



# Multimodal Elements in English-Medium Instruction in Biology and Geography Assessments

## Introduction

- English-medium instruction (EMI) in content subjects like Biology and Geography presents unique assessment challenges. As students learn these subjects through their additional language (L2), concerns arise about whether their performance may be underestimated due to language barriers.
- Multimodal elements, such as visuals, offer potential affordances in helping students overcome these linguistic hurdles.
- Currently, there is a lack of research on the presence and roles of multimodal elements and whether they can help students overcome the potential linguistic barriers in EMI assessments.

## Research Aims and Questions

This study investigates the presence and utilization of multimodal elements in Biology and Geography assessments in a high-stakes public examination, the Hong Kong Diploma of Secondary Education (HKDSE), exploring their potential impact on mitigating language-related challenges faced by L2 learners.

- What roles do multimodal resources play in written assessments in EMI contexts?
- Are there differences in the use and roles of multimodal resources between Biology and Geography assessments?

## Methodology

- Research design: Textual analysis of multimodal elements in written assessment questions
- Data sources: (i) Biology questions from the Hong Kong Diploma of Secondary Education (HKDSE) examination between 2018 and 2022 (N=526); (ii) Geography questions from the HKDSE examination spanning 2018 to 2023 (N=430)
- Data analysis: Based on the coding framework (Figure 1), questions were analyzed in terms of cognitive demands, linguistic demands, presence of different types of multimodal elements and their affordances

Figure 1. Coding framework (adapted from Lo & Fung, 2020; Slough et al., 2010)

Cognitive	(Multi-) Linguistic		Multimodal	
	Receptive	Productive	Receptive	Productive
	Apply Application Analysis	Vocabulary (L1 and/or L2) Sentence (L1 and/or L2) Text (L1 and/or L2)	No Yes: - Symbols; Visuals (e.g. Photograph; Naturalistic Drawing; Flow Chart; Cross Section; Tables; Hybrids (Two or more categories mentioned))	No Yes: - Symbols; Visuals (e.g. Photograph; Naturalistic Drawing; Flow Chart; Cross Section; Table Hybrids (Two or more categories mentioned))

## Result (Biology)

### 1. Prevalance of multimodal elements in EMI assessment questions, particularly in the cognitively demanding questions in Geography

Table 1. Weighted Distribution of questions in HKDSE Biology papers (Cognitive demand by multimodal receptiveness)

Cognitive demand				
Multimodal receptiveness	Recall	Application	Analysis	Total
Yes	13.12% (126)	12.50% (120)	30.73% (295)	56.35%
No	9.17% (88)	4.48% (43)	30.00% (288)	43.65%
Total	22.29%	16.98%	60.73%	100% (960)

- 60%+ of questions belong to analysis
- 55%+ multimodal receptiveness

### 2. Prevalance of hybrid multimodal elements in both subjects, but of different natures

- Hybridity refers to the presence of multiple modalities (e.g., tables, photos, maps) within a single source or the need to combine information from multiple sources to answer a question. There are two types of hybridity, and they play different roles in Biology and Geography.
- Chart 1 shows that assessment questions in DSE Biology predominantly feature **intra-source hybridity**. This means that a single source displays co-existing features belonging to multiple modalities (see Figure 2)

Chart 1. Distribution of cross-source hybridity (Biology)

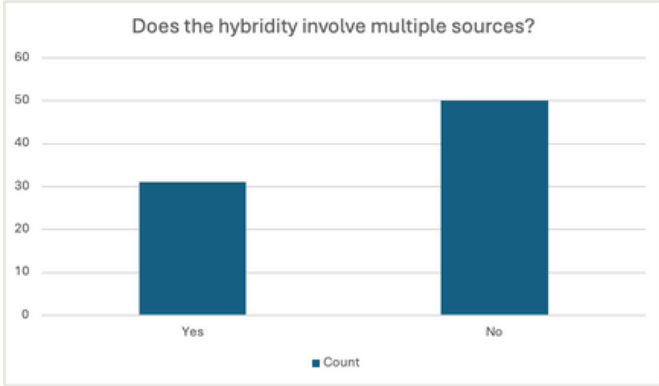
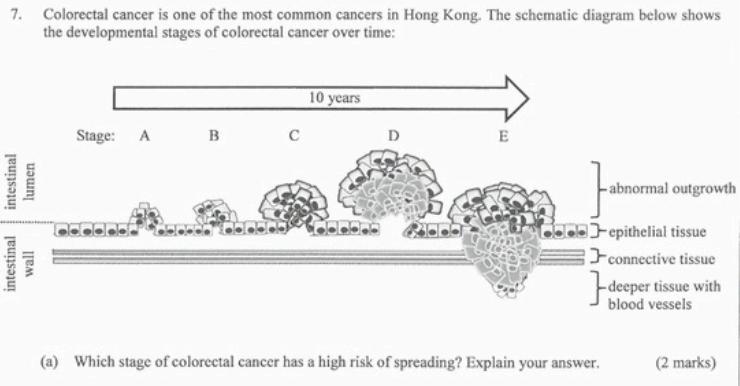


