SUPPLEMENTARY MATERIAL

Scarborough, D.L.A., George-Williams, S.R., & Thompson, C.D. (2022). A cross-institutional perspective of pre-laboratory activities in undergraduate Chemistry. *International Journal of Innovation in Science and Mathematics Education, 30*(2), 46-64.

Table 1: The video and pre-laboratory contents of the laboratory course of Go8-1.

Experiment	Experiment type	Video content	Number of questions relating to:			
			Theory	Aim, Methods and/or experimental technique	Calculation / practice problems	Safety/waste
1. Fischer esterification	Expository	Introduction Link to future laboratory classes Theory Equipment list Results tabulation Overview of experiment	2	2	1	3
2. Chemical detectives	Expository	Theory Analysis instructions and examples		1	1	1
3. IDEA: Identifying and synthesising an unknown	Inquiry / no methods given	Introduction to IDEA experiments Overview of the experiment	3	3		1
4. Electronic waste	Expository	No video	2	2	1	2
5. Synthesis and analysis of an iron oxalate complex	Expository	Aim and background Overview of analysis steps Example calculations		1	3	2
6. IDEA: Identifying and quantifying cymbal metal composition	Inquiry / incomplete methods given	Introduction to IDEA experiments Aims and background Suggested techniques Calibration curves	5	2	1	3

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Table 2: The pre-laboratory quiz contents of the laboratory course of Go8-2.

Experiment name and number	Number of questions relating to:			
	Theory	Aim, Methods and/or experimental technique	Calculation and practice problems	Safety and waste
11. Precipitation	1	2		2
12. Sugar	1	2		2
13. Electrical control of chemical reactions	1	2		2
14. Chemistry of blue jeans	2	1		2
15. Iodine clock	1	2		2
16. Desalination		2		3
17. Supramolecular chemistry	1	2		2
18. Properties of gases	1	1	1	2
19. Chemistry of sticky things	2	2		1
20. Vitamin C titration	1	4		1

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Table 3: Percentage of Go8-1 and Go8-2 student responses for each Likert item. SD = strongly disagree, D = disagree, Ne = neutral, A = agree, SA = strongly agree. *N* = number of responses. The F number indicates the questions sorted into the same factor analysis group.

Likert item	F		*N*	SD	D	Ne	A	SA
1 I feel confident about undertaking the experiments.	2	Go8-1	132	0.8	9.2	20.6	62.6	6.9
		Go8-2	424	0.7	3.3	15.3	59.2	21.5
2 I need more support identifying equipment.	3	Go8-1	132	14.4	48.5	17.4	14.4	5.3
		Go8-2	421	13.5	50.1	21.1	13.1	2.1
3 I need more support setting up equipment	3	Go8-1	132	11.5	52.7	20.6	13.0	2.3
		Go8-2	420	11.7	47.1	23.6	16.2	1.4
4 I need more support using equipment.	3	Go8-1	131	4.6	48.5	26.9	16.9	3.1
		Go8-2	420	11.2	47.9	22.6	16.4	1.9
5 I feel prepared for laboratory classes.	2	Go8-1	132	0.0	13.7	26.0	51.9	8.4
		Go8-2	420	1.4	4.8	26.4	54.3	13.1
6 I can work at my own pace in laboratory classes.	2	Go8-1	131	11.5	27.7	26.2	30.0	4.6
		Go8-2	418	2.9	11.2	15.1	53.6	17.2
7 I enjoy the laboratory classes.	2	Go8-1	131	3.8	6.9	23.1	49.2	16.9
		Go8-2	418	3.8	9.1	29.2	45.9	12.0
8 There is too much to learn in the laboratory.	2	Go8-1	132	5.3	34.4	36.6	19.1	4.6
		Go8-2	418	3.8	41.4	36.1	16.5	2.2
9 I feel anxious in laboratory classes.	2	Go8-1	132	12.2	22.1	29.8	27.5	8.4
		Go8-2	418	16.7	39.7	26.3	14.4	2.9
10 I rely on others to be able to complete experiments.	2	Go8-1	130	9.3	32.6	31.8	23.3	3.1
		Go8-2	415	13.7	46.3	23.1	14.7	2.2
11 I understand the reasons for undertaking each step in the experiments.	2	Go8-1	130	4.7	27.9	23.3	41.1	3.1
		Go8-2	418	2.4	14.4	28.5	47.4	7.4
12 I have to read the laboratory instructions before completing the pre-laboratory exercises.	1	Go8-1	132	1.5	5.3	6.1	36.6	50.4
		Go8-2	418	1.9	7.7	16.0	53.1	21.3
13 What I am expected to do in the laboratory class is made clear by the pre-laboratory exercises.	1	Go8-1	131	0.8	16.2	27.7	42.3	13.1
		Go8-2	417	4.1	16.8	29.5	42.0	7.7
29 It is more important that the pre-laboratory exercises teach theory than experimental information.		Go8-1	131	6.9	29.2	31.5	21.5	10.8
		Go8-2	404	8.7	23.8	32.7	27.0	7.9

