Student Services at Queen's University: An Evaluation of the Supported Learning Groups Pilot Program

Prepared by Jennifer Massey, Sean Field and Jeff Burrow
for the Higher Education Quality Council of Ontario

Higher Education Quality Council of Ontario
An agency of the Government of Ontario

Disclaimer:

The opinions expressed in this research document are those of the authors and do not necessarily represent the views or official polices of the Higher Education Quality Council of Ontario or other agencies or organizations that may have provided support, financial or otherwise, for this project.

Cite this publication in the following format:

Massey. J., Field, S., Burrow, J. (2012). *Student Services at Queen's University: An Evaluation of the Supported Learning Groups Pilot Program.* Toronto: Higher Education Quality Council of Ontario.

Published by:

The Higher Education Quality Council of Ontario

1 Yonge Street, Suite 2402
Toronto, ON Canada
M5E 1E5
Phone: (416) 212-3893
Fax: (416) 212-3899
Web: www.heqco.ca
E-mail: info@heqco.ca

Abstract

In an effort to enhance engagement and retention and improve grades in large undergraduate courses, the use of Supplemental Instruction (SI) has grown considerably across North American campuses. As institutional budgets are squeezed and the size of first-year classes grows, SI has become an important component in the delivery of undergraduate education. Critical examination of the impacts of SI on student success is limited, however, and a deeper understanding of the strengths and weaknesses of this approach is needed given its growing prevalence.

This paper critically assesses the impact of one approach to SI, specifically, Supported Learning Groups (SLGs) at Queen's University. Our findings indicate that several factors influence the likelihood students will attend SLG sessions, including gender, year of study, previous academic performance, and domestic student status. Holding SLG sessions in on-campus student residences, we argue, is also likely to increase participation.

Our findings suggest that the SLG program at Queen's University has been an effective supplement to traditional academic resources such as seminars and lectures, and has shown signs of positive, although mixed, success during its pilot years by reinforcing academic best practices and providing guided study time for students who are at academic risk. We also assert that further research remains to be done to understand more fully the role of this program in supporting student success.

Acknowledgements

The authors of the report wish to express their sincere appreciation and gratitude to the many individuals who contributed throughout the various stages of this research project. This report would not have been possible without their contributions.

First, we would like to thank Elspeth Christie, Coordinator of Learning Strategies at Queen's University, for introducing the SLG program to Queen's and inviting us to measure the outcomes. Our thanks as well to Liz Parsons, the Coordinator of Supported Learning Groups, for her assistance in coordinating the collection of participation data each week.

We would also like to thank Dr. Jason Laker (former Associate Vice-Principal and Dean of Student Affairs), and the Department of Biology and Psychology, for all of their support and advice throughout the duration of the project.

We also wish to acknowledge the contribution of the General Research Ethics Board at Queen's University. We recognize the complexity of this type of study, and are therefore very grateful for the diligent and constructive advice that allowed us to capture the information needed in this study in an ethically responsible way.

Thank you as well, to Chris Conway, Director of the Office of Institutional Research and Planning at Queen's University, for assisting with the extraction of data from the student records system.

A sincere note of appreciation is extended to Lina Di Genova, Manager of Student Affairs Assessment at McGill University, who provided a thoughtful, critical review of an early draft of this report. Your comments, suggestions, and critiques were very useful.

Finally, we would like to express a genuine thanks to the Higher Education Quality Council of Ontario (HEQCO) for funding this study, and to all the participating students who answered the survey and participated in focus groups. This research would have been impossible to undertake without the information you provided.

Introduction

In recent years, the use of Supplemental Instruction (SI) has grown considerably across North American campuses in an effort to enhance student engagement and retention and improve grades in large undergraduate courses. Previous findings have suggested that students who participate in SI experience greater academic success and higher grades than students who do not participate (Arendale, 1997; Martin & Arendale, 1994; McInnis, 2001; Peat, Dalzeil, & Grant, 2001; Tinto, 2002; Yorke & Thomas, 2003;).

As institutional budgets are squeezed and first-year class sizes increase, SI has become an important component of the delivery of undergraduate education. Critical examination of the impacts of SI is limited, however, and a deeper understanding of the strengths and weaknesses of this approach to the delivery of undergraduate education is urgently needed given the growing use of SI across North America.

This report critically assesses the impact of one approach to supplemental instruction – Supported Learning Groups (SLGs) – and its impact at Queen's University. We argue that while SLGs are increasingly presented as a cost-efficient 'solution' to the growth in the number of large undergraduate courses, the impact of this program at postsecondary institutions remains institutionally specific. At Queen's, we find that when the endogenous impacts of demographic differences and entrance grades are controlled for, SLG participation has a mixed and largely statistically insignificant impact on students' final grades. We also find, however, that SLGs play an important role in enhancing student academic engagement. We therefore assert that SLGs are an effective addition to lectures and seminars at Queen's because they are consistent with engagement theory, but that their contribution remains supplemental.

We call for universities and colleges to consider carefully the reasons for implementing SLGs on their campuses, and to adopt an empirically informed and outcomes-based approach. We also call for a rigorous assessment of these programs in order to better understand the distinct and nuanced role these programs play in student success at different postsecondary institutions.

The report begins with a critical review of previous research into the impacts of SI, paying particular attention to the limited research undertaken thus far in Canada. The third section of the report outlines the empirical framework that guided this study. The remainder of the report discusses the findings of our analysis and their implications.

A Review of Supplemental Instruction

The Supported Learning Groups (SLG) model of Supplemental Instruction (SI) was originally developed at the University of Missouri Kansas City (UMKC) in the 1970s in response to an alarming attrition rate in that university's health sciences program, particularly among marginalized students (Blanc & Martin 1994). While various support services already existed at the UMKC Learning Centre, some students felt the resources available were too broad and not directly applicable to the courses with which they were struggling (Blanc, DeBuhr, & Martin, 1983). Dr. Deanna Martin, from the UMKC Centre for Academic Development, conducted a review of existing retention programs at UMKC and noted that high-risk courses were often prerequisites for several other courses, and success in these courses required skill sets that first-year students had rarely mastered (Blanc et al., 1983). As a result, she proposed an intervention to provide additional academic support to students in those academically foundational but also high-risk courses.

The intervention became known as Supported Learning Groups (SLGs) and utilized a peer-led academic model in which upper-year undergraduate students, who had previously achieved a grade of 80 per cent or higher in previous offerings of the course, served as supplemental instruction specialists and led a course-specific study session for current students (Blanc et al., 1983). These SI leaders received training in the principles of SI, as well as hands-on training in leading peer-based group learning. They attended lectures for the corresponding high-risk course and, with the support of professional staff and faculty, designed study sessions to review recent course material and introduce students to a range of study skills and strategies. A central goal of these sessions was to help students gain confidence with the course material by helping students learn to develop the answers to their own questions in the sessions. Students attending the SLG sessions were taught a variety of study skills and approaches to learning, and were encouraged to work with other students in the class to solve problems.

The number of SI programs has grown substantially on campuses across North America and internationally since the 1980s. It is estimated that over 500 colleges and universities in the United States, and a growing number of postsecondary institutions in Canada, the United Kingdom, Australia, and elsewhere, have adopted SI programs (Blanc & Martin, 1994). In Ontario alone three variations – Peer-Assisted Study Sessions (PASS) at Carleton University, the Peer Helper Program at Guelph University, and Supported Learning Groups (SLG) at Queen's University – are all being evaluated as part of the group of projects funded by the Higher Education Quality Council of Ontario (HEQCO) under RFP-006: Student Services.

The potential of boosting student grades and retention is appealing to postsecondary institutions. The adoption of SI programs, however, has not been uniform across campuses, and evidence from colleges and universities that have adopted them suggests that their impact, like many interventions, may vary between institutions and programs.

In the following section, we review some of these findings and identify themes in the literature, differences between programs, and some of the weaknesses of previous SI research.

Since its inception in 1973, the Center for Academic Development at UMKC has led the way in compiling, analyzing, and monitoring the impact of SI programs in the United States (Fayowski & MacMillan, 2008; Ramirez, 1997). Data on thousands of students from SI programs across the United States over several years suggests that SI participants perform better than non-SI participants across institutions and disciplines (Arendale, 1997; Blanc et al., 1983; Congos & Schoeps, 1993; Martin & Arendale, 1992; Martin & Arendale, 1994; Wolfe, 1987;). Overall, this research has shown that SI programs can have a positive impact on a participant's grades, retention rate, and learning skill development. SI has even been recognized twice by the US Department of Education as an exemplary program (Fayowski & MacMillan, 2008).

The findings from these studies have provided a springboard for the development of SI programs at universities and colleges across Canada and the United States. They have also generated additional research on the impact of SI programs. Some of this research has followed the lead of previous studies by using data from across institutions, while other research has been institution-specific. Etter, Burmeister, and Elder (2000) took a meta-analysis approach to examine the impact of SI on students enrolled in Introductory Accounting when they used data from the UMKC Centre for Academic Development . Their data were compiled from 132 courses offered by 21 institutions across the US between 1986 and 1995. The authors found that SI improved both participants' experiences in introductory accounting, and their academic performance and retention.

Rath, Peterfreund, Xenos, Bayliss and Carnal (2007), by contrast, took an institution-specific approach by measuring the impact of SI on students enrolled in Introductory Biology at San Francisco State University (2007). Using data from 1,526 students collected between 1999 and 2005, they found SI participants, on average, earned higher grades, and were more likely to earn a "C" grade or higher in the course. The authors also found students from marginalized backgrounds benefited most from participating in SI, and were more likely to earn higher average grades in Introductory Biology and to graduate from university.

Loviscek and Cloutier's (1997) examination of the impact of SI on students enrolled in Introductory Economics at the University of Wisconsin-Parkside yielded similar results. Using data collected from 81 students and employing a 2-stage regression analysis, the authors found that SI had a statistically significant and positive impact on academic performance. They argued that previous regression results underestimated the impact of SI on student success, and that SI sessions were effective at enhancing learning and economic literacy.

Canadian research on the impact of SI programs has been limited. Like the work of Rath et al. (2007), and Loviscek and Cloutier (1997), much of this research has been institution-specific. Fayowski and MacMillan (2008), for example, examined the impact of SI on students enrolled in Introductory Calculus at the University of Northern British Columbia. To conduct their analysis, the authors used data collected from approximately 1,250 students between 2001 and 2004. Using ANCOVA and regression analyses to control for students' prior GPA and gender, the researchers found that the academic achievement of SI participants exceeded that of non-SI participants by an average of two letter grades.

Findings from Carleton University correspond with these results. Using data from 4,942 students collected in the 2007-2008 school year, Miles, Polovina-Vukovic, Litteljohn and Marini (2010) compared SI participants with non-SI participants across 30 courses in several faculties. The authors found SI participants achieved higher final grades than non-participants after controlling for students' original university admission averages. Based on attendance frequency, the authors found SI participants earned final grades up to one letter grade higher than non-SI participants.

Evidence from the University of Guelph and University of the Fraser Valley (UFV) similarly suggests that SI has a positive impact on student performance. Findings from the University of Guelph, one of the first universities to establish an SI program in Canada, indicate that SI participants earn final grades 2.50 to 5.50 percentage points higher than non-participants (Wilson, 2005). Comparatively, SLG participants at UFV have been found to achieve higher grades than non-participants, and are less likely than non-participants to withdraw or not complete SLG associated courses (UFV, 2010).

