### **Feature Article**

# LONG-RUN IMPACT OF VOCATIONAL SECONDARY EDUCATION

# POVERVIEW O

Singapore's education system has long offered students a range of educational pathways so that students can learn at a pace that suits them. In 1981, students were assigned to one of three courses — Normal, Express and Special — based on their Primary School Leaving Examination (PSLE) scores. In 1994, the Normal course was differentiated into the Normal (Academic) [N(A)] and Normal (Technical) [N(T)] courses, with the latter aimed at reducing dropout rates and supporting students who were inclined towards a vocational secondary education.



# FINDINGS

### Finding 1:

Among students with comparable PSLE scores, those who attended the N(T) course were 3.2 percentagepoints (pp) more likely to complete secondary school, and 7.6 pp more likely to attain post-secondary qualification compared to those who attended the N(A) course.



### Finding 2:

In terms of labour market outcomes (i.e., employment, earnings and wealth accumulation), those who attended the N(T) and N(A) courses had comparable outcomes.



### **POLICY TAKEAWAY**

These findings suggest that the policy objectives of the N(T) course, in terms of reducing dropout rates and enhancing access to vocational quantifications, had been met. They also challenge common perceptions about disparities between educational courses and highlight the importance of providing multiple pathways to success in education given that they could create meaningful opportunities for all students, regardless of the specific course pursued.

Indeed, choosing a course based solely on its perceived benefits (on average) might lead to adverse individual outcomes in some instances; for example, our results implied that comparable students who attended the N(A) course were less likely to complete secondary education and obtain a post-secondary qualification compared to those who attended the N(T) course.



# ♀ EXECUTIVE SUMMARY ♀

- Singapore's education system has long offered students a range of educational pathways so that students can learn at a pace that suits them. In 1994, the Normal course was differentiated into the Normal (Academic) [N(A)] and Normal (Technical) [N(T)] courses, with the latter aimed at reducing dropout rates and supporting students who were inclined towards a vocational secondary education.
- In this study, we examined the long-run impact of vocational secondary education on students. Specifically, we compared the highest education attained and labour market outcomes of students who attended the N(T) course against those of students who attended the N(A) course, focusing on the first five cohorts of N(T) and N(A) students. To estimate the causal impact of attending the N(T) course, we used a regression discontinuity design, which compared the outcomes of students who scored just above versus those who scored just below the Primary School Leaving Examination (PSLE) cut-off score used to assign students to the N(A) or N(T) course.
- We found that students who attended the N(T) course were 3.2 percentage-points (pp) more likely to complete
  secondary school and 7.6 pp more likely to attain a post-secondary qualification, typically from the Institute
  of Technical Education (ITE), compared to those who attended the N(A) course. However, these students
  were also 3.1 pp less likely to obtain a degree from publicly-funded universities. In terms of labour market
  outcomes (i.e., employment, earnings and wealth accumulation), we found that the N(T) and N(A) students
  had comparable outcomes.
- Taken together, our findings indicate that attending the N(T) course resulted in a higher level of minimum
  education attained by its students by increasing their likelihood of completing secondary education and
  obtaining a post-secondary qualification, while also maintaining comparable labour market outcomes. This
  suggests that the policy of having an N(T) course effectively achieved its goals of reducing dropout rates and
  supporting students who were inclined towards vocational secondary education.

The views expressed in this paper are solely those of the authors and do not necessarily reflect those of the Ministry of Trade and Industry (MTI), the Ministry of Education (MOE), or the Government of Singapore.<sup>1</sup>

### INTRODUCTION

Streaming in Singapore's secondary schools began in 1981 with students assigned to one of three courses — Normal, Express and Special<sup>2</sup> — based on their Primary School Leaving Examination (PSLE) scores. Streaming then was a form of curriculum customisation to allow students of varying academic abilities to learn at a pace that suited them. This was intended to ease the difficulty in learning for students with weaker academic abilities and maintain their interest in schooling.

In 1994, the Normal course was differentiated into the Normal (Academic) [N(A)] and Normal (Technical) [N(T)] courses. This change was aimed at supporting students who were inclined towards vocational education to progress to secondary school, thus allowing them to benefit from 10 years of formal education (Ministry of Education, 2019). The N(T) course enabled students to engage in more vocational subjects, culminating in the Singapore-Cambridge General Certificate of Education Normal Level (GCE N-Level) after four years, which prepared them for post-secondary education at the Institute of Technical Education (ITE). Conversely, the N(A) course remained a five-year programme culminating in the GCE Ordinary Level (GCE 0-Level).

