Developing a whole-of-organisation perspective on literacy-embedding practices at Wintec: Multiple perspectives on a selection of 2019 Wintec cohorts

Willfred Greyling, Farzana Ahmad & Nika Wallace

29 May 2020

SUMMARY

This report deals with the reading and numeracy performance of four cohorts of learners, taught by candidates who successfully completed the New Zealand Certificate in Adult Literacy and Numeracy Education (Vocational) in 2019. We show how these selected cohorts' performance can be compared to the overall Wintec performance reported in Greyling, Ahmad and Wallace (2020a, b). We also investigate the links between initial reading and numeracy scores and module completions, defined as either a categorical Pass/Fail binary, or a continuous variable (i.e. the percentage of modules each student completes in any given year). Although the findings show that the targeted cohorts exceeded the mean performance for Wintec students on both reading and numeracy, we point out the limitations and ambiguities associated with such a finding. We recommend that a multifactorial model be developed to explain the complexities of student performance, the pursuit of a whole-of-organisation perspective remain a priority goal, a larger sample of NZCALNE(Voc) candidates' students be tracked, and other methodologies and/or interventions be considered to lift outcomes for students.

INTRODUCTION

The LN-embedding team has submitted three reports on organisational LN-embedding performance in 2019. In all these reports, we recommended that, in our analyses, we had to consider how we could develop a whole-of-organisation perspective (Greyling, Ahmad & Wallace, 2020 a, b and c). This report is the first attempt to extend the focus beyond what has so far been a pre-post approach to tracking learners' progress in reading and numeracy skills. In this report, we attempt to show a link between LN performance and student success. As the title of the report suggests, we selected four cohorts of students who were taught by tutors who were successful candidates on the New Zealand Certificate in Adult Literacy and Numeracy Education (Vocational). These tutors' LN-embedding practices were also analysed and reported on in our third report (Greyling, et al., 2020c) so that the performances of all participants could be accessible and retrievable. Thus, we tracked the performance of the key participants in instructional settings, exploring the dynamics from the following vantage points:

- **Organisational benchmarks for reading and numeracy performance**: In the reports on reading and numeracy progress (Greyling, et al., 2020a, b), we found that the following proportions of students had achieved exemption level steps in their progress assessments:
  - **Reading**: Of the targeted reading cohort (N=557), 40.4% (n=225) progressed to exemption level (step 4 or higher).
  - **Numeracy**: Of the targeted numeracy cohort (N=486), 40.5% of learners (n=197) progressed to exemption level (step 5 or higher).
  - **Matched t-tests** for both reading and numeracy data sets showed that learners had achieved statistically significant progress.
- **Classroom observation findings**: All candidates (N=7) enrolled on the NZCALNE(Voc) completed the programme successfully, with each observed by the instructor/mentor on three occasions.

These observations were analysed and the findings reported in Greyling, et al., 2020c). In summary, the main findings were defined as 11 categories of practice:

- C1: Deliberate proactive lesson planning and pre-teaching choices of teaching strategies, methods and techniques
- C2: The interactive accomplishment of lesson plans as intentional learning conversations
- C3: Deliberate teacher initiations to enact a lesson plan or initiation-response-evaluation sequences aimed at circumventing barriers in the interaction
- C4: Deliberate and explicit references to literacy and numeracy embedding
- C5: Prompting and encouraging teacher acts aimed at facilitating learner participation
- C6: Strategically embedded teacher explanations to ensure learners develop appropriate modes of informed vocational reasoning
- C7: Teacher prompts to raise learner awareness of vocational constructs and actions in relation to training tasks and experiences
- C8: Teacher acts deriving from or promoting workplace and/or cultural values
- C9: Matching LN demands of a programme and the LN needs of learners
- C10: Designing learning experiences to promote learner autonomy
- C11: Designing authentic tasks

We are able to claim with some confidence that the candidates' whose cohorts were selected had implemented LN-embedding strategies consistent with LN-embedding policy documents (TEC, 2009) and the organisation's LN Policy (2018a) and *Ako: Teaching and learning* (Wintec, 2018b) guidelines.

