Report on Analysis of the BCH311H Quercus Data

(Prepared by Qin Liu in summer 2022)

Course Name: BCH311H (Biochemistry II: Nucleic Acids and Biological Information Flow) (Winter Term, 2022)

Instructor: Dr. Roula Andreopoulos

Purpose of Analysis: To understand the extent of students' engagement with the four e-modules in the course, and assess how their engagement with these e-modules related to their academic performance.

Data Sources: The analysis drew upon the following data sources:

- Course access data, generated by linking the weekly data exported from Quercus
- Post-module submission scores and assignment scores for each of the four e-modules, obtained from Gradebook on Quercus
- Final Grades data, provided by the Instructor.

A total of 480 students were enrolled in the course.

Results

Module Viewing Counts

Table 1 shows the variations in total viewing counts and the percentages of early viewing counts. On average, the total viewing counts for Module 2 (Mean=6.36, SD=4.65) were lower than those for other modules; and a lower proportion of the viewing of Module 4 (Mean=37%, SD=26%) happened before the start of the assessment submission than the other modules.

These results need to be interpreted based on assessment types (e.g., Learning related to Module 2 was assessed via a 35-minute quiz within a 3-hour window whereas learning related to other modules was assessed via assignments to be completed within several days) and the timing of the assessments (e.g., The start dates of assignment submission related to Modules 3 and 4 were on the same day.)

Table 1. Total and Early Viewing Counts

Modules	**Total Views**			**% of Early Views in Total Views**		
	n	Mean	SD	Before (Date)	Mean	SD
Module 1 – Ted Talk	475	10.36	7.12	Feb. 23	68%	23%
Module 2 – Journal Article	480	6.36	4.65	March 15	71%	23%
Module 3 – Reflective	471	7.39	5.36	March 29	56%	24%
Module 4 – Concept Map	468	11.56	7.51	March 29	37%	26%

Relationship Between Viewing Counts and Academic Performance

Academic performance was measured by three indicators:

- post-module submission scores
- assignment / quiz scores
- final grades

The following three methods were used to detect the relationship between viewing counts and academic performance indicators:

- Correlation analysis (using Pearson correlation);
- Grouping students by total viewing counts and comparing student groups (using ANOVA test);
- k-means cluster analysis.

Correlation. As shown in Table 2, the strengths of the correlations between the viewing counts and the academic performance indicators were weak[1] or negligible, with variations across the modules.

Table 2. Correlation Between Viewing Counts and Academic Performance Indicators

E-modules	Measures of Viewing	Post-Submission Scores	Assignment/Quiz Scores	Final Grades
Module 1 – Ted Talk	Total Views	.157**	.184**	.218**
	Percentage of Early Views	.289**	0.075	
Module 2 – Journal Article	Total Views	.04	.055	.120**
	Percentage of Early Views	0.030	-0.004	
Module 3 – Reflective	Total Views	.216**	.198**	.251**
	Percentage of Early Views	.269**	0.078	
Module 4 – Concept Map	Total Views	.310**	-	.247**
	Percentage of Early Views	-.146**	-	

**. Correlation is significant at the 0.01 level (2-tailed).
n values varied across modules.

Comparison of Student Groups. Three student groups were created based on the frequency distribution of Total View Counts of Module 3:

- Group 1: 1 to 6 Total Views (54% of all students)
- Group 2: 7 to 13 Total Views (36% of all students)
- Group 3: 14 and more Total Views (10% of all students)

One-way ANOVA was used to inspect the differences across the three groups in the post-module submission scores and assignment scores. The effect of module viewing times on post-module submission scores was significant, $F(2, 468) = 4.46$, $p = .012$, $\eta^2 = .019$. Post-hoc analysis using Tukey's b showed that the mean post-module submission scores of Group 3 students (M = .95,

[1] According to the following two articles, correlation coefficients from .10 to .39 indicate a weak correlation.
Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: Appropriate use and interpretation. *Anesthesia & Analgesia*, *126*(5), 1763-1768. https://journals.lww.com/anesthesia-analgesia/fulltext/2018/05000/correlation_coefficients__appropriate_use_and.50.aspx
Taylor, R. (1990). Interpretation of the correlation coefficient: A basic review. Journal of Diagnostic *Medical Sonography*, *1*(6), 35-39. https://journals.sagepub.com/doi/pdf/10.1177/875647939000600106

SD = .18) were statistically higher than Group 1 students (Mean = .85, SD = .34). The effect of module viewing times on assignment scores was less obvious but just significant, $F(2, 468) = 2.99$, $p = .05$, $\eta^2 = .013$. Post-hoc analysis using Tukey's b showed that the mean assignment scores among Group 3 students (M = 10.60, SD = .63) were statistically higher than Group 1 students (Mean = 9.90, SD = 2.11). The pattern in these results aligned with that those from the correlation analysis of Module 3 data. Similar analysis could be conducted on data related to other modules. This analysis shows a general pattern that more often the students viewed the module, the better their performance on the post-module submission and the module-based assignment was, with a more obvious effect on the immediate assessment (that is, the post-module submission).

K-means Analysis. K-means analysis of the Module 1 data generated three distinctive clusters. In particular, Group 1 students were characteristic of a higher average total view count but a lower percentage of early view counts, with no statistically significant difference in both submission scores and assignment scores as compared to Group 3 students. And, Group 2 students were characteristic of a higher percentage of early view counts but a lower average post-module submission score (Table 3). These results suggest that students' total view counts and when to view the module were somehow associated with their performance in the two module-based assessments. However, the relationships are not straightforward and may be confounded by other factors that were not measured by the existing course data.

Table 3. Results from k-means analysis of Module 1 data

	Group 1 (n=206)		Group 2 (n=67)		Group 3 (n=207)		
Variables	Mean	SD	Mean	SD	Mean	SD	F value
Post-Module Submission Scores	0.95	0.18	**0.69**	0.44	0.93	0.21	29.91***
Assignment Scores	10.34	1.85	9.72	2.63	10.16	1.97	2.42
Total View Counts	**11.45**	7.56	9.04	6.28	9.46	6.87	5.16**
Percentage of Early View Counts	**25.40**	13.60	**89.16**	9.82	**67.43**	24.08	1145.96***

** p < .01; *** P < .001

The bolded values in the table indicate they are statistically significant different from other values for the same variable.

Conclusions

The results above demonstrate that student engagement measured by the module viewing count was associated with academic performance indicators. However, the strength of the correlation varied, possibly depending on types and timing of learning assessments. It should be noted that the module viewing count only indicates the quantity of access to course materials and, in no way, measures the quality of students' cognitive engagement while viewing modules. To capture the quality aspects of viewing online modules, a short survey could be accompanied to the online module to ask about what the students did (e.g., note-taking and rewinding for some content etc.) while viewing the materials.

In addition, the timing of module viewing appeared to be associated with the post-module submission scores for some students. Therefore, the instructor may want to consider the timing of learning assessments when designing the online, module-related assessments.

These results need to be interpreted based on the course context, particularly the types and the timing of the assessments.