The difference in the curriculum offered by the N(T) and N(A) courses could have led to differential impact on students' highest education attained and labour market outcomes. This study thus examined the causal impact of attending the N(T) course on N(T) students' longer-term education and labour market outcomes, compared to those who attended the N(A) course. Our study focused on the first five cohorts of students — i.e., those who took their PSLE between 1993 and 1997 — who were offered the N(T) and N(A) courses in secondary schools.

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<sup>2</sup> The Normal course was a five-year programme that culminated in the GCE O-Level. By contrast, the Express course was a four-year programme leading to the GCE O-Level. The Special course, on the other hand, allowed students to study English and their Mother Tongue at first-language levels while following the four-year curriculum leading to the GCE O-Level.

The rest of the article is organised as follows. We begin with a brief review of the academic literature related to streaming in schools, followed by a description of the data and methodology used in our study. We then present our findings, concluding with a summary of our results and their policy implications.

### LITERATURE REVIEW

Streaming, which is synonymous with "tracking" in the academic literature, refers to the assignment of students to different types of learning environments such as schools, classes or courses, and has been a subject of extensive research and debate in the field of education. Proponents of streaming have argued that it accommodated the diverse abilities and interests of students, allowing them to thrive in environments tailored to their specific learning needs.

Terrin and Triventi's (2023) meta-analysis of the research on streaming found that streaming could positively influence student learning and performance by enabling educators to align their pedagogical strategies with the varying needs of students. From a human capital perspective, streaming also allowed for greater gains from specialisation, as the accumulation of human capital (whether academic or vocational) was faster if students specialised early (Volker and Schütz, 2007).

On the other hand, concerns have also been raised regarding the potential negative implications of streaming, particularly in relation to educational inequality. In particular, critics have argued that streaming might exacerbate disparities in school achievement due to peer group effects and uneven resource allocation. For instance, low-performing students might miss out on the advantages of interacting with high-performing peers, while schools might disproportionately assign the most capable teachers to higher-ability classes (Terrin and Triventi, 2023).

Empirical studies around the world have yielded mixed findings on the effects of streaming. Duflo et al. (2011) investigated the impact of streaming within the context of the 2005 Extra Teacher Programme in Kenya. In their study, schools were divided into two groups: one where students were randomly assigned to sections and another where students were streamed based on their examination scores. The results indicated that students in schools that did streaming achieved significantly higher math and literacy scores compared to those in non-streaming schools, a trend that persisted across the entire spectrum of initial achievement levels.

Conversely, Betts and Shkolnik (2000) utilised data from the Longitudinal Study of American Youth to assess the effects of ability grouping on average math scores. Their findings showed that grouping students by ability had no significant overall impact on average scores and also had little to no differential effects across high-achieving, average and low-achieving students. Similarly, Figlio and Page (2002) drew upon data from the National Educational Longitudinal Study and the Schools and Staffing Survey in the US to compare achievement gains between similar students in schools with and without streaming. Their analysis found no evidence that streaming had an impact on low-ability students.

In sum, the existing empirical literature reveals a lack of consensus regarding the effects of streaming, with the outcomes found likely dependent on how streaming was operationalised as well as variations in school quality across the different contexts. Given Singapore's smaller size and significant investment in education, our streaming policy was likely more uniformly implemented, resulting in less variations in the quality of schools offering N(T) and N(A) courses compared to other countries. We thus aimed to contribute to the discourse in the literature by studying the effects of attending the N(A) course on students' highest education attained and labour market outcomes.

### DATA AND SUMMARY STATISTICS

Our study focused on students who took the PSLE between 1993 and 1997, and subsequently attended either the N(T) or N(A) course. We merged education data, including PSLE scores, stream eligibility and stream attendance, with an individual-level longitudinal administrative dataset that contained demographic, economic and other educational characteristics for selected years (i.e., 2006, 2009, 2012 and 2015).