- **Defining measures of success**: Our main challenge was to find an appropriate measure of success. We argued that programme completion was the relevant measure and could be added as the Pass/Fail dependent variable in our data set with 1 = Pass and 0 = Fail. When we checked on programme completions, we soon discovered that Pass/Fail was a crude measure. Learners enrol for between 3 and 7 modules and in 2019 only 35.5% of cases they pass all their modules. We then reasoned that it would be more realistic to add a continuous measure for success, adding the *percentage of successfully completed modules* as the measure of success.
- **Portfolios for candidates**: In addition to course work, we also co-constructed personalised portfolios for each candidate. The components of the portfolio were the following:
    - Preferred principles and practices from the candidate's point of view.
    - Ten pedagogical constructs related directly to their vocational training practices
    - Repertory grid ratings and analysis of the candidate's pedagogical constructs
    - Three lesson observations

  The portfolios reinforce the earlier point that candidates' awareness of the principles and practices of LN embedding and general pedagogy had been raised and tracked in an evidence-based approach. These portfolios are lodged with candidates who successfully completed the 2019 iteration of the NZCALNE(Voc).

MAIN AIMS

The main aims of this report are to

- show how the selected cohorts performed in reading and numeracy in relation to the 2019 Wintec cohort, reported on in Greyling, et al. (2020a, b),
- explore the relationship between initial reading and numeracy step scores and pass/fail success rates, and

- investigate initial reading and numeracy scale scores as predictors of student success expressed as the proportion of successfully completed modules.

DATA COLLECTION

We selected the following data to illustrate how we could begin to develop a whole-of-organisation perspective:

- We selected 3 of 5 cohorts[1] of students as our sources of the following data:
  - **Initial and progress scores** where these were available for 2019, following the Tertiary Education Commission's sequence concept. These scores were then collated as follows:
    - Of the 5 cohorts, only 3 had 2019 scores which meant that we discarded the fourth and the fifth cohorts whose progress scores were due by mid-2020.
    - The three cohorts comprised were constituted as follows:
      - Total number of learners: N=51
      - Learners who achieved exemption-level scores and were excluded from progress assessments:
        - Reading: n=27 (53% of the total)
        - Numeracy n=34 (67%)
      - Learners targeted for progress assessment:
        - Reading: n=24 (47% of the total)
        - Numeracy: n=17 (33% of the total)
- **Two cohorts were eliminated** because they did not have progress scores, and if they did, they were follow-up scores on 2018 that were achieved early in 2019 which discounted any effect of the LN-embedding practices of the candidates who taught them.
- **Four of five cohorts** could be selected to see whether reading and numeracy steps and scale scores could predict membership of the Pass/Fail categories (for categorial data) and the percentage of modules completed (based on continuous variables, i.e. scale scores on reading and numeracy). Of the total of 90 students from the five cohorts, 76 were included in the analysis. We retained all subjects that had both initial and progress assessment scores.

METHODS OF ANALYSIS

We performed the following analyses in IBM/SPSS (V26, 2019):

- **Cross-tabulations** of initial and progress step scores for both reading and numeracy. We then compared these results with the benchmark averages reported in Greyling, et al., 2020a, b).
- **Matched t-tests** for initial scales scores for initial and progress assessments for both reading and numeracy.
- **Initial reading and numeracy steps cross-tabulated with Pass-Fail**, a binary capturing Pass as 100% completion of all modules or units for a given year and Fail referring to any lesser proportion of modules or units completed. We sensed that this measure was crude because

[1]. A clarifying note is needed re the selection of cohorts. We selected three of the five because they had complete data for reading and numeracy at the start and completion of the programme. For the model predicting learner success, we were able to add a fourth. The fourth cohort had initial reading and numeracy scores but no end-of-programme scores. They could be added because they had final programme outcomes. This may seem odd; however, under the sequence concept, learner progress on reading and numeracy may be assessed beyond current programme enrolments (TEC, 2012).

of the range of module completions. Some students had completed none, while a large number of students completed a significant number of their modules. On average, learners completed 67.7% of their modules, with the standard deviation 32.6%; hence our next analysis.