Overall, evidence about the benefits of SI, and SLGs in particular, on student performance and retention is significant. Indeed, in addition to the short-term course-specific impact of SI programs, evidence also suggests such programs have a long-term positive impact on the academic performance of participants (Ogden, Thompson, Russell, & Simons, 2003; Ramirez, 1997). There are three main weaknesses in current SI literature, however, and these have received only mixed attention to date.

The first of these weaknesses is the impact of self-selection bias. In SI, the problem of self-selection arises when researchers try to distinguish the impact of SI participation from the student's underlying ability and motivation for academic performance. Although Martin and Arendale (1992) have previously found that student motivation (a factor in self selection bias) is not significant in explaining differences in SI outcomes, there is a growing consensus that self-selection bias in this area of research does indeed matter. Loviscek and Cloutier (1997), for example, use a Heckman two-stage regression model for estimating the influence of SI participation on a student's academic performance. (The first stage models self-selection, the second outcomes.) Others, by contrast, have opted to use ANCOVA (Fayowski & MacMillan, 2008; Kochenour, Jolley, Kaup, Patrick, Roach, & Wenzler, 1997; Miles et al., 2010), which compares the outcomes of two or more groups while taking into account the influence of one or more covariates. While the development of more sophisticated statistical techniques to control for the impact of self-selection continues, attention to its resultant impact remains mixed (see for example Mahdi, 2004; Ogden et al., 2003; Rath et al., 2007).

The second issue associated with SI research is the lack of attention paid to institutional and program diversity. The results presented by Etter et al. (2000), for example, reveal differences in SI participation rates and outcomes between public and private, as well as large and small postsecondary institutions. While descriptive, these data suggest that the impact of SI varies across institutions and programs. This is not a new observation. Previous authors have raised questions about how systematic differences in program specification, administration, and participant composition have affected SI outcomes (Burmeister, Kenney, & Nice, 1996). Yet no

known studies in Canada or elsewhere have systematically reviewed how program and student diversity may affect successful SI implementation and participant success.

While it is common for authors examining the impact of SI at specific institutions to identify the institution and describe the structure of the SI program (there are many variations of the SI model), there has been surprisingly little focus on what makes these institutions, and consequently their SI programs, unique. Although postsecondary institutions have much in common, they are historically, geographically, culturally, socially, and nationally embedded (Amin, 1999). Consequently, large urban and private universities are likely to have different faculties, enrolments, course offerings, class sizes, and resources than smaller public universities located in more rural areas. Similarly, older postsecondary institutions may have, over time, developed different student-centred resources and support systems than newly established universities, and universities in Canada are likely to differ somewhat from universities in the US due to systemic historical institutional differences. Furthermore, some universities may attract a higher proportion of high-achieving academically resilient students by virtue of the university's reputation or students' prior access to educational enrichment.

Consequently, the diversity of postsecondary institution types and their local institutional embeddedness present a challenge when comparing SI program outcomes across institutions that are characteristically distinct (i.e., public vs. private, large vs. small, new vs. old, or geographically dispersed); and institutional diversity may be concealed by large-scale meta-analytical approaches that may over-generalize program success (see for example Burmeister et al., 1996; Etter et al., 2000; Kochenour et al., 1997; Schwartz, 1992).

Finally, there has been little critical discussion on the changing role of SI programs at postsecondary institutions. According to Blanc and Martin (1994), the impetus for SI was the desire to significantly reduce attrition rates amongst marginalized students in health related programs in the US by providing peer-oriented academic support in historically difficult courses (i.e., courses with attrition rates of approximately 30 per cent). Its subsequent adoption by universities and colleges across the US and internationally is no doubt a consequence of the program's widespread success, and this success should be celebrated. The recent impetus for the expansion of SI programs across and within institutions, however, seems to have somewhat diverged from its original intent. For example, while student attrition has always had an associated monetary cost for postsecondary institutions, Ramirez (1997: 3) notes that an "era of fiscal constraints" was partially the impetus for the prioritization of a successful SI program. Similarly, Loviscek and Cloutier argue "since the SI program is staffed largely by undergraduate students, it may be a *cost-effective* option that smaller undergraduate institutions may want to consider" (emphasis added) (1997, p. 75). Finally, Kochenour et al. (1997) have argued that SI is more cost effective per contact hour than either tutoring or course-based skill development (averaging $4 US per hour in 1994-95, less some administrative costs), which is also due to its dependence on lower paid (or unpaid) undergraduate student SI leaders.

The remainder of this report is dedicated to critically examining the pilot implementation of the SLG program, a form of SI, at Queen's University. This assessment focuses specifically on the student participant impact of the pilot program using available data. Based on resource, time, and space constraints, this report does not directly respond to all of the gaps in the literature

outlined above. Rather, it specifically addresses the need to control for the endogenous impact of self-selection bias, and interprets the findings that follow as unique to the institutional character of Queen's University and its SI program. While a systemic review of the relationship between higher education, fiscal constraints, and the growth of SI programs is outside the scope of this paper, this relationship is considered in relation to our findings in the concluding remarks.

Supplemental Instruction at Queen's University

Queen's University is a research-intensive mid-sized postsecondary institution located half way between Toronto and Montréal in Kingston, Ontario. Established in 1841, Queen's is one of the oldest postsecondary institutions in Canada, and offers a wide range of professional, undergraduate, and graduate programs in the areas of engineering, science, the arts, the social sciences, medicine, business, law, and education. Over the past five years, Queen's has expanded its range of innovative academic support services, including the expansion of online resources, resources offered through the Learning Commons, and the introduction of Supported Learning Groups (SLGs).

Queen's University initially piloted its SLG program during the 2008-09 academic year in Biology 102 and Biology 103. This pilot was subsequently extended to include Psychology 100 in 2009-10. While planning the expansion of the SLG program, Queen's staff consulted and conducted site visits to gain a deeper understanding of how other universities managed and operated their SLG programs. These visits provided additional information on SLG program implementation, SLG session and curriculum development, peer-leader recruitment, support and training, and SLG promotion and marketing.

A recruitment strategy for SLG peer leaders was launched in April 2009. To qualify, SLG leaders had to:

1. be a current Peer Learning Assistant (PLA);
2. have successfully completed the first-year Biology/Psychology courses that would be the focus of the SLG program at Queen's;
3. show interest in the SLG program; and
4. demonstrate excellent facilitation skills.

When the recruiting process was completed, the PLAs participated in a pre-service training session facilitated by the SLG Coordinator and the Coordinator of Learning Strategies Outreach before classes began in September. This training session equipped PLA leaders with the tools they needed to facilitate an SLG session. During the training, PLA leaders were required to lead a mock SLG session where they learned how to re-direct questions to students (thus reducing the tendency of participants to view the PLA as an expert) and to encourage group-led problem solving. The training also covered program logistics, as well as administrative issues (room bookings, attendance, etc.).

At Queen's, two teams of PLAs rotated on a bi-weekly schedule to expose students in the SLGs to multiple PLAs. Sessions were held on a weekly basis and were attended primarily by first-year students from the targeted classes. In the SLG sessions, PLAs modeled personal learning strategies and facilitated activities that aided students in understanding course material and

developing their own learning strategies. The PLAs were also responsible for taking attendance each week.[1]

The SLG Coordinator was responsible for creating weekly study guides for sessions. These course-based guides contained activities that students worked through collaboratively to help them understand and reinforce lecture material from the previous week. Feedback from the initial SLG pilot program indicated students felt there was not enough emphasis on the course content or a clear link between course material and learning strategies. Consequently, the 2009-10 study guides balanced course content with learning strategy development.

The SLG Coordinator was also responsible for promoting the SLG program. Before classes began in September, Residence Life staff received detailed information about the program, which they used to help promote SLGs to students. The program also collaborated with the faculty members teaching Psychology 100, Biology 102, and Biology 103. Instructors posted links to the SLG schedules on their course websites, and the SLG Coordinator made a brief information presentation during the first week of classes.

SLG sessions at Queen's were held in student residences. They formed part of the broader residence educational programming model, which is based on the philosophy that students' first-year experience in residence has a powerful effect on their attitudes and approaches to learning (Pascarella & Terenzini, 2005; Trotter & Roberts, 2006; Upcraft, Gardner, & Barefoot, 2005). Additionally, previous research has found that students living in residence have greater critical thinking skills than first-year students living off-campus (Kuh, Douglas, Lund, & Ramin-Gyurnek, 1994; Pascarella, Bahr, Nora, Zusman, Inman, & Desler, 1993) and it has been found to be an ideal environment for developing and conducting small group work (Tinto, 2002; Yorke & Thomas, 2003).

To guide the assessment of the SLG program at Queen's, this report investigates five key research questions:

1. What factors influence students' likelihood of participating in SLG sessions?
2. To what extent does student participation in SLGs lead to increased academic success in a course?
3. To what extent does student participation in the SLGs increase course material retention?
4. To what extent does student participation in the SLGs increase engagement with the course material?
5. To what extent does student participation in the SLG sessions enhance study skills?

[1]Attendance was taken at these sessions for the purposes of the research project. No academic credit was given for attendance, and information about which students attended the SLG was never shared with the course instructors.

Data and Methods

This study adopted a mixed methods approach. Quantitative data were compiled from student surveys, student records, and SLG attendance files collected during the 2009-10 academic year. Qualitative data were collected through focus groups conducted at the end of the 2009-10 academic year.

Data Collection

At the beginning of the fall semester, all students registered in Biology 102 and Psychology 100 were invited to participate in a pre-course survey administered during the first class of the semester. (See Appendix A and Table 10.) This survey sought to gather an initial understanding of students' awareness of, and comfort level with, various learning strategies. Student awareness was gauged by yes/no questions, while comfort levels were assessed using 5-point Likert scales. The survey asked participants to provide their student identification number so their responses could be matched with data collected in the post-SLG survey.

At the end of the winter semester, all students registered in Biology 103 and Psychology 100 received an invitation to participate in the post-course survey. This survey was administered online, due to concerns about low in-class response rates during the last week of the semester. Students received an e-mail containing a letter of information and a unique URL linking them to the survey. The post-course survey included the same questions on learning strategies as the pre-course survey. It also included questions from the Classroom Survey of Student Engagement (CLASSE) instrument, which is based on the National Survey of Student Engagement (NSSE) survey.[2]

An SLG participant was defined as a student who attended one or more SLG sessions. "Regular" SLG participants (those SLG participants who attended at least 6 of the 22 sessions offered each semester) were invited to participate in a focus group at the end of the 2009-10 academic year. They were sent a personalized e-mail inviting them to participate and were offered a meal and a $15 gift card for their time. Several reminder invitations were sent out over a three-week period, and ultimately three focus groups with seven participants each were held. The purpose of the focus groups was to capture students' reflections and experiences in the program. The focus groups gathered information regarding students' motivations for participating in the SLG program, as well as student self-assessments of the skills and strategies learned from attending sessions. The focus groups were held in the residence halls, conducted by a trained focus group facilitator and audio-recorded.

