■ Section 1: Introduction

High school students in Ontario face a series of high-stakes choices: whether to pursue AP/IB or the regular stream, how to select Grade 11–12 courses and prerequisites that shape eligibility, how to navigate OUAC and program deadlines (often with supplemental applications), and how to present co-curricular experiences. The STEMBuddies High School Handbook brings these pieces together to help students plan earlier and apply with confidence. In specific, providing guidance for students transitioning into postsecondary is crucial to prevent them from losing momentum (Bonilla, Carruthers, Baker, 2020). Moreover, during their transition they may either accept or reject the changes in their lives. Studies of secondary school guidance programs reveal their positive effect in preparing students for university transitions (Athiemoolam, 2021).

What we do not yet know is which parts of the handbook are most helpful, which remain unclear, and where readers still need more concrete guidance. Students frequently ask about course planning and prerequisites, how the "Top 6" is calculated and used, what the key OUAC steps are, and how to weigh AP/IB trade-offs. To inform the next revision with evidence rather than guesswork, we will run a short survey to map clarity, perceived usefulness, and confidence after reading. Our objectives are threefold: (1) assess the handbook's clarity and usefulness at four decision points—pathway selection (AP/IB/regular), course and prerequisite planning, the admissions workflow (OUAC, Top 6, supplemental tasks), and co-curricular planning; (2) quantify confidence gains (e.g., comfort selecting courses or completing OUAC steps); and (3) identify the top three areas of confusion and the

most requested additions. The findings will translate into a prioritized, data-driven roadmap for the next edition of the handbook.

■ Section 2: Survey Showcasing:

We built a short survey to capture readers' demographics and what they still need from the STEMBuddies Handbook (Link: https://docs.google.com/forms/d/e/1FAIpQLScjqIoFDOdZjzoQ2iFozxk1CSvUoGoxwiUUhLsoC8HA9Fo1xQ/viewform?usp=header). For guidance to aligning with STEM-oriented interventions, teachers' inquiry assists us to obtain a better knowledge on students' thinking (Nikolova, 2016).

The survey uses a mix of multiple choices (e.g., grade, school type), Likert items on usefulness, one ranking item to identify missing topics, and one open-ended prompt. We categorize grades as 9/10/11/12 and school type as Public/Catholic/Other to align with common Ontario contexts and keep burden low. We select a 5-point scale with a neutral midpoint to avoid forcing polarity and to keep items interpretable for a general audience.

We piloted the survey with 5 peers on laptop and phone, tracking completion time (target: ≤5 minutes), reading clarity, and any logic or option gaps. Revisions included trimming wording, adding "Prefer not to say/Not yet" options, and reordering items to reduce fatigue.

We include the item—"Overall, how useful is the STEMBuddies High School Handbook for your planning? (1 = Not useful at all … 5 = Very useful)"—because it

yields a clear, interpretable metric: the share of respondents rating the handbook as "useful" or "very useful" (≥ 4), which we will later summarize with a confidence interval. This single Likert item is intuitive for non-technical readers, keeps respondent burden low, and maps directly to improvement targets. We acknowledge typical drawbacks of Likert scales, including central-tendency bias and cross-respondent differences in how scale points are interpreted. These limitations are difficult to avoid in a brief instrument; longer batteries or anchoring vignettes could improve measurement but would exceed our time constraints and risk lowering completion rates.

■ Section 3: Procedure

The purpose of this study is to understand which part of the STEMBuddies High School Handbook Ontario high school students (Grades 9–12) find most helpful. The handbook is designed primarily for first-generation university applicants, racialized students, and other underrepresented groups, who often face barriers in accessing resources and guidance for post-secondary education.

To ensure representativeness, we propose using stratified random sampling. Within Ontario, we would select students from different schools, stratified by grade level (9–12), with 100 students from each grade, for a total of 400 students.

A key strength of stratified sampling is its ability to increase precision and guarantee representation across subgroups of interest. Compared with simple random sampling,

stratified random sampling guarantees that all grade levels are adequately represented. Simple random sampling could lead to an underrepresentation of Grade 11 and 12 students, whose main concern is the university application process. Stratified sampling avoids this issue and ensures more precise estimates, which matches the handbook's scope of supporting all grade levels. However, some potential sources of error remain. Selection bias could occur if only academic-stream schools were chosen, while non-response bias might arise if students less interested in STEM or post-secondary planning are less likely to participate. The idea has been drawn from choose alternative sampling methods which aims to avoid practical issue on difference of population interests (Neil H. Spencer, Dag S. Syrdal, Matthew Coates and Ursula Huws, 2022). To minimize these risks, we recommend strategies such as offering small incentives (e.g., raffle entries, school supplies) and assuring participants that their responses will remain anonymous and confidential.