- **Regression analysis** was used to see to what extent reading scale scores and numeracy scale scores predicted the variance of the proportion of modules passed.

FINDINGS

We followed the above sequence of methods to report our findings.

Cross-tabulations of initial and progress steps for reading and numeracy

First, we report the cross-tabulations of step scores for reading and numeracy for initials and progress assessments. In Table 1, we show the results for reading.

Table 1: Cross-tabulation of Initial and Progress Reading Steps for targeted learners in three cohorts (N=24)

			Reading Progress Step				Total
			2	3	4	5	
Initial reading step	Step 2	Count	0	1	3	1	5
		% within Initial Reading Step	0.0%	20.0%	60.0%	20.0%	100.0%
		% within Initial Reading Step	0.0%	9.1%	37.5%	25.0%	20.8%
		% of Total	0.0%	4.2%	12.5%	4.2%	20.8%
	Step 3	Count	1	10	5	3	19
		% within Initial Reading Step	5.3%	52.6%	26.3%	15.8%	100.0%
		% within Initial Reading Step	100.0%	90.9%	62.5%	75.0%	79.2%
		% of Total	4.2%	41.7%	20.8%	12.5%	79.2%
Total		Count	1	11	8	4	24
		% within Initial Reading Step	4.2%	45.8%	33.3%	16.7%	100.0%
		% within Initial Reading Step	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	4.2%	45.8%	33.3%	16.7%	100.0%

These findings are clear: of the 24 students who were targeted for process assessment, 50% (12 learners) achieved exemption level scores.

Table 1 also shows that

- of the 5 learners who achieved step 2 at the start,
  - none remained at step 2;
  - 1 achieved a step 3 score;
  - 3 achieved the exemption level; and
  - 1 moved up by 3 steps to step 5, a step above the exemption level.
- of the 19 learners who achieved step 3 at the start,
  - 1 regressed to step 2;
  - 10 remained at step 3;
  - 5 achieved the exemption level; and
  - 3 moved up from step 3 to step 5, a step above the exemption level.

These results show that the three cohorts performed 9.6% above the Wintec average of 40.4%. This means that whereas for the three cohorts 50% (12 of 24 learners) scored at exemption level or higher, this was 9.6% above the Wintec average.

Another noteworthy point is that none of the targeted learners achieved step 6.

We have to note immediately that the sample size of 24 is relatively small so that outliers have a significant impact. In practical terms, a single student represents 4.1% (1/24) of the cohort. This means that 2 to 3 students represent the 9.6%.

We performed the same analysis on the numeracy results. In Table 2, we report these results for targeted students in the three cohorts (N=17).

Table 2: Cross-tabulation of Initial and Progress Numeracy Steps for targeted learners in three cohorts (N=17)

			Numeracy Progress Steps				Total
			2	3	4	5	
Initial Numeracy Step	3	Count	1	1	0	1	3
		% within Initial Numeracy Step	33.3%	33.3%	0.0%	33.3%	100.0%
		% within Initial Numeracy Step	25.0%	100.0%	0.0%	12.5%	17.6%
		% of Total	5.9%	5.9%	0.0%	5.9%	17.6%
	4	Count	3	0	4	7	14
		% within Initial Numeracy Step	21.4%	0.0%	28.6%	50.0%	100.0%
		% within Initial Numeracy Step	75.0%	0.0%	100.0%	87.5%	82.4%
		% of Total	17.6%	0.0%	23.5%	41.2%	82.4%
Total		Count	4	1	4	8	17
		% within Initial Numeracy Step	23.5%	5.9%	23.5%	47.1%	100.0%
		% within Initial Numeracy Step	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	23.5%	5.9%	23.5%	47.1%	100.0%

The same pattern as for reading is clear from Table 2. Of the 17 learners, 47% (8 of 17) progressed to the exemption level. It is noteworthy that there were no students at step 1 or step 2 of the numeracy progressions at the start of the programme. Thus, the targeted learners were learners at either step 3 (n=3) or step 4 (n=14) on progress assessments at the conclusion of the programme.