[2] While NSSE is intended to measure levels of engagement at the institutional level, the CLASSE survey instead focuses on the frequency and practices of engagement activities at a class level.

Data Analysis

Quantitative data were analyzed using Stata and SPSS. Linear regression was used to estimate the impact of covariates on SLG participation. Regression models utilized propensity score matched (PSM) treatment and control group members to attempt to isolate the impact that participation in SLG sessions had on a student's final grades, study skill development, and academic engagement.[3] In postsecondary education research involving program and course-based interventions, PSM is used to identify the impact of participation while controlling for factors that influence self-selection into these same programs (Conway, 2010; Padgett, Salisbury, An, & Pascarella, 2010;).

Covariates for these analyses were chosen based on available data. The more covariates used in a regression model (or incorporated into PSM) the greater the potential to isolate and measure treatment effects. Researchers try to control for a range of demographic and other characteristics in the regression and PSM analyses, while recognizing that these variables are surrogates for more complex attitudinal and behaviour factors.

The covariates used in the linear regression analyses are listed in Table 3. In the testing phase of the analysis, some initial covariates were dropped due to a lack of observations and collinearity with other covariates. The covariates used in the regression analyses include entering grade point average, gender, full-time/part-time student status, identifying as an international student, year of study, average entrance grade, and SLG attendance both in the targeted course and in "other" courses also offering SLGs (i.e., attending, or having attended, SLG sessions in Psychology 100 or Biology 102 at Queen's University).

In the PSM analyses on final grades and academic engagement, SLG participants and non-SLG participants were likewise matched according to gender, full-time/part-time student status, identifying as an international student, year of study, average entrance grade,[4] and other SLG attendance. In the PSM analyses on students' confidence using study strategies, SLG participants and non-SLG participants were additionally matched on their pre-course survey Likert scores measuring their confidence with study skills. Pre-course Likert scores were included for the purpose of accounting for students' confidence using these particular study skills prior to attending SLG sessions.

Variance inflation factor (VIF) scores were generated for all covariates included in the models in order to detect and estimate the influence of multicollinearity, which can skew the model results

[3]The propensity scores were calculated using a probit model (the default estimator) and matched using the nearest neighbour matching algorithm. The underlying conditions of PSM are judged to be met. The set of parsimonious covariates included in the estimation were judged to be valid matching criteria, and only observations in the treatment and control groups that shared a common region of support were used in the analysis. Matching was conducted with replacement.

[4] Average entrance grades were available for 44 out of 70 international students.

(see for example Greene, 2008; Tabachnick & Fidell, 2007). While several acceptable VIF limits have been proposed by previous authors (see for example O'Brien, 2007), a limit of four was adopted for the purposes of this report. This suggests that at the limit, the standard error associated with a particular covariate would be double what it would otherwise be if it were completely orthogonal (Greene, 2008; O'Brien, 2007; Tabachnick & Fidell, 2007). No VIF scores were found to exceed 2.01, and most were below 1.33, meaning the standard errors for these covariates were higher than they would have been if the covariates were completely orthogonal, but well within conservative VIF limits.

Focus group recordings were transcribed and prepared for analysis. Each focus group transcript was read in its entirety before coding began. Then, each was read a second and third, and where necessary, a fourth time, and initial codes were made throughout. Codes from each transcript were then collated into a separate list, and particular attention was paid to codes that overlapped or were duplicated. The transcripts were reviewed a final time with this set of revised codes.

Results

This section of the report addresses the five research questions underpinning the assessment of the Queen's SLG program. For ease of reading, Table 1 provides a summary of the research questions, methods, and key findings.

Table 1: Summary of the research questions, data source and type of analysis and key findings from each section of analysis

Research Question	Data Source	Main Method of Analysis	Main Findings
1. What factors influence students' likelihood to participate in SLG sessions?	- Office of the Registrar - SLG Attendance - Focus Groups	- Linear Regression - Focus Group Transcript Analysis	- Factors that influence participation in SLG sessions at Queen's include gender, having attended an SLG session for another course, identifying as an international student, and entrance grades.
2. To what extent does student participation in SLGs lead to increased academic success in a course?	- Office of the Registrar - SLG Attendance	- Propensity Score Matching	- SLG sessions may have a positive influence on student's academic performance but PSM results indicate that SLG attendance cannot be clearly linked with academic success at Queen's.
3. To what extent does student participation in the SLGs increase course retention?		- Multivariate Analysis	- Relatively few SLG participants were found to drop target courses. While it is likely, it is not clear from these data whether SLG attendance is positively associated with lower levels of attrition at Queen's. D and F grade rates were comparable between SLG participants and non-participants, with the exception of Biology 102 where SLG participants earned proportionally fewer D grades. Statistical differences between participants and non-participants in drop rates, and D grades and F grade rates could not be detected due to low observation numbers.
4. To what extent does student participation in the SLGs increase engagement with the course material?	- Focus Groups - Post-Course Surveys	- Propensity Score Matching - Focus Group Transcript & Text Analysis	- These results suggest that SLG sessions likely increase academic engagement, encourage self-directed group oriented learning, and increase students' confidence with course material. Overall, SLG participants were significantly more likey to ask questions in class, included diverse perspectives in assignments and discussions, draw on a wide variety of ideas and concepts, and more frequently discussed course concepts outside of class than non-SLG participants. On average, SLG participants were also more likely to attend class and complete assigned readings and assignments.
5. To what extent do the SLG sessions enhance study skills?	- Focus Groups - Pre and Post-Course Surveys	- Propensity Score Matching - Focus Group Transcript Analysis	- Changes in relative study skill development were mixed. Data and analyses suggest that there are few discernible differences between participants and non-participants in study skill confidence. Although SLG participants are likely to have increased their confidence with some study strategies this increase is not uniform across study skills or between courses.

Research Question 1: Factors influencing SLG Participation

Demographic information for all students enrolled in Psychology 100 (*n* = 1,885), Biology 102 (*n* = 1,051) and Biology 103 (*n* = 951), as well as the demographic information for the SLG participants (*n* = 125, *n* = 92, and *n* = 63 respectively) can be found in Table 2. The data in Table 2 indicate that students in the three target courses are predominately domestic, full-time, first-year women enrolled in the Faculty of Arts and Science. These figures translate into a 6.6 per cent SLG participation rate in Psychology 100, a 8.8 per cent participation rate in Biology 102, and a 6.6 per cent participation rate in Biology 103. These data also indicate that SLG participants are generally similar to students in Psychology 100, Biology 102, and Biology 103, with the exception of gender: proportionately more women attended SLG sessions than men, which correspond with the findings of other authors (Loviscek & Cloutier, 1997).

Table 2: Descriptive Characteristics

	All Students						SLG Participants					
	Psychology 100		Biology 102		Biology 103		Psychology 100		Biology 102		Biology 103	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Gender												
Women	1,364	72%	684	65%	625	66%	98	78%	69	75%	53	84%
Men	521	28%	367	35%	326	34%	27	22%	23	25%	10	16%
Year of Study												
1st Year	1,538	82%	948	90%	906	95%	123	98%	91	99%	60	95%
2nd Year	185	10%	48	5%	25	3%	1	1%	1	1%	2	3%
3rd Year	101	5%	27	3%	14	2%	1	1%	0		1	2%
4th Year	61	3%	28	3%	6	1%	0	0%	0	0%	0	0%
Faculty												
Arts & Science	1,733	92%	1,013	96%	939	99%	119	95%	90	97%	60	95%
Business	43	2%	8	1%	4	0%	4	3%	2	3%	1	2%
Engineering	27	1%	29	3%	7	1%	2	2%	0	0%	0	0%
Nursing	82	4%	1	0%	1	0%	0	0%	0	0%	2	3%
International												
Yes	57	3%	27	3%	19	2%	3	2%	2	3%	1	2%
No	1,828	97%	1,024	97%	932	98%	122	98%	90	97%	62	98%
Registration												
Full-time	1,734	92%	1,013	96%	932	98%	124	99%	89	96%	62	98%
Part-time	151	8%	38	4%	19	2%	1	1%	3	4%	1	2%

The results of the regression analyses are contained in Table 3. The first two models (Psychology 100 and Biology 102) were found to have r^2 statistics of 0.302 and 0.356, respectively, suggesting these models accounted for approximately one-third of the variance in SLG participation. The third model (Biology 103) has an r^2 statistic of 0.059. As expected, each of the models explains a portion of the variation in participation, but clearly factors exogenous to the models explain the majority of the variation.

Table 3 shows that the coefficients for gender, year of study, and international student status were negative across all three models. Regarding gender, this suggests men were less likely to attend SLG sessions than women. These results, however, were only statistically significant for Psychology 100 and Biology 103. The same is true for the coefficients associated with identifying as an international student. While all three coefficients were negative, indicating international students were less likely to attend sessions than domestic students, only the coefficients for Psychology 100 and Biology 103 were statistically significant. And while all three coefficients were negative for the year of study coefficients, indicating that first- (and second-) year students were more likely to attend sessions than upper-year students (as expected), only the coefficients for Psychology 100 and Biology 102 were statistically significant.

The coefficients associated with students' entrance average were positive across all three models, but statistically significant only for Biology 102. This suggests there is likely a mild self-selection bias associated with former academic achievement, but this bias may not be as strong as the self-selection bias associated with other covariates. Attending SLG sessions for other courses, for example, was found to have a positive and statistically significant effect on the likelihood of students attending SLG sessions in all three models. While attending Psychology 100 sessions was found to have a positive and significant impact on Biology 103 SLG attendance, prior Biology 102 attendance did not have the same impact. Registration status as either a full-time or part-time student, by contrast, was found to have no statistically significant effect in any of the models.

Table 3: Linear Regression Results for SLG Attendance

	Psychology SLG				Biology 102 SLG				Biology 103 SLG			
	Coeff.	Std. Err.	t		Coeff.	Std. Err.	t		Coeff.	Std. Err.	t	
Gender (Men = 1)	-0.075	0.045	-1.660	*	-0.016	0.048	-0.330		-0.172	0.041	-4.180	***
Entrance Average	0.001	0.005	0.190		0.007	0.004	1.650	*	0.000	0.007	0.020	
Full/Part Time (Full = 1)	0.033	0.048	0.700		-0.056	0.127	-0.440		-0.196	0.277	-0.710	
Year of Study	-0.047	0.014	-3.460	***	-0.041	0.014	-2.920	***	-0.026	0.028	-0.930	
International Student (Yes = 1)	-0.097	0.058	-1.670	*	-0.032	0.075	-0.430		-0.156	0.076	-2.050	**
Psychology SLG Attendance					0.416	0.062	6.700	***	0.127	0.062	2.030	**
Biology 102 SLG Attendance	1.030	0.225	4.570	***					0.008	0.065	0.120	
Constant	0.082	0.432	0.190		-0.360	0.370	-0.97		0.404	0.623	0.650	
No. Observations	1710				995				877			
F	11.670	(6, 1703)			12.450	(6, 948)			3.490	(7, 869)		
Prob > F	0.000				0.000				0.001			
R Sqrd	0.302				0.356				0.059			
Root MSE	0.911				0.679				0.736			

Statistical significance denoted at 10% (*), 5% (**) and 1% (***)

Analysis of focus group data provides further insight on the reasons students choose to participate in SLG sessions. All focus group participants noted that they believed attending SLG sessions would help them improve their grades, and that this influenced their decision to attend sessions. One student, for example, stated, “I guess I just decided to participate to try and improve my grades.” Other students reportedly attended sessions to enhance their understanding of course content. One student said, for example, that SLGs were “a really good opportunity just to review things and to just go over it one more time.” Other students explained they liked the small group format.