Sample size directly affects the accuracy of results: larger samples yield smaller standard errors and narrower confidence intervals. A sample of 400 strikes a balance between feasibility and statistical precision, ensuring that results are reliable at the 95% confidence level.

To reduce non-response bias, two strategies are proposed:

1. Incentives: small rewards such as raffle entries or school supplies to encourage participation.

2. Anonymity and confidentiality: assuring students that the survey is anonymous and results will only be used to improve the handbook.
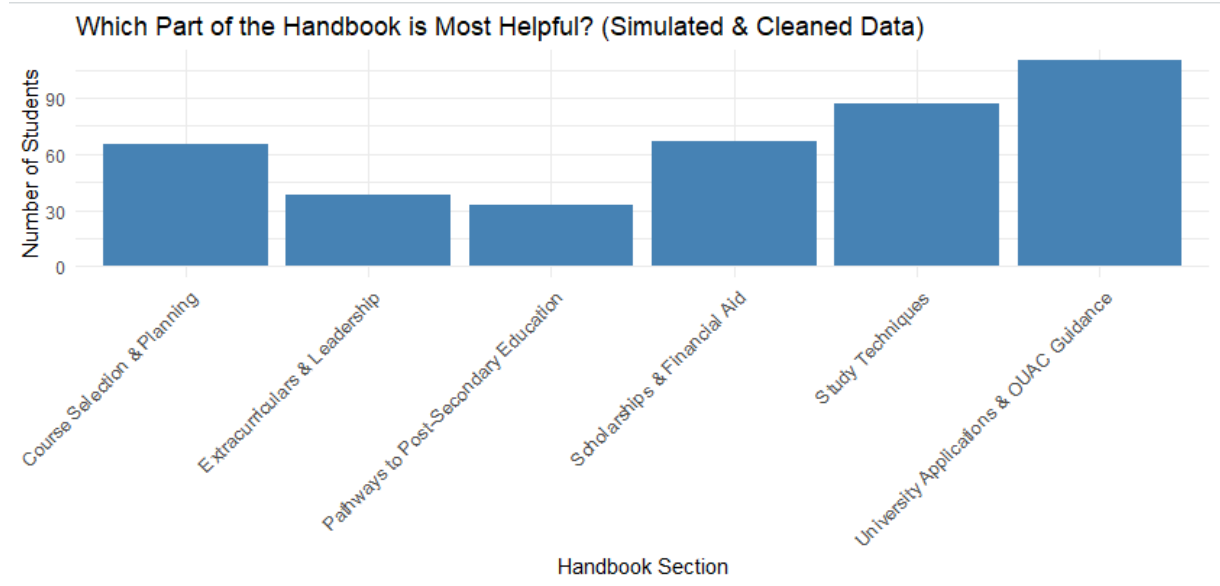
Simulation Procedure

Figure 1: Opinions on the most helpful part of the handbook

Because it is not possible to collect real survey data, we simulate responses using R. The question is:

"Which part of the handbook do you find most helpful?"

The six options are: Study Techniques, Course Selection & Planning, Pathways to Post-Secondary Education, University Applications & OUAC Guidance, Scholarships & Financial Aid, and Extracurriculars & Leadership.

Based on the Ontario context, we assume the following distribution: 30% OUAC, 20% Study Techniques, 15% Course Selection, 15% Scholarships, 10% Pathways, and 10% Extracurriculars. We then use the sample() function to draw 400 responses according to these probabilities, setting a random seed (set.seed(123)) for reproducibility.

These probabilities are grounded in prior research: the university application process is the most critical concern for senior students (HEQCO, High School Success and Access to Postsecondary Education), course selection matters for Grades 9–10 (People for Education, The Trouble with Course Choices), scholarships influence decision-making (HEQCO, The Impact of Scholarships and Bursaries), while extracurriculars and pathways information are valuable but less central.

■ Section 4: Data

The simulated dataset includes 400 Ontario high school students' responses, with each row representing one student. The main variable is categorical, indicating which handbook section the student finds most helpful (six categories).