Table 2 also shows that

- of the 3 learners who achieved step 3 at the start,
    - 1 regressed to step 2;
    - 1 remained at step 3; and
    - 1 moved up by 2 steps to step 5, the exemption level for numeracy.
- of the 14 learners who achieved step 4 the start,
    - 3 regressed to step 2;
    - 4 remained at step 4; and
    - 7 moved up from step 4 to step 5, the exemption level.

It would be interesting to explore who the three students were who regressed from step 4 to step 2. Two of these students were from a programme with a low numeracy demand, while the third was from a programme with a high numeracy demand. None of them passed all the modules they were required to complete for the year. Also, 7 of the 8 students who progressed to step 5 were enrolled in the two cohorts facing programmes with a high numeracy programme demand.

These results show that the three cohorts performed 6.6% above the 2019 Wintec average of 40.5%. This means that whereas for the three cohorts 47.1% (8 of 17 learners) scored at exemption level, this was 6.6% above the Wintec average for targeted 2019 Wintec students. Again, we caution that the small sample size may have big effects because 1 student represents 5.9% of the targeted group.

Matched pairs t-test results for targeted reading and numeracy learners

Second, Tables 3 and 4 report the matched t-test results for reading and numeracy for the targeted learners.

Table 3: Paired Samples Test Results for Reading (N=24)

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t-value	df	Sig. (2-tailed)
	Comparison				Lower	Upper			
Pair 1	Reading Progress – Initial Reading	63.1	69.5	14.179	33.7	92.4	4.45	23	0.000

Table 3 shows that a statistically significant difference exists when initial and progress assessments for each learner are compared (mean difference: 63.1; t value=4.45; df=23; p<0.00). These results compare favourably with the 2019 Wintec-wide analysis where the mean difference for reading was 47.8, which was deemed to be statistically significant (t-value=15.3; df = 556; p<0.00) (Greyling, et al., 2020a).

Table 4 reports the numeracy results:

Table 4: Paired Samples Test for Numeracy (N=17)

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t-value	df	Sig. (2-tailed)
	Comparison				Lower	Upper			
Pair 1	Numeracy Progress – Initial Numeracy Scores	14.0	80.8	19.600	-27.551	55.551	0.714	16	0.485

The mean difference of 14.0 (on a scale of a 1000) was not statistically significant. The results for the targeted Wintec group (N=486) showed a statistically significant result and a mean difference of 52.9 (mean difference, 52.87; t-value=15.7; df=485; p<0.00) (Greyling, et al., 2020b).

As we stated earlier, one of our aims is to see how initial literacy and numeracy steps and scale scores can be linked to module outcomes. The next two sections report our attempt to show the links between initial reading and numeracy scores and "completion variables".

We defined two completion variables. We reasoned that each learner was enrolled for x number of modules for the year. If they passed all of them, they would be assigned to the **Pass** category (coded as 1 in the data set); all other students, irrespective of the number of modules successfully completed, were assigned to the level **Fail** (coded as 0 in the data set). This categorical approach, we reasoned, was a very crude way to describe success, but would provide a useful statistic: it would allow us to identify the percentage of students who had successfully completed all modules in 2019. This statistic would allow us to set specific targets for the cohorts investigated in this analysis.

The second *completion variable* was to generate a continuous variable: for each student we calculated the number of modules completed divided by the total number of modules enrolled for (multiplied by 100 to obtain a percentage). We then performed a multiple regression analyses to

identify the level of association between the independent variables (initial reading and numeracy scale scores) and the dependent variable (percentage of modules passed).

We present these results in the sections below.

Cross-tabulation of initial reading and numeracy scores and the pass/fail categories

We retained the data for four of the five cohorts, discarding the fifth because final module outcomes were due mid-2020. The cross-tabulations for Pass/Fail and initial reading steps appear in Table 5 below, while the equivalent cross-tabulation for initial numeracy appears in Table 6.