Not all students, however, came to the SLGs with a similarly strong understanding of the course material. By contrast, some students reportedly attended sessions in order to keep pace with the course material. One student explained that “the course material, they were going through it really fast [in class]… and I needed some extra help,” while another similarly attested that “I think [SLGs] helped me to get caught up with things so I could understand the week’s lesson.”

Overall, the results of these models lend several key insights into what factors influence SLG participation at Queen’s University. First, these results suggest there may be a gender dynamic influencing student participation in SLGs, as evidenced by the negative and statistically significant coefficients. In addition, these results suggest that social or other barriers may prevent international students from participating in SLG sessions. Second, these results may suggest that attending SLG sessions for one course may have a spillover effect and increase the likelihood of students attending SLG sessions for other courses (or that an unmodeled predisposition or self-selection factor may influence multiple SLG participation).

Focus group data may support the former suggestion: participants reported attending SLGs in one course (e.g., Biology) because they found it to be beneficial in another course (e.g., Psychology). Finally, these results suggest that the factors that influence participation in SLGs may vary slightly from course to course within the same institution. While many of the factors that drive SI participation may be common, there may be nuanced differences in the strength of participation covariates between science and social science courses and courses with more than one part (i.e., Biology 102 and Biology 103). Further research is needed, however, to understand these nuanced differences and what barriers may exist for students who wish to attend SLG sessions but do not.

Research Question 2: SLG Participation and Academic Performance

Table 4 compares SLG attendance frequency with students’ average university entrance grades and their average final grades. It shows that most SLG participants attended one to three sessions, and that a few students attended eight or more sessions. No observable patterns in entrance or final grades emerge from this table.

Table 4: Comparison of SLG Attendance, Average Final Grades, and Average Entrance Grades

Number of Sessions Attended	Time in Session (Hours)	Psychology 100				Biology 102				Biology 103			
		Entrance Avg.		Avg. Final Grade		Entrance Avg.		Avg. Final Grade		Entrance Avg.		Avg. Final Grade	
		Grades	No. Students	Grades	No. Students	Grades	No. Students	Grades	No. Students	Grades	No. Students	Grades	No. Students
0	0	87.79	1592	71.80	1441	89.04	873	72.39	887	89.32	816	75.01	836
1	1.5	87.88	59	74.51	61	91.27	41	76.69	45	90.33	24	77.38	24
2	3	88.48	22	74.22	23	91.21	18	79.74	23	89.49	17	72.41	17
3	4.5	89.19	9	70.50	8	89.29	10	75.90	10	87.43	10	73.20	10
4	6	90.58	6	74.17	6	84.85	2	67.50	2	90.90	5	69.40	5
5	7.5	88.03	6	76.50	6	88.25	4	85.50	4	86.80	2	64.00	2
6	9	88.95	4	83.00	4	90.07	3	74.75	4	n/a	0	76.00	1
7	10.5	89.63	3	81.00	4	n/a	0	n/a	0	88.50	1	71.00	1
8	12	86.57	3	74.00	3	89.33	3	78.00	3	n/a	0	n/a	0
9	13.5	86.30	1	60.00	1	94.50	1	83.00	1	91.90	2	78.50	2
more than 9	>15	89.68	4	82.25	4	n/a	0	n/a	0	n/a	0	n/a	0

The PSM results in Table 5 show mixed results regarding the relationship between SLG attendance and final grades after accounting for demographic differences, other SLG session attendance, and entrance averages. While the results in the top half of Table 5 show attending SLG sessions had a positive effect on students' final grades, few results were statistically significant. In fact, only attending two SLG sessions in Biology 102 was found to have a positive statistically significant result on students' final grades.[5] These results, however, were likely influenced by the relatively low number of observations.

When participants and non-participants were compared based on having attended "at least" *x* number of sessions, for the purpose of including more observations, more statistically significant results emerged, but only amongst students who attended fewer sessions. Students who attended at least one SLG session in Psychology 100, and one or two SLG sessions in Biology 102, for example, had significantly higher grades than students who attended no SLG sessions in these courses. By contrast, few statistically significant differences in final grades emerged between non-participants and SLG participants who attended multiple sessions, with the exception of Biology 103. In fact, in Biology 103 students who attended at least two or three SLG sessions had significantly lower grades than those who did not attend SLG sessions. The model results are largely inconclusive with respect to the relationship between SLG participation and final average grades.

[5] The results of five PSM analyses in the top half of Table 5 were omitted due to statistically insignificant probit models on which matching was based, likely due to the relatively low number of observations.

Table 5: PSM Results for Impact of SLG Attendance on Final Grades

SLG Session Attendance	Hours	Course	# Participants (Treatment)	# Non-Participants (Control)	Final Grade ATT (Difference)	Std. Err.	t	
Attended One Session	1.5 Hours	Psychology 100	57	331	1.360	2.243	0.606	
		Biology 102	41	147	1.700	1.953	0.871	
		Biology 103	23	69	-	-	-	
Attended Two Sessions	3 Hours	Psychology 100	21	157	3.432	3.425	1.002	
		Biology 102	17	82	7.274	2.597	2.801	***
		Biology 103	16	64	-	-	-	[1]
Attended Three Sessions	4.5 Hours	Psychology 100	7	40	-	-	-	[1]
		Biology 102	9	36	-	-	-	[1]
		Biology 103	10	18	-5.460	2.739	-1.993	*
Attended Four Sessions	6 Hours	Psychology 100	5	65	-	-	-	[1]
		Biology 102	2	4	-4.333	5.406	-0.802	
		Biology 103	4	20	-	-	-	[1]
Attended At Least One Session	1.5 Hours +	Psychology 100	114	499	3.130	1.799	1.740	*
		Biology 102	81	214	4.032	1.572	2.564	**
		Biology 103	58	178	-1.953	1.415	-1.380	
Attended At Least Two Sessions	3 Hours +	Psychology 100	57	298	2.517	2.458	1.024	
		Biology 102	41	133	4.640	2.213	2.097	**
		Biology 103	36	112	-2.993	1.684	-1.777	*
Attended At Least Three Sessions	4.5 Hours +	Psychology 100	35	222	3.855	3.067	1.257	
		Biology 102	23	54	3.668	3.553	1.032	
		Biology 103	20	50	-4.342	2.215	-1.960	*
Attended At Least Four Sessions	6 Hours +	Psychology 100	28	184	3.393	3.319	1.022	
		Biology 102	13	15	0.846	4.87	0.174	
		Biology 103	10	33	-4.253	3.217	-1.322	
Attended At Least Five Sessions	7.5 Hours +	Psychology 100	22	113	2.422	3.661	0.662	
		Biology 102	11	11	2.767	5.301	0.522	
		Biology 103	3	13	-3.850	5.859	-0.657	

Statistical significance denoted at 10% (*), 5% (**) and 1% (***).

[1] *The probit model from which the propensity scores were calculated was found to be statistically insignificant, likely due to the relatively low number of observations. These results were therefore omitted.*

Focus group data tend to support the quantitative findings. While students cited grade improvement as the primary reason for attending SLG sessions, many commented that the sessions did not have the desired effect on their academic performance. One student, for example, reported that attending SLG sessions made her "[feel] more confident. But I don't think that [the SLG] made me do well though." Overall, these results suggest that while students might initially be motivated to attend SLG sessions to enhance their grades, the benefits they derive from SLG attendance may accrue elsewhere.

These results should be interpreted carefully due to the relatively low number of observations available, especially after participants and non-participants were matched on their relative likeness. The PSM results suggest that the impact of SLG attendance on student's final grades – if any – is not clear-cut when prior SLG attendance, entrance grades, and demographic characteristics are controlled for. More research is needed to fully understand the impact of SI at Queen's on students' overall academic performance.

Table 6 shows the grade distribution and course drop rates of SLG participants and non-SLG participants in Psychology 100, Biology 102, and Biology 103. It compares the proportion of students that earned grades above 80 per cent in each of the courses, as well as the percentage who earned grades below 60 per cent (in the "D" and "F" grade ranges). The importance of "D" and "F" grades in introductory courses is that they are a likely indicator of subsequent attrition, because these courses provide prerequisite skills and knowledge required in later classes. According to the data in Table 6, the proportions of participants and non-participants who earned grades below 50 per cent (an "F" grade) were comparable across all three courses. In Biology 103, the percentage of participants and non-participants who earned grades in the 50-59 per cent range (a "D" grade) was also comparable. In Psychology 100 and Biology 102, however, the data show that SLG participants performed better than non-participants, earning proportionally fewer grades in the 50-59 per cent range.

While the relatively low number of SLG participants earning grades in the below 50 per cent range (n=7 total across the three courses) and the 50-59 per cent range (n=18 total across the three courses) is encouraging, the low number of observations makes statistical testing difficult, particularly using PSM. Propensity score matching analyses comparing participants and non-participants in these ranges produced statistically unreliable results and, therefore, were omitted. The analysis of the effect of SLG participation on individual course grades is inconclusive, as was the case with overall academic performance (grade average).

Table 6: Grade Distribution of Participants and Non-Participants

Final Mean Grade Range	Psychology 100						Biology 102						Biology 103					
	Non-Participants			SLG Participants			Non-Participants			SLG Participants			Non-Participants			SLG Participants		
	No.	%	Mean Grade %	No.	%	Mean Grade %	No.	%	Mean Grade %	No.	%	Mean Grade %	No.	%	Mean Grade %	No.	%	Mean Grade %
Dropped	317	18%	n/a	4	3%	n/a	70	7%	n/a	0	0%	n/a	52	6%	n/a	1	2%	n/a
Less than 50%	64	4%	38.266	6	5%	42.333	14	1%	41.643	1	1%	45.000	13	1%	30.692	0	0%	n/a
50-59%	209	12%	55.033	12	10%	55.500	102	11%	55.069	5	5%	55.400	21	2%	55.524	1	2%	59.000
60-69%	355	20%	64.823	20	16%	64.100	227	24%	64.930	17	18%	64.530	15 6	18%	65.968	16	25%	66.375
70-79%	331	19%	73.991	27	22%	73.111	279	29%	73.943	24	26%	74.542	34 6	39%	74.182	29	46%	74.103
80-89%	329	19%	83.824	38	30%	83.711	208	22%	83.620	27	29%	83.778	27 0	30%	83.085	16	25%	83.063
Above 90%	153	9%	94.366	18	14%	95.944	57	6%	92.035	18	20%	92.611	30	3%	91.767	0	0%	n/a

Research Question 3: SLG Participation and Attrition

Table 7 compares trends in course completion rates. It shows that Biology 102 and 103, on average, have completion rates of about 90 per cent, whereas the completion rate in Psychology 100 is approximately 83 per cent. Table 7 also indicates average completion rates in these courses have remained relatively stable between the 2006-07 and 2009-10 school years, with the exception of Biology 103, which saw a marked increase in its completion rate in 2008-09.