Based on the data, students who attended the N(T) course had lower PSLE scores than those who attended the N(A) course on average (Exhibit 1). For those who attended the N(T) course, their highest education attained and annual incomes were also lower compared to those who attended the N(A) course. Specifically, only 7 per cent of N(T) students obtained a bachelor's degree from publicly-funded universities, in contrast to 26 per cent of N(A) students (Exhibit 2). Additionally, in 2012 and 2015 (when the N(T) and N(A) cohorts covered in the study would likely have been in the workforce for a few years), those who attended N(T) earned, on average, 31 per cent less than their N(A) counterparts (Exhibit 3).<sup>3</sup>

#### Exhibit 1: PSLE Score and Course Attended for the 1994 Cohort



Source: Authors' calculations





Source: Authors' calculations

3 The individuals covered in this study were aged 21 to 25 by 2006, and 30 to 34 by 2015. We focused on the average annual income from work for the years 2012 and 2015 as individuals from the N(T) and N(A) cohorts studied would likely have been in the workforce for a few years by then. Annual income data for the years 2006 and 2009 were excluded because some individuals might have still been pursuing further studies during those years. This delayed labour force participation effect was particularly noticeable among males, who typically had to complete National Service before formally entering the workforce.

#### Exhibit 3: Average Annual Income from Work, 2012 and 2015



However, the differences in the highest education attained and labour market outcomes presented thus far could be due to the underlying academic ability of the students, and not specifically because of the course that they attended (i.e., N(T) or N(A) course), as those who attended N(T) had lower PSLE scores. Beyond academic ability, various observable and unobservable factors (e.g., family resources, the quality of primary school peers, motivation and individual aptitudes) could have also affected the students' outcomes. For example, parents of N(T) students had lower annual incomes in 1996 (Exhibit 4), and N(T) students had peers with slightly lower average PSLE scores<sup>4</sup> (Exhibit 5).



#### Exhibit 4: Parents' Annual Income in 1996

Source: Authors' calculations

<sup>4</sup> This variable was constructed by calculating the average PSLE score of all other students in the school who took the PSLE, excluding the individual's own PSLE score.



#### Exhibit 5: Average PSLE Score of Primary School Peers, 1993 – 1997

Source: Authors' calculations

## **METHODOLOGY**

To estimate the causal impact of attending the N(T) course relative to attending the N(A) course on highest education attained and labour market outcomes, the study must address the various confounding factors described above. To do so, the study exploited the quasi-random variation in stream attendance resulting from the stream eligibility criteria based on PSLE scores (i.e., students were eligible for different courses based on specific PSLE score cut-offs). Specifically, those eligible for the N(T) course scored below a designated PSLE score cut-off, identified by the highest score attained by students eligible for the N(T) course in each exam cohort. For instance, in 1993 and 1994, students scoring 149 and below were eligible for the N(T) course, while those scoring above 149 were allowed to choose between the N(T) and N(A) courses (Exhibit 6). Among those given a choice, approximately 96 per cent opted for the N(A) course (Exhibit 7).

#### Exhibit 6: PSLE Cut-Off Scores for Each Course, 1993 to 1997

Course Eligibility	PSLE Score Required					
	1993	1994	1995	1996	1997	
N(T)	≤149	≤149	≤150	≤151	≤151	
N(T)/N(A)	150 – 159	150 – 159	151 – 160	152 – 160	152 – 160	
N(A)	≥160	≥160	≥161	≥161	≥161	

Source: Authors' calculations



#### Exhibit 7: Comparison of Course Eligibility and Course Attended for the 1994 Cohort

Note: The graphs above show the PSLE score cut-offs for the exam year of 1994. Graphs for the other exam years show similar patterns. Course attended refers to the Secondary 1 course of study and course transfers within the school in later years were not captured. Each point represents the "average course eligibility" or "average course attended" for each PSLE score. The slight "bumps" in the graph for course attended indicate that there were exceptions for some individuals whose PSLE score fell below the cut-off score for the N(A) course. For instance, across the years studied, there were on average 12 successful appeal cases for the N(A) course even though their PSLE scores fell below the respective years' PSLE cut-off score for the course. Source: Author's calculations

We then employed a regression discontinuity (RD) design methodology, which entailed comparing the outcomes of students who scored just below the cut-off score for the N(T) course with those who scored just above the score. The key assumption in this approach is that students who scored just below or above the cut-off are similar in terms of unobserved individual abilities and characteristics. By comparing the outcomes of students who scored below the cut-off and attended the N(T) course, with those of students who scored above the cut-off and attended the N(A) course, we would be able to isolate the impact of streaming. To further ensure comparability between students above and below the cut-off, we accounted for observable individual characteristics, including race, gender, exam cohort, age at the time of the PSLE, average PSLE scores of primary school peers, and parents' socio-economic status as indicated by household income and the father's annual income in 1996. We also included an indicator for dual-earner families.