Figure 2. An example of intra-source hybridity in Biology



## Result (Geography)

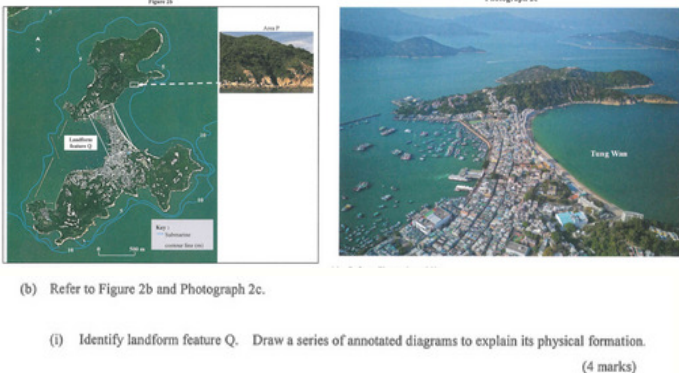
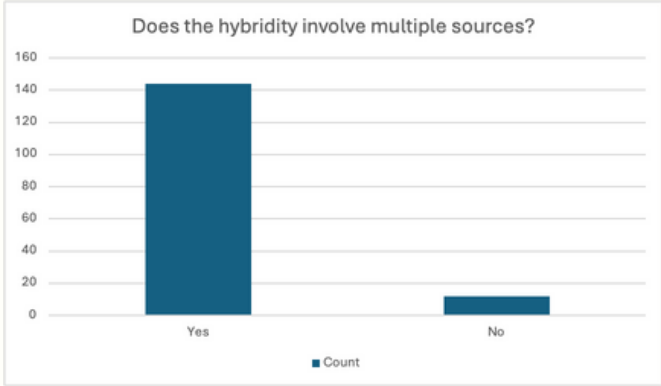
Table 2. Weighted Distribution of questions in HKDSE Geography papers (Cognitive demand by multimodal receptiveness)

Cognitive demand				
Multimodal receptiveness	Recall	Application	Analysis	Total
Yes	6.30% (101)	9.10% (146)	47.84% (767)	63.24%
No	2.62% (42)	0.56% (9)	33.57% (538)	36.76%
Total	8.92%	9.67%	81.41%	100% (1603)

- 80%+ of questions analysis
- 60%+ multimodal receptiveness

- On the other hand, Chart 2 shows that assessment questions from DSE Geography predominantly feature **inter-source hybridity**. This type of hybridity requires integrating information across multiple multimodal sources (e.g., maps, tables, graphs) (see Figure 3).
- This inter-source hybridity demands students to mentally combine different modalities, potentially imposing extra cognitive load.

Chart 2. Distribution of cross-source hybridity (Geography) Figure 3. An example of inter-source hybridity in Geography



## Discussions and Limitations

### Implications:

- Multimodal resources are widely used in EMI assessment questions, regardless of the disciplines. Comparatively speaking, they are more dominant in Geography.
- While these multimodal resources can help students understand the assessment questions through elaborating on the text in questions or adding additional information, those questions with hybrid multimodal resources may impose additional challenges on students.
- To address this challenge, teachers may need to enhance students' multimodal literacy skills, enabling them to effectively process and synthesize information from diverse multimodal resources.

### Limitations & Future research:

- This study focuses exclusively on written assessments, specifically the HKDSE examination papers.
- The analysis is confined to visual modalities, such as photos, graphs, and drawings while neglecting other modalities like audio and video.
- Future research can examine multimodal resources in homework assignments and classroom assessments, and how students process and integrate information from diverse modalities.

### References:

- Lo, Y. Y., and D. Fung. 2020. "Assessments in CLIL: The Interplay Between Cognitive and Linguistic Demands and Their Progression in Secondary Education." International Journal of Bilingual Education and Bilingualism 23 (10): 1192–1210.
- Slough, Scott W., Erin M. McTigue, Suyeon Kim, and Susan K. Jennings. "Science Textbooks' Use of Graphical Representation: A Descriptive Analysis of Four Sixth Grade Science Texts." Reading Psychology 31 (3): 301–25.