Table 7: Trends in Course Completion Rates

Course	Term	Status	2006/07		2007/08		2008/09		2009/10	
			No.	%	No.	%	No.	%	No.	%
Biology 102	Fall	Overall Course Average		76.6		73.9		72.6		72.9
		Completed	880	91.2	883	94.9	977	94.2	981	93.3
		Dropped With Penalty	8	0.8	16	1.7	19	1.8	6	0.6
		Dropped Without Penalty	77	8.0	31	3.3	41	4.0	64	6.1
Biology 103	Winter	Overall Course Average		79.0		75.0		73.4		75.0
		Completed	741	88.5	750	87.6	885	92.6	898	94.4
		Dropped With Penalty	12	1.4	13	1.5	12	1.3	13	1.4
		Dropped Without Penalty	84	10.0	93	10.9	59	6.2	40	4.2
Psychology 100	Fall & Winter	Overall Course Average		72.1		72.9		71.5		72.1
		Completed	1,248	81.6	1,378	83.7	1,522	82.8	1,563	82.8
		Dropped With Penalty	89	5.8	122	7.4	147	8.0	138	7.3
		Dropped Without Penalty	192	12.6	146	8.9	169	9.2	187	9.9

Table 7 (discussed previously) also indicates that the proportion of students who dropped Psychology 100, Biology 102, and Biology 103 was lower amongst SLG participants than non-SLG participants. In Biology 102, no SLG participants dropped the course compared to 7 per cent of students in the non-SLG group. As noted above, apparently lower course dropout rates for SLG participants are inconclusive because of the low number of observations. Due to the statistical unreliability of the underlying probit models and the resultant PSM results, these figures were also omitted.

Tables 6 and 7 in combination indicate that in the 2009-10 academic year, 33 per cent of students in Psychology 100 earned a D grade, an F grade or withdrew from the course. In Biology 102 and Biology 103, the percentage of students who earned a D grade, an F grade or withdrew from the course was 18 per cent and 9 per cent, respectively. It is unclear from these data whether SLG attendance is positively associated with lower levels of course attrition at Queen's University.

Research Question 4: SLG Participation and Engagement

To understand academic engagement, data from the pre- and post-course surveys were examined. The post-SLG survey drew questions from the CLASSE survey and allowed us to examine the types of academic activities students participated in, as well as students' post-semester motivation and anxiety levels. The post-course survey data were collected at the end of the winter term when both Psychology 100 and Biology 103 were ending. The CLASSE survey is attached as Appendix B; the post-course surveys and response data for Psychology 100 and Biology 103 are attached as Appendices C and D.

We also examined post-semester anxiety levels because it was expected that increased engagement through SLG sessions may lower student anxiety and increase motivation. To examine academic motivation and anxiety, we adopted univariate probit regression because there were too few observations to use anxiety and motivation levels as dependent variables in PSM analysis, and because bivariate models failed to converge. The univariate probit results for anxiety and for motivation (where high or very high = 1) are summarized in Tables 8 and 9. Identifying as an international student was found to predict post-semester motivation in Biology 103 perfectly, and was dropped. The model examining the impact of attending Psychology 100 SLG sessions on student motivation, by contrast, was found to be statistically insignificant overall, and the results from this model were omitted.

Table 8: Post-Course Anxiety by Course

	Psychology 100 Post Anxiety					Biology 103 Post Anxiety				
	Coeff.	**Std. Err.**	**t**	**P>t**		**Coeff.**	**Std. Err.**	**t**	**P>t**	
Gender (Men = 1)	-0.333	0.183	-1.820	0.069	*	-0.786	0.199	-3.960	0.000	***
Full/Part Time (Full = 1)	-0.252	0.339	-0.740	0.457		-0.384	0.529	-0.730	0.468	
Year of Study	-0.274	0.105	-2.620	0.009	***	-0.304	0.311	-0.980	0.328	
International Student (Yes = 1)	0.654	0.457	1.430	0.153		0.004	0.636	0.010	0.995	
Biology 103 SLG Attendance	-	-	-	-		0.072	0.107	0.670	0.502	
Psychology 100 SLG Attendance	0.039	0.043	0.910	0.362		-	-	-	-	
Constant	0.891	0.378	2.360	0.018		1.437	0.687	2.090	0.037	
No. Observations	334					219				
Wald Chi2 (5 df)	13.640					19.400				
Pseudo Log Likelihood	-216.604					-125.005				
Prob > Chi2	0.018					0.002				
Pseudo R2	0.032					0.073				

Statistical significance denoted at 10% (*), 5% (**) and 1% (***)

Table 9: Post Course Motivation to Receive 70% or Higher

Biology 103 Motivation 70+	Coeff.	Std. Err.	t	*p>t*	
Gender (Men = 1)	-0.448	0.223	-2.010	0.045	**
Full/Part Time (Full = 1)	0.919	0.667	1.380	0.168	
Year of Study	-0.556	0.222	-2.500	0.012	**
Biology 103 SLG Attendance	0.055	0.088	0.630	0.531	
Constant	0.799	0.749	1.070	0.286	
No. Observations	217		Prob > Chi2	0.001	
Wald Chi2 (4 df)	18.22		Pseudo R2	0.059	
Pseudo Log Likelihood	-91.752				

Statistical significance denoted at 10% (*), 5% (**) and 1% (***)

The data described in Table 8 indicate that being an upper year student attending Psychology 100 was significantly associated with lower post-course anxiety levels. Men were also found to be significantly less likely to suffer from post-course anxiety in both samples, although this result was stronger in Biology 103. These results are interesting because students experiencing lower anxiety about their academic success may be less likely to participate in additional 'help activities' like SLGs, which may partially explain the gender dynamic in the earlier regression model examining SLG participation in Biology 103 (see Table 2). Attending SLG sessions, however, was found to have a statistically insignificant effect on anxiety, suggesting that if anxiety motivates SLG participation, attending actual sessions did little to lower it.

These findings correspond with the findings presented in Table 9. The findings on post-course performance motivation indicate that men and upper year students were significantly less likely to be motivated to score final grades of 70 per cent or higher, and attendance at SLG sessions was found to have no statistically significant effect.

Table 10 summarizes data from several CLASSE survey questions related to academic engagement that were included in the post-course survey.[6] The data indicate that SLG participants were more likely than non-SLG participants to ask questions in class, include diverse perspectives in assignments and discussions, draw on a wide variety of ideas and concepts, and discuss course concepts outside of class. Additionally, non-SLG participants reported more frequently coming to class without having completed assigned readings and assignments, and more frequently missing class altogether.

[6] The table summarizes student responses to several four-point scale questions, where 1 is equal to "None" and 4 is equal to "Five or more."

Table10: Changes in Factors Related to Student Engagement

	Psychology 100							Biology 102/103						
	SLG Participants			Non-Participants				SLG Participants			Non-Participants			
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.
Asked Questions During Class	39	1.36	0.74	288	1.33	0.70	0.03	48	1.48	0.80	169	1.27	0.61	0.21
Contributed to Class Discussion	38	1.23	0.54	284	1.39	0.74	-0.16	42	1.17	0.44	163	1.25	0.62	-0.08
Came to class without competing readings or assignments	36	3.11	0.95	276	3.27	1.03	-0.16	46	2.87	1.26	165	3.02	1.12	-0.15
Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments	20	1.85	1.09	175	1.73	1.05	0.12	42	1.90	0.98	141	1.64	0.78	0.27
Put together ideas or concepts from different courses when completing assignments or during class discussions	26	2.27	1.12	208	1.95	1.06	0.32	49	2.41	1.04	170	2.23	0.92	0.18
Discussed ideas from your class with others outside of class (students, family members, coworkers, etc.)	39	3.33	0.96	291	3.07	1.10	0.27	49	2.92	1.10	170	2.64	1.01	0.28
Number of times absent from this class this semester	39	1.97	0.96	298	2.352	1.04	-0.38	49	2.29	0.9789	171	2.67	1.03	-0.39

Results from the PSM analyses, in Table 11, coincide with these data. When the impact of SLG attendence is examined course-by-course, and demographic and other covariates are controlled for, the findings indicate that SLG participants in Psychology 100 were significantly more likely to ask questions in class, draw on a wide variety of ideas and concepts, and discuss course concepts outside of class. The results also indicate SLG participants in Psychology 100 were less likely to miss class and less likely to come to class without completing assigned readings and assignments. Similarly, Biology 102 participants were found to be significantly more likely to ask questions in class, contribute to class discussion, include a diverse array of perspectives in their assignments, and discuss course concepts outside of class. Comparatively, Biology 103 SLG participants were significantly more likely to include a diverse array of perspectives in their assignments, but less likely to contribute to class discussion. Overall, these results suggest that SLG participants experienced significantly higher levels of academic engagement than non-SLG participants in selected areas (and arguably overall).

Table 11: PSM Results for Impact of SLG Attendance on Student Engagement

	Psychology 100						Biology 102						Biology 103					
	# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t		# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t		# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t	
Asked Questions During Class	35	100	0.23	0.08	3.08	***	21	49	0.40	0.11	3.63	***	24	46	0.10	0.10	1.04	
Contributed to Class Discussion	34	99	-0.05	0.06	-0.75		16	48	0.25	0.08	3.02	***	21	44	-0.20	0.05	-4.22	***
Came to class without competing readings or assignments	32	97	-0.21	0.10	-2.08	**	19	47	-0.07	0.17	-0.40		24	44	0.07	0.20	0.36	
Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments	18	59	-0.03	0.12	-0.24		18	38	0.59	0.13	4.58	***	21	39	0.27	0.14	1.86	*
Put together ideas or concepts from different courses when completing assignments or during class discussions	22	67	0.39	0.12	3.22	***	22	50	0.21	0.15	1.35		24	46	-0.03	0.17	-0.17	
Discussed ideas from your class with others outside of class (students, family members, coworkers, etc.)	35	98	0.18	0.11	1.72	*	22	50	0.32	0.16	2.04	**	24	46	-0.13	0.18	-0.71	
Number of times absent from this class this semester	35	100	-0.45	0.11	-4.19	***	22	50	0.03	0.15	0.19		24	46	-0.05	0.16	-0.28	

Statistical significance denoted at 10% (*), 5% (**) and 1% (***)

Data from the focus groups supports the quantitative findings on the relationship between SLG sessions and student engagement. One student commented, for example, that "in the lectures, the prof just goes over things. Whereas [in SLGs] you have actual questions. So it makes you actually think about exactly what happened, what's going on." Another student similarly remarked that "I personally learn by explaining things to other people or talking about things, and that's what we did in the SLGs. A lot of the time we discussed within our groups, a more hands-on approach to learning."

Focus group data suggests this heightened engagement in the course may, at least in part, be a consequence of peer academic support networks formed through SLGs. One participant noted, for example, that "everyone is really friendly so you start talking to people. But it's also good to talk to other people about the course material and it's good to get different perspectives… but it's something that makes you feel part of something and shows that people actually care." Another student echoed these sentiments, saying that "you see the people who attend these groups and if you see them around campus like you say, 'Hello.' And you get to know them through these groups and you have a study buddy in some way." These results, consequently, suggest that SLG sessions at Queen's increase academic engagement, encourage self-directed group oriented learning, and increase students' confidence with course material.