Table 5: Cross-tabulation of initial reading steps and the pass/fail categories

			Fail category	Pass category	Total
	Steps		0	1	
Initial Reading Step	2	Count	10	1	11
		% within Initial Reading Steps	90.9%	9.1%	100.0%
		% within Pass/Fail categories	20.4%	3.7%	14.5%
		% of Total	13.2%	1.3%	14.5%
	3	Count	20	18	38
		% within Initial Reading Steps	52.6%	47.4%	100.0%
		% within Pass/Fail categories	40.8%	66.7%	50.0%
		% of Total	26.3%	23.7%	50.0%
	4	Count	12	4	16
		% within Initial Reading Steps	75.0%	25.0%	100.0%
		% within Pass/Fail categories	24.5%	14.8%	21.1%
		% of Total	15.8%	5.3%	21.1%
	5	Count	4	3	7
		% within Initial Reading Steps	57.1%	42.9%	100.0%
		% within Pass/Fail categories	8.2%	11.1%	9.2%
		% of Total	5.3%	3.9%	9.2%
	6	Count	3	1	4
		% within Initial Reading Steps	75.0%	25.0%	100.0%
		% within Pass/Fail categories	6.1%	3.7%	5.3%
		% of Total	3.9%	1.3%	5.3%
Total		Count	49	27	76
		% within Initial Reading Steps	64.5%	35.5%	100.0%
		% within Pass/Fail categories	100.0%	100.0%	100.0%
		% of Total	64.5%	35.5%	100.0%

The cross-tabulation results in Table 5 define the challenge for the four cohorts of learners (N=76) included in this analysis. Only 35.5% of them (27 of 76 learners) completed all the modules they enrolled for in 2020. We also have to note that

- 35.5% (27 of 76 learners) had achieved step 4 (the exemption level) or higher.
- 15.8% (12 of 76) achieved step 4 yet failed some or all of their modules.
- 5.3% (4 of 76 learners) achieved step 5 yet failed some or all of their modules.
- 3.9% (3 of 76 learners) achieved step 6 yet failed some or all of their modules.
- 25% (19 of 76 learners) achieved an exemption level score yet failed some or all of their modules.

We also note that 19 of 76 students (25% of the total cohort) achieved step scores below exemption level yet passed all their modules.

Table 6: Cross-tabulation of initial numeracy steps and the pass/fail categories

			Fail category	Pass category	Total
	Steps		0	1	
Initial Numeracy Step	1	Count	1	0	1
		% within Initial Numeracy Steps	100.0%	0.0%	100.0%
		% within Pass/Fail categories	2.0%	0.0%	1.3%
		% of Total	1.3%	0.0%	1.3%
	2	Count	1	0	1
		% within Initial Numeracy Steps	100.0%	0.0%	100.0%
		% within Pass/Fail categories	2.0%	0.0%	1.3%
		% of Total	1.3%	0.0%	1.3%
	3	Count	6	2	8
		% within Initial Numeracy Steps	75.0%	25.0%	100.0%
		% within Pass/Fail categories	12.2%	7.4%	10.5%
		% of Total	7.9%	2.6%	10.5%
	4	Count	18	13	31
		% within Initial Numeracy Steps	58.1%	41.9%	100.0%
		% within Pass/Fail categories	36.7%	48.1%	40.8%
		% of Total	23.7%	17.1%	40.8%
	5	Count	15	11	26
		% within Initial Numeracy Steps	57.7%	42.3%	100.0%
		% within Pass/Fail categories	30.6%	40.7%	34.2%
		% of Total	19.7%	14.5%	34.2%
	6	Count	8	1	9
		% within Initial Numeracy Steps	88.9%	11.1%	100.0%
		% within Pass/Fail categories	16.3%	3.7%	11.8%
		% of Total	10.5%	1.3%	11.8%
Total		Count	49	27	76
		% within Initial Numeracy Steps	64.5%	35.5%	100.0%
		% within Pass/Fail categories	100.0%	100.0%	100.0%
		% of Total	64.5%	35.5%	100.0%

Table 5 and Table 6 confirm that students who achieve at steps 1 and 2 do not have a reasonable chance of achieving success. For example, Table 5 shows that of 11 step 2 readers, only 1 passed all modules, while neither of the two students who scored at steps 1 and 2 for numeracy (Table 6) passed.