Note: F values refer to the following factors

1. Performance/understanding
2. Personal/affective
3. Equipment support

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Table 4: Percentage of Go8-1 and Go8-2 student responses for each Likert item beginning with the phrase 'The pre-laboratory exercises…'. SD = strongly disagree, D = disagree, Ne = neutral, A = agree, SA = strongly agree. *N* = number of responses. The F number indicates the questions sorted into the same factor analysis group.

Likert item: The pre-laboratory exercises …	F		*N*	SD	D	Ne	A	SA
14 boost my confidence about the laboratory class.	1	Go8-1	131	0.0	14.6	23.8	43.1	18.5
		Go8-2	409	1.7	17.6	30.6	45.2	4.9
15 help me to finish experiments on time.	1	Go8-1	131	2.3	24.6	30.0	32.3	10.8
		Go8-2	410	3.2	27.3	30.2	34.9	4.4
16 help me to better understand the theory behind the laboratory experiments.	1	Go8-1	131	0.8	11.5	23.8	43.8	20.0
		Go8-2	410	2.7	18.0	22.7	48.0	8.5
17 help me to identify equipment.	1	Go8-1	130	2.3	16.3	20.2	50.4	10.9
		Go8-2	408	2.2	18.1	21.3	49.8	8.6
18 help me to assemble laboratory equipment.	1	Go8-1	131	0.8	17.7	27.7	45.4	8.5
		Go8-2	407	3.9	26.8	24.1	40.3	4.9
19 help me operate laboratory equipment.	1	Go8-1	131	0.8	16.9	30.0	43.8	8.5
		Go8-2	406	3.9	25.6	26.1	38.7	5.7
20 need more detail regarding identifying, assembling and/or using laboratory equipment.	3	Go8-1	130	1.6	21.7	25.6	45.0	6.2
		Go8-2	407	3.4	18.7	25.1	44.0	8.8
21 help me to form links between theory and laboratory content.	1	Go8-1	131	2.3	18.5	25.4	42.3	11.5
		Go8-2	406	2.7	17.2	28.1	47.5	4.4
22 allow me to focus on the experiment.	1	Go8-1	131	0.8	10.0	27.7	49.2	12.3
		Go8-2	406	2.7	16.7	28.3	48.0	4.2
23 help me to understand the reasons behind each step in the experiment.	1	Go8-1	131	3.1	22.3	32.3	34.6	7.7
		Go8-2	403	3.5	22.8	27.3	42.7	3.7
24 help me to better engage with the material being taught.	1	Go8-1	131	1.5	10.8	25.4	53.1	9.2
		Go8-2	406	3.2	12.8	30.5	49.5	3.9
25 increase my interest in the laboratory class.	1	Go8-1	131	5.4	18.5	36.9	30.8	8.5
		Go8-2	405	4.9	22.2	38.0	31.4	3.5
26 help me to understand the broader applications of the material taught in the laboratory class.	1	Go8-1	131	3.1	15.4	25.4	45.4	10.8
		Go8-2	404	3.7	22.5	26.5	42.8	4.5
27 help me to analyse data collected in the laboratory class.	1	Go8-1	130	0.0	12.4	21.7	57.4	8.5
		Go8-2	405	6.2	24.4	29.4	35.3	4.7
28 help me complete calculations in the laboratory class.	1	Go8-1	130	1.6	6.2	8.5	48.1	35.7
		Go8-2	406	7.4	27.6	26.4	35.5	3.2

Note: F values refer to the following factors

1. Performance/understanding
2. Personal/affective
3. Equipment support