Research Question 5: SLG Participation and Study Skills

Table 12 shows changes in students' confidence working with six common learning strategies practiced in SLG sessions (the Cornell method of note taking, study schedules, mindmaps, mnemonic devices, developing test questions, and studying out loud), based on data from the pre- and post-course surveys.7 In Psychology 100, both SLG participants and non-SLG participants were found to have improved their confidence with these six study skills during the semester. While SLG participants in Biology 102 and 103 similarly reported an increase in confidence with these study skills between the pre- and post-course surveys (with the exception of studying out loud), non-SLG participants in Biology reported a decrease in confidence using these same study skills.

[7] The table summarizes student responses to several five-point Likert scale questions where 1 is "Very Unconfident" and 5 is "Very Confident."

Table 12: Changes in Student Confidence in Using Learning Strategies

	Psychology 100														Biology 102/103												
	SLG Participants							Non-SLG Participants							SLG Participants							Non-SLG Participants					
	Pre-test			Post-Test				Pre-test			Post-Test				Pre-test			Post-Test				Pre-test			Post-Test			
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Mean Diff.
Cornell method	78	2.82	0.98	32	3.19	1.15	0.37	758	2.93	1.06	223	3.10	1.33	0.18	68	2.94	1.02	41	3.17	1.26	0.23	403	3.00	1.10	131	2.92	1.32	-0.08
Study schedules	93	2.85	1.22	37	3.81	1.02	0.96	978	2.92	1.11	261	3.65	1.08	0.73	95	3.74	0.88	44	3.84	0.91	0.10	556	3.62	0.91	155	3.55	1.12	-0.07
Mindmaps	90	2.90	1.04	37	3.41	0.98	0.51	919	2.95	1.02	254	3.17	1.11	0.21	91	2.88	1.04	44	3.43	1.19	0.55	519	3.00	0.96	142	2.79	1.13	-0.21
Mnemonic devices	78	2.94	1.06	30	3.10	1.18	0.16	849	2.95	1.09	236	3.15	1.17	0.20	80	3.16	1.11	42	3.33	1.16	0.17	471	3.23	1.02	139	3.04	1.19	-0.19
Developing test questions	97	3.07	1.16	37	3.16	1.28	0.09	996	2.95	1.08	269	3.60	1.07	0.64	97	3.58	1.07	44	3.59	1.13	0.01	562	3.56	0.99	154	3.36	1.20	-0.20
Studying out loud	99	2.92	1.42	36	3.86	1.20	0.94	999	2.90	1.35	275	3.94	1.12	1.04	92	4.01	1.07	45	3.93	1.10	-0.08	566	3.87	0.93	155	3.75	1.15	-0.13

When participants and non-participants were compared using PSM, SLG participants in Psychology 100 reported being significantly more confident using mindmaps than non-SLG participants, but significantly less confident using the Cornell method of note taking and developing test questions. (The Cornell method is a structured method of note taking during class and note review after class, utilizing topic cues and Q&A sequences to enhance topic understanding and recall.) In contrast, Biology 102 SLG participants reported being significantly more confident than non-SLG participants developing study schedules, but significantly less confident using mnemonic devices. Biology 103 SLG participants, meanwhile, reported being significantly more confident than non-SLG participants using the Cornell method and mindmaps. The PSM matching results, however, must be interpreted with caution due to the low number of observations.

Table 13: PSM Results for Impact of SLG Attendance on Learning Skills Confidence

	Psychology 100						Biology 102						Biology 103					
	# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t		# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t		# Participants Treatment	# Participants Control	Likert Scale ATT (Diff)	Std. Err.	t	
Cornell method	18	17	-0.076	0.257	-2.960	***	13	9	-0.516	0.453	-1.139		11	8	0.773	0.426	1.816	*
Study schedules	25	30	0.227	0.173	1.314		18	19	0.451	0.224	2.013	*	18	13	0.056	0.18	0.308	
Mindmaps	22	19	0.716	0.202	3.544	***	18	15	0.373	0.311	1.198		19	9	0.997	0.438	2.274	**
Mnemonic devices	19	21	-0.241	0.246	-0.98		17	12	-0.86	0.278	-3.104	***	15	11	-0.08	0.26	-0.321	
Developing test Questions	26	28	-0.429	0.21	-2.038	**	18	16	0.20	0.288	0.692		19	12	0.20	0.305	0.668	
Studying out loud	25	27	0.034	0.226	0.151		19	15	0.136	0.195	0.697		18	19	0.249	0.268	0.928	

Overall, while the data in Table 12 indicates SLG participants were, on average, more confident than non-SLG participants with these study skills, the PSM results were more mixed. When the effect of SLG participation in Biology 102 and 103 was separated and several demographic and other variables were controlled for using PSM, SLG participants were found to be significantly more confident than non-SLG participants using some study skills, while significantly less confident using others. These results suggest that although SLG participants are likely to have increased their confidence with some study strategies, this increase is not likely uniform across study skills or between courses.

These mixed results may suggest that a positive spill-over effect is occurring. While positive, this possible effect makes statistical comparisons between SLG participants and non-SLG participants difficult. These results may also be attributed to non-participants attending sessions on learning strategy development hosted by the Learning Strategies Department, which are not accounted for in this comparison. Similarly, these results may also reflect learning skill development acquired by participants and non-participants before coming to Queen's University.

Data from the focus groups indicate the study strategies learned in SLG sessions were important to students' academic development. One student said, for example, "in terms of transferable skills, it was after the SLG that I started making mind maps a lot more." Another student, by comparison, remarked that in session "[we] would draw or write things on cue-cards. That helped me with memorization in other courses."

Time management was the study skill most frequently cited by focus group participants. Some students, for example, used SLG sessions as part of their academic time management strategy. One student reported " [I] have a hard time planning time management. So if I come [to the SLGs] every week then I am actually stuck here to do work for two hours." Another participant similarly explained "I'd come [to the SLG] and actually do the work, but when I wouldn't go, I wouldn't follow up with it." Other students, by contrast, reported applying the time management strategies learned in the SLG session, such as the 50/10 rule (50 minutes of studying followed by 10 minutes of relaxation), to make more effective use of their independent study time.

Empirical Limitations

While the results presented in this report are important, they should be interpreted carefully due the relatively low number of SLG participants. The small number of participants from which to draw data is a systemic statistical problem associated with assessing targeted academic programs that attract relatively low numbers of students. These results should also be interpreted carefully because, like other comparative statistical techniques, they may be confounded by spill-over effects associated with knowledge transfer between participants and non-participants. While knowledge spill-over is a positive outcome of SI initiatives, it can make statistical comparisons difficult.

Implications and Conclusion

The results presented in the preceding section shed various shades of light on the factors that influence SLG attendance and the resultant academic outcomes at Queen's University. The results of our analysis indicate gender and identifying as an international student may influence the likelihood that students will attend SLG sessions. While our analysis presents no specific explanation for these findings, the results suggest invisible barriers may be preventing some students from attending SLG sessions. Our results also suggest students with relatively high entrance averages may self-select to participate in SLG sessions, particularly in Biology 102, and that prior SLG attendance likely affects subsequent SLG participation in other courses. These results, therefore, indicate that direct grade comparisons of participants and non-participants may be biased without accounting for these factors.

When self-selection bias was accounted for using PSM, the results indicate the relationship between SLG participation and final grades is mixed. In many cases, the difference between a participant's and a non-participant's final grades were found to be statistically insignificant. Where final grade differences were statistically significant, the signs of the coefficients were mixed, suggesting that in some cases SLG participants performed better than non-participants while in other cases they performed more poorly.

The data on student attrition indicates a lower proportion of SLG participants in Psychology 100 and Biology 102 earned grades between 50-59 per cent, and the proportion of students who earned grades below 50 per cent was comparable across all three courses. The data also indicate that proportionally fewer SLG participants dropped the associated courses, particularly Psychology 100. While a low number of observations amongst SLG participants prevented empirical testing and controlling for self-selection bias, these results suggest SLG attendance likely has a positive impact on lowering student attrition.

Changes in relative study skill development were also mixed. The data suggest there are few discernible differences between participants and non-participants in study skill confidence. The data indicate that while SLG participants increased their confidence using the six study skills under examination, most observable post-course Likert scale differences between participants and non-participants are minor. Altogether, these data and the results of the PSM analyses suggest that although SLG participants are likely to have increased their confidence with some study strategies, this increase is not uniform across study skills or between courses. The lack of discernible differences between SLG participants and non-SLG participants may suggest a positive spill over-effect is occurring.

By contrast, the results of this analysis indicate that SLGs may have had a positive effect on academic engagement. On average, SLG participants were more likely than non-SLG participants to ask questions in class, include diverse perspectives in assignments and discussions, draw on a wide variety of ideas and concepts, and discuss course concepts outside of class (though the last of these is tautological given the existence of the SLGs). SLG participants in Psychology 100 were also significantly less likely to come to class without having completed assigned readings and assignments, and less likely to miss class altogether. On the other hand, one could also argue that students who are more likely to come to class prepared,

and to ask questions in class, etc., might also be more likely to become informed about and take advantage of SLG sessions that are made available to them.

The results were likely influenced by the institutional uniqueness of Queen's University and its variant of the SI program. As one of the oldest postsecondary institutions in Canada, Queen's draws undergraduate students internationally, but also from families with a generally high socioeconomic background. Its location in a relatively small city between Toronto and Montreal, its medium size, and its selection of undergraduate programs also likely had an effect on which students selected to attend Queen's, the diversity of its undergraduate population, and the impact of SI.

Hosting sessions in residence also likely had an effect on these results. While there are many benefits to running sessions in residence, the residence location may also invite adverse social dynamics (such as personal or group conflicts) that spill-over from residence and, subsequently, affect the participation and engagement of some students. Additionally, hosting sessions in residence likely facilitated knowledge spill over between SLG participants and non-SLG participants. While this is a positive outcome, this spill-over effect makes statistical comparisons between participants and non-participants difficult and likely complicated the results of this analysis.

Overall, the results presented in this report provide one of the first glimpses into the impact of the SLG program at Queen's University. While this paper finds the SLG program at Queen's has shown signs of positive, although mixed, success during its pilot years, much research remains to be done on the role of this program as it continues to evolve and grow in the years to come. What is certain from these results, however, is that Supplemental Instruction, and Supported Learning Groups at Queen's in particular, are an unlikely substitute for traditional academic resources such as labs, seminars and lectures that are led by trained academic professionals. The evidence presented in this report suggests that SLGs play an important supplementary role to these resources by reinforcing academic best practices and by providing guided study time for students, especially those at academic risk. In particular, the results of this report underline the importance of SLGs in increasing academic engagement.

However, at least two significant questions remain unanswered. First, while the SLG program is open to all students, it appears that students most at risk, or those who could potentially benefit the most, did not attend very often, or in some cases at all. As a recently published HEQCO meta-analysis of its student services assessments (Wiggers & Arnold, 2011) concluded, "If you build an intervention designed to help students achieve academic success, they may not actually come," (p.9). Further research is needed to explore strategies to increase participation among students with low engagement, and among students who are most at risk of not completing the course, failing or receiving a grade too low to allow progression into upper year courses.

