
			Non-Integrated	8.39 ± 1.73			8.41 ± 1.41	
RCT 8	Cervical Screening and Colposcopy	61	Integrated	7.97 ± 1.50	<.001	-3.37 to -1.98	11.30 ± 2.46	0.006
			Non-Integrated	10.64 ± 2.04			12.79 ± 2.89	

- The image below shows mean changes in I/E/GCL with CVI.

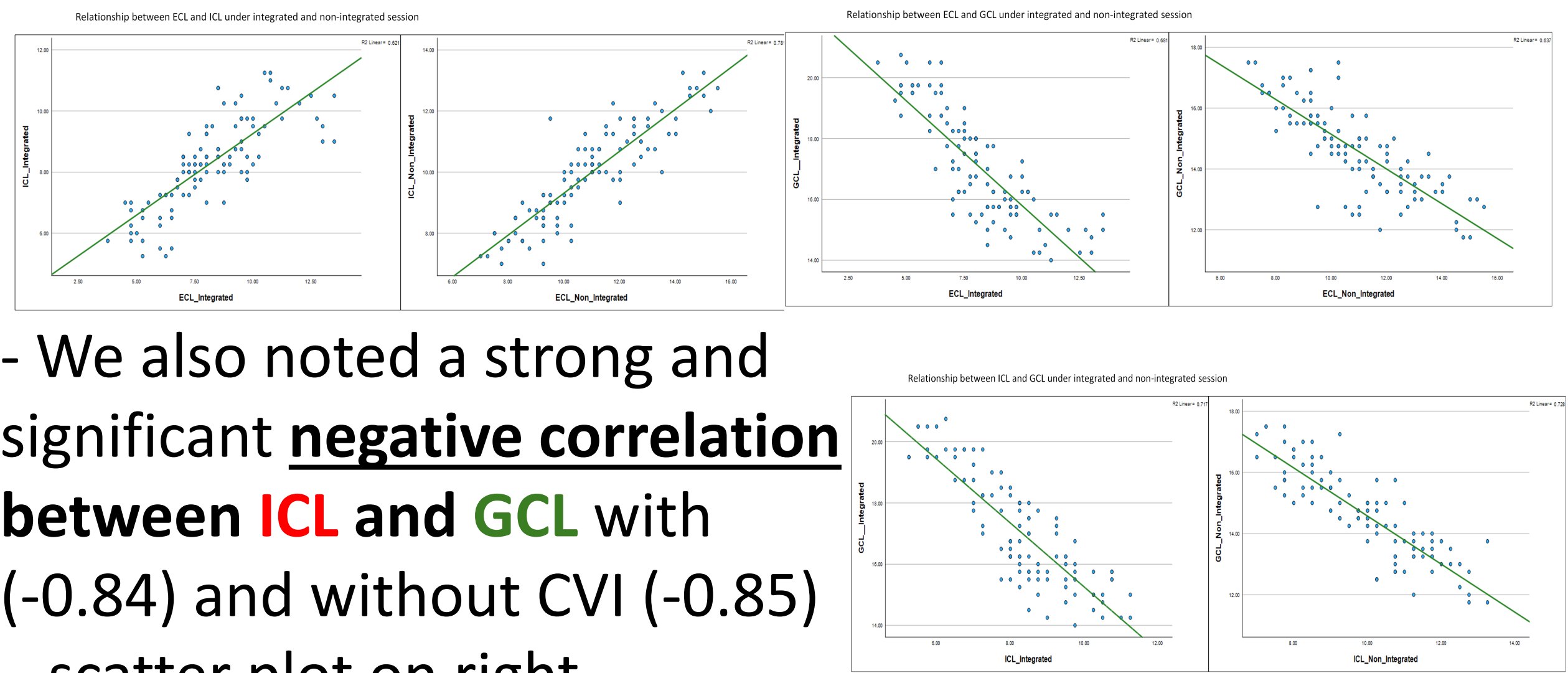


- Similar effects were noted when 'within' students' analysis was performed to assess curriculum-wide effects.

Comparison of Cognitive Load in students with and without Integrated Teaching

S.No.	Type of Cognitive Load	Sample Size (N)	Integration	Mean ± Standard Deviation (M ± SD)	t-value	p-value [two-tailed] (Significance of difference)	95% Confidence interval
1.	Intrinsic Cognitive Load (ICL) – maximum 14	103 pairs	Integrated	8.31 ± 1.44	-14.406	<.001 (Significant)	-1.847 to -1.400
			Non-Integrated	9.93 ± 1.56			
2.	Extraneous Cognitive Load (ECL) – maximum 21	103 pairs	Integrated	8.21 ± 2.14	-14.700	<.001 (Significant)	-3.038 to -2.315
			Non-Integrated	10.89 ± 2.01			
3.	Germane Cognitive Load (GCL) – maximum 21	103 pairs	Integrated	17.01 ± 1.78	21.688	<.001 (Significant)	2.176 to 2.614
			Non-Integrated	14.63 ± 1.44			

- The secondary outcomes of the study revealed that with and without CVI - a **decrease in ECL is associated** with a **decreased perception of ICL** (r = 0.78 and 0.88) and an **increased perception of GCL** (r = -0.82 and -0.79), with these associations being statistically significant (scatter plot below).



- We also noted a strong and significant **negative correlation between ICL and GCL** with (-0.84) and without CVI (-0.85) – scatter plot on right.

CONCLUSION

- **CVI allows new information to be encoded on existing schemas** and significantly **reduces ICL and ECL**, allowing limited working memory resources to be allocated for **generating GCL**, which **facilitates schema acquisition**
- It is, hence, incumbent upon **clinical teachers** to include **basic-science explanations** when delivering or facilitating **clinical teaching** to optimise cognitive load and **facilitate learning**.

REFERENCES →

Please scan for references on Google Drive