Specifically, to examine the effect of attending the N(T) course on outcomes, we used the following RD specification:

$$Y_i = \alpha_0 + \beta_1 [score_N T_i \ge 0] + \beta_2 score_N T_i + \beta_3 [score_N T_i \ge 0] \times score_N T_i + X_i \beta_4 + \varepsilon_i$$

Where:

- Y<sub>i</sub> denotes the outcomes of interest for individual *i*. For highest education attained, we analysed four distinct indicators: (i) completed at least secondary education, (ii) completed at least ITE, (iii) obtained at least a diploma, and (iv) obtained at least a degree from publicly-funded universities. This approach was chosen to ensure that an increase in the likelihood of one outcome would not result in a decrease in another. Labour market outcomes studied included employment, earnings and Central Provident Fund (CPF) Special Account (SA) balances (as a proxy for wealth accumulation)<sup>5</sup>;
- score\_NT<sub>i</sub> corresponds to the recentred PSLE score, which is the difference between the PSLE cut-off score in a given year and the actual PSLE score. For example, in 1993 and 1994, the PSLE cut-off score of 149 would be recentred to 0, and a score of 150 would then be -1, while a score of 148 would be 1;
- $1[score_NT_i \ge 0]$  is an indicator variable that equals 1 if individual *i* met the cut-off score for the N(T) course;
- X<sub>i</sub> is a vector of control variables that includes indicators for gender, race, whether the family was a dualearner household in 1996, the exam year, and whether individual *i* was younger or older than 12 at the time of the PSLE. It also includes the average PSLE score of primary school peers and the annual incomes of the father and household in 1996;
- $\varepsilon_i$  represents the error term.

The coefficient of interest,  $\beta_1$ , represents the effect of attending the N(T) course on educational and labour market outcomes, relative to attending the N(A) course.

### **RESULTS AND DISCUSSION**

In this section, we present and discuss the findings of our regression analysis on the educational and labour market outcomes of attending the N(T) course.

### **Educational Outcomes**

<u>First</u>, we present findings on how attending the N(T) course affected highest education attained (Exhibit 8). Our results showed that students who fell below the PSLE score cut-off and attended the N(T) course were 3.2 percentage-points (pp) more likely to complete secondary school. In other words, vocational secondary education raised the secondary school completion rate by about 3.2 pp (relative to the baseline mean of 93 per cent), which meant that the dropout rate was nearly halved. This was a significant achievement consistent with the policy goals of the N(T) course. Furthermore, students who attended the N(T) course were 7.6 pp more likely to attain a post-secondary qualification, usually a National ITE Certificate (Nitec) or Higher Nitec qualification from the ITE. They were also found to be as likely as N(A) students to obtain a diploma, although their odds of attaining a bachelor's degree from publicly-funded universities were 3.1 pp lower. On balance, our findings suggest that attending the N(T) course significantly improved the minimum education attained of students, chiefly by reducing the odds of adverse outcomes (e.g., dropping out of secondary school or not achieving any post-secondary qualification).

#### Exhibit 8: Summary of Regression Estimates for Highest Education Attained

Effect of Attending N(T) Course on:	%-point	Bandwidth <sup>1,2</sup>	Number of Observations	
Completing at least secondary education	3.2***	±13	17,200	
Completing at least ITE	7.6***	±13	17,200	
Obtaining at least a diploma	-1.7	±13	17,200	
Obtaining at least a bachelor's degree	-3.1***	±14	18,500	

Notes: [1] The bandwidth refers to the range of PSLE scores around the cut-off that were included in the analysis. For the 1993 and 1994 cohorts where the cut-off was 149 for example, a bandwidth of ±13 meant that students who scored between 136 and 162 were included in the analysis. The bandwidth choice represents a trade-off: a larger bandwidth provided more observations for statistical power, while a narrower bandwidth ensured comparison between more similar students. The optimal bandwidth was determined by minimising the mean squared error (MSE) of the estimated treatment effect, which balanced these competing considerations. [2] Results held up to falsification tests (i.e., replacing the true cut-off with a placebo cut-off) and were robust to variations in bandwidth choice, polynomial order, and kernel function.