Secondly, an issue strongly related to the first point is the question of institutional expectations. As SI use increases across Canada, understanding variations in institutional expectations of programs like SLG is critical to unpacking the relationship between reforms in higher education, fiscal constraints, and the growth of SLG programs. The expectations associated with SLG programs are broad, complex and expanding. Understanding these expectations and the context within which they are constructed, as well as what outcomes are realistic and reasonable, is urgently needed to enable institutions to determine appropriate uses for the program and benchmarks of success.

Although a plethora of research indicates the implementation of SI programs can have positive – and even in some cases dramatic effects on student performance and retention, we argue these results may vary greatly between institutions, and indeed between courses. The expectation that SI can be applied with uniform results is likely unrealistic, and may be partially attributed to meta-analytical approaches that conceal institutional differences, as well as early empirical work that failed to pay sufficient attention to problems associated with self-selection bias. Evidence suggests that heightened expectations for SI may also be attributable to the financial motivations of postsecondary institutions seeking cost effective means of boosting student performance.

Quoting again from the recent HEQCO publication which addresses this general topic, some interventions such as SLG:

> are too limited in scope to begin with, involving only one or at most several hours of actual contact time. Because so many different class-based and student service interventions exist – including some targeted at specific "at risk" populations – their impacts also often overlap, making it even more difficult to measure the impact of any individual intervention. It may not be possible to measure the impact of even the most specialized or targeted intervention on improved writing skills, study habits on academic performance in a single course or in a single year's retention (Wiggers and Arnold, 2011, p. 13).

Supplemental Instruction programs can be an important addition to traditional academic resources. However, SI programs cannot be used as a substitute for traditional resources, and are certainly not a one stop solution to issues of poor academic performance and retention. By contrast, they should be viewed as an additional resource for students, and expectations for their performance should be institution specific.

References

Amin, A. (1999). An institutionalist perspective on regional economic development. *International Journal of Urban and Regional Research, 23*(2), 365-378

Arendale, D.R. (1997). *Supplemental instruction: Review of research concerning the effectiveness of SI from the University of Missouri-Kansas City and other institutions from across the United States.* National Center for Supplemental Instruction, University of Missouri-Kansas City. Accessed May 2011, available at: http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED457797&ERICExtSearch_SearchType_0=no&accno=ED457797

Blanc, R.L., DeBuhr, L., & Martin, D. (1983). Breaking the attrition cycle. *Journal of Higher Education, 54* (1), 80-90.

Blanc, R., & Martin, D.C. (1994). Supplemental instruction: Increasing student performance and persistence in difficult academic courses, *Academic Medicine*, 69(6).

Burmeister, S.P., Kenney, P., & Nice, D. (1996). Analysis of the effectiveness of SI sessions for college algebra, calculus, and statistics. In Research in Collegiate Mathematical Education II, J. Kaput, A.H. Schoenfeld, and E. Dubinsky eds., American Mathematical Society, Rhode Island, pp 145-154.

Congos, D.H., & Schoeps, N. (1993). Does supplemental instruction really work and what is it anyway? *Studies in Higher Education*, *18*(2), 165-176.

Conway, C. (2010). Implementing engagement improvements through targeted interventions: Final report: Intervention processes, impacts and implications. Toronto: Higher Education Quality Council of Ontario.

Etter, E.R., Burmeister, S.P., & Elder, R.J. (2000). Improving student performance and retention via supplemental instruction. *Journal of Accounting Education*, *18* (4), 355-368.

Fayowski, V., & MacMillan, P.D. (2008). An evaluation of the Supplemental Instruction programme in a first year calculus course. *International Journal of Mathematical Education in Science and Technology*, *39*(7), 843-855.

Greene, W.H. (2008). *Econometric Analysis*. New Jersey, Prentice Hill.

Kochenour, E.O., Jolley, D.S., Kaup, J.G., Patrick, D.L., Roach K.D., & Wenzler, L.A. (1997). Supplemental Instruction: An effective component of student affairs programming. *Journal of College Student Development*, 38(6), 577-586.

Loviscek, A.L., & Cloutier. N.R. (1997). Supplemental instruction and the enhancement of student performance in economic principles. *American Economist*, *41*(2), 70-76.
Kuh, G.D., Douglas, K.B., Lund, J.P., & Ramin-Gyurnek, J. (1994). *Student learning outside the classroom: Transcending artificial boundaries*. ASHE-ERIC Higher Education Report, 8. Washington, DC: The George Washington University, Graduate School of Education and Human Development.

Mahdi, A.E. (2004). Peer-Supported learning groups: A collaborative approach to supporting students learning in engineering and technology. *Transactions on Advances in Engineering Education*. Accessed May 2011, available at: http://74.125.155.132/scholar?q=cache:URBYD08y6D8J:scholar.google.com/&hl=en&as_sdt=0,5&as_vis=1

Martin, D.C., & Arendale, D. R. (1992). *Supplemental instruction improving first-year student success in high risk courses* (2nd ed. Monograph No. 7). Columbia, SC: National Resource Centre for the Freshmen Year Experience, University of South Carolina.

Martin, D.C., & Arendale, D. R. (1994). Supplemental Instruction: Review of research concerning the effectiveness of SI from the University of Missouri-Kansas City and other institutions from across the United States. National Center for Supplemental Instruction, University of Missouri-Kansas City. Accessed May 2011, available at: http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED370502&ERICExtSearch_SearchType_0=no&accno=ED370502

McInnis, C. (2001). Signs of disengagement?: The changing undergraduate experience in Australian universities. *Inaugural professorial lecture*. Melbourne: Faculty of Education, University of Melbourne. Accessed May 2011, available at: http://www.eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED466720&ERICExtSearch_SearchType_0=no&accno=ED466720

Miles, C.A., Polovina-Vukovic, D., Litteljohn, D., & Marini, A. (2010) *The effectiveness of the peer-assisted study sessions (PASS) program in enhancing student academic success at Carleton University*. Accessed July 2010, available at: http://www.heqco.ca/SiteCollectionDocuments/PASS%20ENG.pdf

O'Brien, R.M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality and Quantity 41*(5), 673-690.

Ogden, P., Thompson, D., Russell, A., & Simons, C. (2003). Supplemental instruction: Short- and long-term impact. *Journal of Development Education*, 26 (3), 2-8.

Padgett, R.D., Salisbury, M.H., An, B.P., & Pascarella, E.T. (2010). Required, practical, or unnecessary? An examination and demonstration of propensity score matching using longitudinal secondary data. *New Directions for Institutional Research*, Assessment Supplement, 29–42.

Pascarella, E. T., Bohr, L., Nora, A., Zusman, B., Inman, P., & Desler, M. (1993). Cognitive impacts of living on campus versus commuting to college, *Journal of College Student Development, 34,* 216-220.

Pascarella, E.T., & Terenzini, P.T. (2005) *How college effect students, volume 2: A third decade of research*. San Francisco CA: Jossey-Bass.

Peat, M., Dalziel, J., & Grant, A.M. (2001) Enhancing the first year student experience by facilitating the development of peer networks through a one-day workshop. *Higher Education Research & Development*, *20*(2), 199-215.

Ramirez, G.M. (1997). Supplemental Instruction: The long term impact. *Journal of Developmental Education*, 21 (1), 2-10.

Rath, K.A., Peterfreund, A.R., Xenos, S.P., Bayliss, F., & Carnal, N. (2007). Supplemental Instruction in Introductory Biology I: Enhancing the performance and retention of underrepresented minority students. *Life Sciences Education*, 6(3), 203-216.

Schwartz, M. (1992). Study sessions and higher grades: Questioning the causal link. *College Student Journal,* 26(3), 292-299.

Tabachnick, B.G. , & Fidell, L.S. (2007). *Using multivariate statistics*. Pearson Education: Toronto

Tinto, V. (2002). Establishing Conditions for Student Success: Lessons Learned in the United States. Paper presented at the 11th Annual Conference of the European Access Network, Monash University, Prato, Italy. Accessed June 2011, Available at: http://faculty.soe.syr.edu/vinto/

Trotter, E., & Roberts, C.A. (2006). Enhancing the early student experience. *Higher Education Research and Development, 25*(4), 371–386.

University of the Fraser Valley (2010). *Supported learning groups*. Accessed May 2010 http://www.ufv.ca/SLG/About_SLG.htm

Upcraft, M.L., Gardner, J.N., &. Barefoot, B.O. (2005). *Challenging and supporting the first-yearsStudent: A handbook for improving the first year of College.* San Francisco: Jossey-Bass.

Wilson, M. (2005). Supplemental instruction in the Canadian context. *Journal of Student Centered Learning*, *2*(2), 109-119.

Wiggers, R.D., & Arnold, C. (2011). *Defining, Measuring and Achieving "Student Success" in Ontario Colleges and Universities.* Toronto: Higher Education Quality Council of Ontario.

Wolfe, R.E. (1987). The Supplemental Instruction program: Developing learning and thinking skills. *Journal of Reading*, 31(3), 228-232

Yorke, M., & Thomas, L. (2003) Improving the retention of students from lower socio-economic groups, *Journal of Higher Education Policy and Management,* 25(1), 63–74.

Appendix A: Supported Learning Groups Pre-Test

Consent

- I confirm that I have read the Letter of Information and have had any questions answered to my satisfaction.
- I understand that I will be participating in the study titled *Assessing the Impact of Supported Learning Groups in aFirst Year Undergraduate Class.*
- I have been informed that my involvement consists of a 5-mintue survey.
- I understand that the purpose of the study is to understand the way in which these workshops have impacted students' learning and personal development.
- I understand that I will be asked to provide my student number so that the investigator can compare the academic and social development of participants with non participants (data will only be used in aggregate and no individuals will be identified).
- I understand I may contact Jennifer Massey (jennifer.massey@queensu.ca) with any questions, concerns or complaints.
- I understand that participation is voluntary and that I may withdraw at any time.

1. How motivated are you to obtain a high grade (70% or above) in BIO 102?

- ☐ Very motivated
- ☐ Motivated
- ☐ Neither motivated or unmotivated
- ☐ Unmotivated
- ☐ Very unmotivated
- ☐ Decline to answer

2. How would you rate your anxiety level relating to BIO 102?

- ☐ Very High
- ☐ High
- ☐ Neither high nor low
- ☐ Low
- ☐ **No anxiety relating to BIO 102**
- ☐ **Decline to answer**

3. Please check which of the following learning strategies you current use or have used in the past? *Check all that apply*

- ☐ The Cornell method of note taking
- ☐ Mindmaps
- ☐ Study schedule
- ☐ Mnemonic devices
- ☐ Developing example test questions
- ☐ Studying out loud
- ☐ Other _____ (please specify)
- ☐ Decline to answer

4. How confident are you with using the Cornell method of notetaking when studying?

- ☐ Very confident
- ☐ Confident
- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

5. How confident are you with using Study schedules when studying?

- ☐ Very confident
- ☐ Confident
- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

6. How confident are you with using mindmaps when studying?

- ☐ Very confident
- ☐ Confident

- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

7. How confident are you with using Mneumonic devices when studying?

- ☐ Very confident
- ☐ Confident
- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

8. How confident are you with developing example test questions when studying?

- ☐ Very confident
- ☐ Confident
- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

9. How confident are you with studying out loud?

- ☐ Very confident
- ☐ Confident
- ☐ Neither confident nor unconfident
- ☐ Unconfident
- ☐ Very Unconfident
- ☐ Decline to answer

10. What is your student number?

Appendix B: Classroom Survey of Student Engagement

CLASSE$_{\text{STUDENT}}$
Classroom Survey of Student Engagement*

This survey includes items that ask about your participation in Biology 103 and about educational practices that occur in this class. Your honest and straightforward responses to these questions will help us identify targets for improvements and enable us to provide an even higher quality academic experience.