These results show that

- 30.2% (23) of learners who scored at or above exemption level steps (5 and 6) for numeracy, failed to complete all their modules.
- 42.3% (11 of 26) of learners who scored at step 5 numeracy at the start, passed all their modules.
- 10.5% (8 of 9 learners) who scored at step 6 numeracy at the start, did not complete all their modules successfully.

Regression analysis

Our last step was to perform a linear regression analysis to see whether the two independent variables (initial reading and numeracy scale scores) explained a statistically significant component of the variability on the dependent variable (in this case, the percentage of modules passed). We found no statistically significant result for an ANOVA and the regression coefficients computed in SPSS. These results are reported in Tables 7 and 8 below**:**

Table 7: Regression analysis (ANOVA)

Analysis of Variance (ANOVA[a])						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4589.553	2	2294.776	2.224	.115[b]
	Residual	75322.434	73	1031.814		
	Total	79911.987	75			

a. Dependent Variable: Percentage of Modules Passed

b. Predictors: (Constant), Initial Reading Scale Score, Initial Numeracy Scale Score

The probability value ($p>0.05$) means that the predictor variables do not explain a statistically significant amount of the variability on the dependent variable. As anticipated, the coefficients for the regression equation show a similar pattern (see Table 8).

Table 8: Regression analysis (Coefficients)

Coefficients[a] for Regression Equation (Dependent variable – Percentage of Modules Passed)								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-2.490	33.694		-0.074	0.941	-69.643	64.662
	Initial numeracy scale score	0.032	0.055	0.080	0.591	0.556	-0.077	0.141
	Initial reading scale score	0.086	0.062	0.187	1.381	0.172	-0.038	0.209

a. Dependent Variable: Percentage of modules passed

The absence of statistically significant results indicates that the two independent variables should not be seen as efficient predictors of learner success.

DISCUSSION

This report describes our first attempt at developing a whole-of-organisation perspective on the literacy and numeracy performance of targeted Wintec learners in 2019. We compared the LN performance of three 2019 cohorts with the full 2019 Wintec group, reported in the regular LN progress reports (Greyling, et al., 2020a, b), to see how their performance compared with the overall group.

Cross-tabulations for reading and numeracy progress

The students in the three cohorts of students taught by NZCALNE(Voc) candidates performed above the Wintec mean for 2019:

Table 9: Difference in % of learners who progressed to exemption level for candidates' students compared to Wintec mean

Literacy domain	Performance of NZCALNE (Voc) candidates' learners: % progressing to exemption level	Wintec 2019 mean	Difference in favour of candidates' targeted students
Reading	50% (12 of 24 learners) N=24	40.4% (225 of 557 learners) N=557	9.6%
Numeracy	47.1% (8 of 17 learners) N=17	40.5% (197 of 486 learners) N=486	6.6%

These differences should be viewed with caution. That they occurred cannot be attributed unequivocally to the NZCALNE(Voc) candidates' training and their teaching strategies. Table 1 shows that the targeted learners for reading included step 2 and step 3 learners, while Table 2 shows that the targeted learners for numeracy included only step 3 and step 4 learners. It is easier to record progress at the lower end of the distribution than at the upper end.

Table 1 shows that 5 students scored at step 2 at the start, but that 4 of the 5 scored at exemption level on the progress assessment. This may seem significant; however, Table 6 shows that of the ten students in the larger group who achieved step 2 on their initial reading assessments, only 1 was able successfully to complete all modules enrolled for in 2019. Thus, Table 1 shows that the reading progress was significant, but Table 6 suggests that students who obtain step 2 scores on reading continue to struggle with successful module completion.

Extending this reasoning, we note that students on initial reading scores of step 3 (n=38), 47.1% (18 of 38 students) completed all their modules. This outcome shows that students on initial step 3 reading scores (i.e. a step below exemption level) have a reasonable (50/50) chance of success.

We may use similar reasoning for the difference in numeracy performance. Table 6 shows that students at step 1 and step 2 did not complete all their modules, while only 25% (2 of 8 students) of step 3 students completed all their modules. As for reading, if learners achieved a step 4 (i.e. a step away from exemption), they had a reasonable chance of success. Of the 31 students who scored at step 4, 41.9% (11 of 31 students) passed all their modules.