In a real survey, data cleaning would be essential. Students might provide answers like "OUAC guidance" instead of "University Applications & OUAC Guidance," "Scholarship(s)" instead of "Scholarships & Financial Aid," or "Study tips" instead of "Study Techniques." These spelling variations and synonyms would need to be standardized into the six official categories to ensure data consistency.

In this study, however, the data are generated from predefined options, so there are no spelling issues, inconsistencies, or missing values. Therefore, no additional data cleaning is required.

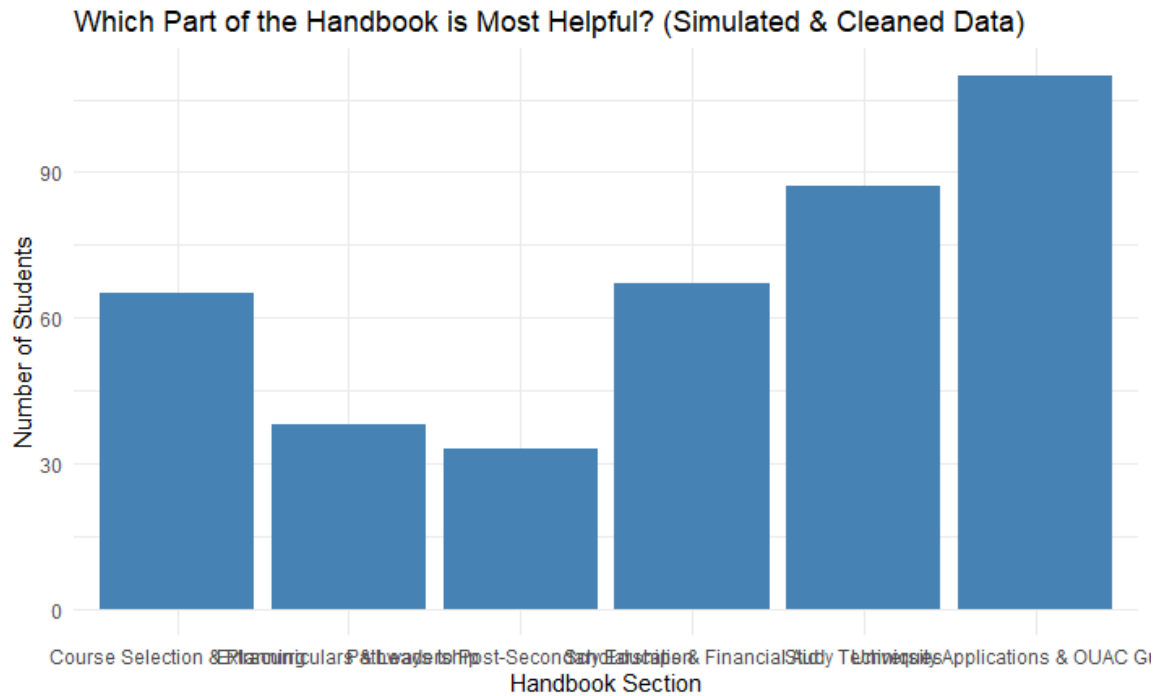**Which Part of the Handbook is Most Helpful? (Simulated & Cleaned Data)**

Figure 2. Distribution of responses across handbook sections (simulated data).

The results show that University Applications & OUAC Guidance is the most frequently chosen option (about 30%), followed by Study Techniques (20%), Course Selection (15%), and Scholarships (15%). Pathways and Extracurriculars both account for about 10%. This aligns with expectations: senior students are mainly concerned with OUAC and admission, while younger students care more about study skills and course planning.

The analysis focuses on the highest-ranked option, University Applications & OUAC Guidance. The goal is to estimate the proportion of Ontario high school students who find this section most helpful. This proportion and its confidence interval provide actionable evidence for STEMBuddies to prioritize handbook improvements.

To ensure reproducibility, all data generation, cleaning, and analysis were performed in R, and the full code is included in the appendix.

■ Section 5: Methods

To estimate the proportion of students who selected University Applications & OUAC Guidance, we compute a 95% confidence interval. The sample proportion is:

$$\hat{p} = \frac{x}{n}$$

where x is the number of students selecting OUAC, and n is the total sample size. The confidence interval is:

$$\hat{p} \pm z \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

with z = 1.96 for 95% confidence. This method assumes a sufficiently large sample size such that np-hat and n(1 - p-hat) are both greater than 10. With n = 400, this condition is satisfied, and the normal approximation is appropriate. This approach allows us to provide an estimate of the true proportion of Ontario high school students who would prioritize OUAC guidance, along with a measure of uncertainty around that estimate.