\*\*\* denotes statistical significance at the 1 per cent level. Source: Authors' calculations

#### Source: Authors Calculation

### Labour Market Outcomes

<u>Second</u>, we present findings on whether attending the N(T) course had an impact on labour market outcomes, focusing on the following measures — likelihood of being employed, number of months employed, annual income and CPF SA balances. On average, we found no significant differences in these outcomes between individuals who attended the N(T) course and those who attended the N(A) course (Exhibit 9).

#### Exhibit 9: Summary of Regression Estimates for Labour Market Outcomes

Effect of Attending N(T) Course on:	Bandwidth	Number of Observations				
Employment						
Being Employed	1.0 %-pt	±15	20,300			
Number of Months Employed	0.2 months	±16	21,600			
Earnings						
Annual Income	0.9%	±15	19,000			
Wealth						
CPF SA	4.9%	±15	20,000			

Source: Authors' calculations

Taken together, our findings suggest that the course that individuals attended in secondary school – whether N(T) or N(A) – had a limited impact on their labour market outcomes. The average differences in outcomes observed in the data likely reflected underlying differences in the socioeconomic background and ability of individuals who attended N(T) or N(A) instead.

### CONCLUSION

Our study on the causal impact of attending the N(T) course presents a more accurate view of the educational and labour market outcomes of N(T) students, compared to simple observations of the average differences in outcomes between N(T) and N(A) students. Notably, our study found that the N(T) course significantly improved the highest education attained of its students by increasing their likelihood of completing secondary education and obtaining post-secondary qualifications. These findings suggest that the policy objectives of the N(T) course, in terms of reducing dropout rates and enhancing access to vocational qualifications, had been met.

When examining longer-term labour market outcomes, our results showed that students who attended the N(T) course had similar employment rates, earnings and wealth accumulation as those who attended the N(A) course. This finding challenges common perceptions about disparities between educational courses and highlights the importance of providing multiple pathways to success in education given that they could create meaningful opportunities for all students, regardless of the specific course pursued. Indeed, choosing a course based solely on its perceived benefits (on average) might lead to adverse individual outcomes in some instances; for example, our results implied that students who attended the N(A) course were less likely to complete secondary education and obtain a post-secondary qualification compared to those who attended N(T).

It is also worth noting that the Ministry of Education has moved to full subject-based banding since 2024, which can better cater to the unique interests and strengths of each student. This inclusive approach enables students to study different subjects at varying levels, fostering a more flexible secondary education system that adapts to their learning needs while empowering students to make informed choices that align with their personal goals and aspirations.

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### REFERENCES

Betts, Julian R., and Jamie L. Shkolnik. "Key difficulties in identifying the effects of ability grouping on student achievement." *Economics of Education Review* 19, no. 1 (2000): 21-26.

Duflo, Esther, Pascaline Dupas, and Michael Kremer. "Peer effects, teacher incentives, and the impact of tracking: Evidence from a randomized evaluation in Kenya." *American economic review* 101, no. 5 (2011): 1739-1774.

Figlio, David N., and Marianne E. Page. "School choice and the distributional effects of ability tracking: does separation increase inequality?." *Journal of Urban Economics* 51, no. 3 (2002): 497-514.

Meier, Volker, and Gabriela Schütz. *The economics of tracking and non-tracking*. No. 50. Ifo working paper, 2007.

Ministry of Education. "Supporting Our Students Through the Years — Evolution of Streaming in Secondary Schools." Prepared for the Committee of Supply, 2019. <u>https://www.moe.gov.sg/microsites/psle-fsbb/assets/infographics/full-subject-based-banding/Evolution-of-Streaming.pdf</u>.

Terrin, Éder, and Moris Triventi. "The effect of school tracking on student achievement and inequality: A meta-analysis." *Review of Educational Research* 93, no. 2 (2023): 236-274.