Table 5 and Table 6 also reveal that for students on exemption-level scores for reading and numeracy, fewer than 50% at each step level completed all their modules. The question has to be asked why this occurred as one would anticipate that with higher levels of reading and numeracy skills, learners' module completions would improve. Clearly, exemption-level scores on reading and numeracy are not a guarantee of successful module completion. A further question has to explore how students who enter on exemption-level scores can be managed so that their level of module completions may improve. Factors other than reading and numeracy are clearly at play.

T-test results

The above dynamic may also be used to explain the t-test result reported in Table 3. Although statistically significant gain is reported for reading, this gain has to be viewed against the results in Table 5. Although statistically significant reading gain has been recorded, we note that for step 2 learners, the distance between their level of skill and the demands of their courses poses too big a challenge.

Table 4 shows that the differences between initial and progress scores were not statistically significant. This is supported by the information in Table 6: at all step levels fewer than 50% of learners completed all their modules. Table 2 also shows that 21.4% (3 of 14 students) who obtained step 4, regressed to step 2 on progress assessments. A factor that could have affected the scores remain the low-stakes status of the LN assessment tool results: if the LN assessments do not count towards credits, what is the cost or benefit for learners? The messaging of LN assessments should remain a priority. Also, as stated earlier, there could be several other factors at play.

Regression analysis

The regression analysis was not significant. In other words, initial reading and numeracy scores did not explain a significant proportion of the variability on the dependent variable labelled as the *Percentage of Modules Passed.* We could argue that the LN-embedding interventions of the candidates had a confounding effect because LN-embedding strategies used by tutors impacted on student success. Thus, we could see this result as evidence of student progress and improved performance.

CONCLUSIONS AND RECOMMENDATIONS

We concluded that this report could serve as a first step in beginning to track the module-level success of learners in relation to their reading and numeracy performance at the start of each programme. We showed that cross-tabulations remained a meaningful way of tracking shifts in reading and numeracy step-based performance and that meaningful links could be explored between LN performance and *completion variables* defined as either a categorical pass/fail binary, or continuous scale scores.

Our main conclusions were that

- sample sizes for the selected cohorts were too small to come to any unequivocal conclusions as small shifts in student performance in these small cohorts had dramatic effects on the measurement outcomes.
- variables other than literacy and numeracy impact on student success,
- students whose reading and numeracy performance on initial reading and numeracy scores were two or more steps below the exemption levels did not have a reasonable chance of passing all their modules; and
- that a multifactorial model be developed to uncover the complexities that are hidden in student performance.

We recommend that

- a multifactorial model be developed to explain the complexities of student performance.
- the pursuit of a whole-of-organisation perspective remain a priority goal.
- larger numbers of NZCALNE(Voc) candidates be included so that their impact can be investigated with more precision.
- other methodologies and/or interventions be considered to lift outcomes for students.

REFERENCES

Greyling, W., Ahmad, F. and Wallace, N. (2020a). Literacy and Numeracy Assessment (LNAT) tool reading progress for targeted Wintec learners in 2019. Hamilton: Wintec (Institutional report).

Greyling, W., Ahmad, F. and Wallace, N. (2020b). Literacy and Numeracy Assessment (LNAT) tool numeracy progress for targeted Wintec learners in 2019. Hamilton: Wintec (Institutional report).

Greyling, W., Ahmad, F. and Wallace, N. (2020c). Trends in LN-embedding practices at Waikato Institute of Technology (Wintec) in 2019. Hamilton: Wintec (Institutional report).\

IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

Tertiary Education Commission (TEC) (2009). Strengthening literacy and numeracy: Theoretical framework. TEC Wellington, New Zealand.

Tertiary Education Commission (TEC) (2012). Indicators for literacy and numeracy provision and gain. Version 0.4, August 2012, TEC, Wellington, New Zealand.

Wintec LN Policy (Revised) (2018a), accessed on 14 January 2020 at URL: https://wintecac.sharepoint.com/sites/qua/academic_support_web/regulatoryhierarchy/Policy_Web

Wintec (2018b). *Ako: Teaching and Learning Directions*. Hamilton: Wintec (Internal Publication).