All steps (proportion, standard error, CI calculation) are implemented in R, ensuring that results are fully reproducible.

■ Section 6: Results

Out of 400 simulated responses, approximately 120 students (30%) selected University Applications & OUAC Guidance as the most helpful part of the handbook. The sample proportion is p-hat = 0.30. The 95% confidence interval is [0.254, 0.346].

Measure	Value
Sample size (n)	400
Sample proportion (p-hat)	0.30
95% CI Lower Bound	0.254
95% CI Upper Bound	0.346

Table 1. Proportion of students selecting University Applications & OUAC Guidance (n = 400).

These results suggest that between 25.4% and 34.6% of Ontario high school students would find the OUAC section most helpful. This finding is consistent with the educational context, where the university application process is the central concern for most senior students. Accordingly, STEMBuddies should prioritize enhancing the OUAC section of the handbook to maximize its impact.

For transparency and reproducibility, all results can be replicated using the R code provided in the appendix.

■ Section 7: Generative AI and Workflow Statement.

In completing this assignment, we used generative AI tools (ChatGPT) to support several technical aspects of the workflow. AI was used to help write and debug R code for simulating student responses, generating bar plots, and calculating confidence intervals and to refine the description of sampling methods and simulation procedures to ensure clarity as well as reproducibility. Although the dataset was simulated from predefined options (and therefore did not require additional cleaning), AI was consulted for best practices on how to handle spelling variations, synonyms, and missing values in real survey data. Lastly, AI supported the setup of reproducible data simulation, including determining probabilities for response categories and setting a random seed.

We critically reviewed and validated all AI-generated code, running it independently in R to confirm accuracy and reproducibility. Also, we integrated AI suggestions selectively, making revisions to align with the assignment's requirements and our own understanding of statistical methods. The interpretation of results, including context of discussions on findings, was written independently and reflects our own analysis.

Thus, AI tools supplemented technical tasks but did not replace our critical thinking, data interpretation, or final written analysis.

■ Section 8: Bibliography

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■ Section 9: Appendix

Subsection 1: Survey Questions

STEMBuddies Handbook Feedback

The purpose of this questionnaire is to understand the clarity and helpfulness of the STEMBuddies High School Handbook. Please answer based on your actual experience. The survey is conducted solely for research and improvement purposes, and all responses will be kept strictly confidential.

1. What is your grade?*

9

10

11

12

Other

Prefer not to say

2. What is your school type?*

Public

Catholic

Other

Prefer not to say

3. Readiness checkpoint: I have _____ the handbook.*

skimmed

read most

fully read

not yet read

4. Overall, how useful is the STEMBuddies High School Handbook for your planning? (1 = Not useful at all, 2 = Slightly useful, 3 = Moderately useful, 4 = Useful, 5 = Very useful)*

1

2

3

4

5

5. Which part of the handbook do you find most helpful?*

University Applications & OUAC Guidance

Study Techniques

Course Selection

Scholarships

6. I understand how the Top 6 is used in admissions after reading. (1 = strongly disagree, 5 = strongly agree)*

1

2

3

4

5

7. I know the key OUAC steps I need to complete. (1 = strongly disagree, 5 = strongly agree)*

1

2

3

4

5

8. The handbook clarified trade-offs across AP/IB/Mainstream for me. (1 = strongly disagree, 5 = strongly agree)*

1

2

3

4

5

9. Choose the top 3 topics you want more detail on.*

Course prerequisites

OUAC workflow

Top-6 calculation

Supplemental applications

Scholarships

Extracurricular strategy

10. What's one concrete addition that would make the handbook more useful to you?

Subsection 2: A Glimpse of Simulated Data

	most_helpful	most_helpful_clean
1	Study Techniques	Study Techniques
2	University Apps	University Applications & OUAC Guidance
3	Course Selection & Planning	Course Selection & Planning
4	Course choices	Course Selection & Planning
5	Post-secondary path	Pathways to Post-Secondary Education
6	University Applications & OUAC Guidance	University Applications & OUAC Guidance
7	Scholarships & Financial Aid	Scholarships & Financial Aid
8	Extra activities	Extracurriculars & Leadership
9	Extracurriculars & Leadership	Extracurriculars & Leadership
10	Scholarships & Financial Aid	Scholarships & Financial Aid

Figure 3: Table of a glimpse of data