PART I: ENGAGEMENT ACTIVITIES				
So far this semester, how often have you done each of the following in your Biology 103 class?	Never ▼	1 or 2 times ▼	3 to 5 times ▼	More than 5 times ▼
1. Asked questions during your Biology 103 class	□	□	□	□
2. Contributed to a class discussion that occurred during your Biology 103 class	□	□	□	□
3. Prepared two or more drafts of a paper or assignment in your Biology 103 class before turning it in	□	□	□	□
4. Worked on a paper or a project in your Biology 103 class that required integrating ideas or information from various sources	□	□	□	□
5. Included diverse perspectives (different races, religions, genders, political beliefs, etc.) in class discussions or writing assignments in your Biology 103 class	□	□	□	□
6. Came to your Biology 103 class without having completed readings or assignments	□	□	□	□
7. Worked with other students on projects **during** your Biology 103 class	□	□	□	□
So far this semester, how often have you done each of the following in your Biology 103 class?	Never	1 or 2 times	3 to 5 times	More than 5 times

8. Worked with classmates **outside of** your Biology 103 class to prepare class assignments	□	□	□	□
9. Put together ideas or concepts from different courses when completing assignments or during class discussions in your Biology 103 class	□	□	□	□
10. Tutored or taught other students in your Biology 103 class	□	□	□	□
11. Used an electronic medium (list-serv, chat group, Internet, instant messaging, etc.) to discuss or complete an assignment in your Biology 103 class	□	□	□	□
12. Used email to communicate with the instructor of your Biology 103 class	□	□	□	□
13. Discussed grades or assignments with the instructor of your Biology 103 class	□	□	□	□
14. Discussed ideas from your Biology 103 with others outside of class (students, family members, coworkers, etc.)	□	□	□	□

□ Never	□ Once	□ 2 times
□ Never	□ Once	□ 2 times
□ Never	□ Once	□ 2 times
□ Never/Rarely	□ Sometimes	□ Often
□ Never/Rarely	□ Sometimes	□ Often

So far this semester, how much of your coursework in your Biology 103 class emphasized the following mental activities?	Very Little ▼	Some ▼	Quite a Bit ▼	Very Much ▼
20. **Memorizing** facts, ideas, or methods from your courses and readings so you can repeat them in pretty much the same form	□	□	□	□

21. **Analyzing** the basic elements of an idea, experience, or theory, such as examining a particular case or situation in depth and considering its components	□	□	□	□
22. **Synthesizing** and organizing ideas, information, or experiences into new, more complex interpretations and relationships	□	□	□	□
23. **Making Judgments** about the value of information, arguments, or methods, such as examining how others gathered and interpreted data and assessing the soundness of their conclusions	□	□	□	□
24. **Applying** theories or concepts to practical problems or in new situations	□	□	□	□

PART III: OTHER EDUCATIONAL PRACTICES

So far this semester

25. How often in your Biology 103 class have you been required to prepare written papers or reports of more than 5 pages in length?

□ Never □ Once □ 2 times □ 3 or more times

26. To what extent do the examinations in your Biology 103 class challenge you to do your best work?

□ Very little □ Some □ Quite a bit □ Very much

27. In a **typical week** in your Biology 103 class, how many homework assignments take you more than one hour each to complete?

□ None □ 1 or 2 □ 3 or 4 □ 5 or more

28. In a **typical week**, how often do you spend more than 3 hours preparing for your Biology 103 class (studying, reading, doing homework or lab work, analyzing data, rehearsing, and other academic matters)?

□ Never/Rarely □ Sometimes □ Often □ Very Often

29. How many times have you been absent so far this semester in your Biology 103 class?

□ None □ 1 - 2 absences □ 3 – 4 absences □ 5 or more absences

30. How frequently do you take notes in your Biology 103 class?

□ Never/Rarely □ Sometimes □ Often □ Very Often

31. How often do you review your notes prior to the next scheduled meeting in your Biology 103 class?

□ Never/Rarely □ Sometimes □ Often □ Very Often

32. How often have you participated in a study partnership with a classmate in your Biology 103 class to prepare for a quiz or a test?

□ Never □ Once □ 2 times □ 3 or more times

33. How often have you attended a review session or help session to enhance your understanding of the content of your Biology 103 class?

□ Never □ Once □ 2 times □ 3 or more times

34. How interested are you in learning the Biology 103 course material?

□ Very uninterested □ Uninterested □ Interested □ Very Interested

PART IV: CLASS ATMOSPHERE

So far this semester, what are your general impressions of the Biology 103 class atmosphere?

35. How comfortable are you talking with the instructor of your Biology 103 class?
□ Uncomfortable □ Somewhat Comfortable □ Comfortable □ Very Comfortable

36. How much do you enjoy group work with your classmates in your Biology 103 class?
□ Very Little □ Some □ Quite a Bit □ Very Much

37. How difficult is the course material in your Biology 103 class?
□ Easy □ Somewhat Difficult □ Difficult □ Very Difficult

38. How easy is it to follow the lectures in your Biology 103 class?
□ Difficult □ Somewhat Easy □ Easy □ Very Easy

PART V: OPTIONAL BIOLOGY 103 ITEMS

So far this semester

39. How motivated are you to obtain a high grade (70% or above) in Biology 103?
□ Very Motivated □ Motivated □ Neither motivated or unmotivated □ Unmotivated □ Very motivated □ Decline

40. How would you rate your anxiety level relating to Biology 103?
□ Very High □ High □ Neither high nor low □ Low □ Very low □ Decline to answer

41. Please check which of the following learning strategies you currently use or have used in the past. Check all that apply
□ Cornell Method of notetaking □ Mindmaps □ Study Schedule □ Mnemonic Maps

□ Developing example test questions □ Studying out loud □ Other _____ (please specify)

□ Decline to answer

42. How confident are you with using the Cornell method of notetaking when studying?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □ Decline

43. How confident are you with using Study schedules when studying?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □ Decline

44. How confident are you with using mindmaps when studying?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □ Decline

45. How confident are you with using Mneumonic devices when studying?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □ Decline

46. How confident are you with developing example test questions when studying?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □ Decline

47. How confident are you with studying out loud?

□ Very Confident □ Confident □ Neither confident nor unconfident □ Unconfident □ Very unconfident □

Please enter your student identification number here:_____

If you do not know your ID number, please print your first and last name.

We ask you to identify yourself by student identification number in order to permit us to relate your responses to the particular educational experience you've had at **Queen's University.** Please know that your individual responses will remain confidential. No individual responses will ever be identified in any report, shared with your faculty instructor, or in any other way made available. As a student-centered university, we know we will make the best decisions to improve the educational experience when those decisions are informed by student feedback. Thank you for helping us attain this goal.

Thank you for taking the time to complete this survey

Appendix C: Psychology 100 Post test items and percentage response distributions

	Never		1 to 2		3 to 5		5 or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Asked questions … participated in discussions	77	75	13	13	8	6	3	2	2	3
Contributed to class discussion	79	70	13	16		6	5	3	3	5
Prepared 2+ drafts of paper	26	33	3	4		2		1	72	61
Worked on a paper or a project	28	33	3	2		2		2	69	61
Included diverse perspectives in class discussions	26	36	15	10	3	6	8	7	49	41
Came unprepared to class	3	9	28	13	18	15	44	56	8	7
Worked with students during class	44	42	5	9	5	1	3	3	44	45
Worked with classmates outside class	18	26	3	11	33	11	5	8	41	43
Integrated ideas from different courses	21	32	21	19	13	10	13	9	33	30
Tutored or taught other students	31	42	38	23	15	16	10	11	5	8
Used an electronic medium to discuss assignments	41	39	15	15	8	9	8	8	28	29
Discussed grades with instructor	77	78	13	11	3	2	3	2	5	7
Discussed ideas with faculty outside class	8	13	10	17	23	19	59	49		2

	Never		Sometimes		Often		Very Often		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Discussed ideas from readings with instructor out of class	82	78	8	7	3	2	3	4	5	9
Received prompt written or oral feedback on assignments	80	70	13	10	4	2	8	14		
Worked harder than you thought you could to meet instructors expectations	23	26	13	33	36	18	26	19	3	4

	Very little		Some		Quite a bit		Very much		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Memorizing facts, ideas, or methods from your courses and readings	5	2	10	10	13	20	72	68		
Analyzing the basic elements of an idea, experience, or theory	5	8	26	34	49	38	21	19		
Synthesizing and organizing ideas, information, or experiences	10	16	28	40	49	27	13	17		
Making Judgments about the value of information, arguments, or methods	26	24	33	40	28	26	13	10		
Applying theories or concepts to practical problems or in new situations	18	12	18	31	38	38	26	19		

	Never		Once		Twice		Twice or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How often did you do papers or reports of more than 5 pages in length?	85	74				2		4	15	19

	Never		Once		Twice		Twice or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
To what extent do the exams challenge you to do your best work?	10	5	8	17	41	27	41	50		1

	Never		1 to 2		3 to 5		5 or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
In a typical week in your class, how many homework assignments take you more than one hour each to complete?	44	28	26	18	3	6	3	4	26	44

	Never		1 to 2		3 or 4		5 or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
In a typical week, how often do you spend more than 3 hours preparing for class?	28	35	31	40	23	17	18	8		
How many times absent?	38	23	33	37	21	21	8	19		

	Never		Sometimes		Often		Very Often		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How frequently do you take notes in your class?	5	4	8	7	8	13	79	73		4
How often do you review your notes prior to the next scheduled meeting in your class?	49	44	33	36	8	8	10	8		4

	Never		Once		Twice		3 or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How often have you participated in a study partnership with a classmate in your class?	18	27	5	13	13	14	62	42	3	4

	Never		Once		Twice		3 or more		Does not apply	
How often have you attended a review session?	21	44	10	24	18	13	51	16		3

	Very uninterested		Uninterested		Interested		Very Interested		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How interested are you in learning the course material?	15	8	8	15	44	49	33	29		

	Uncomfortable		Somewhat comfortable		Comfortable		Very comfortable		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How comfortable are you talking with the instructor of your class?	18	22	46	30	23	30	13	8		9
	Easy		Somewhat difficult		Difficult		Very difficult		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How difficult is the course material?	5	5	51	46	36	35	8	15		
How easy is it to follow lectures in class?	8	13	46	38	33	34	13	10		

Appendix D: Biology 103 Post test items and percentage response distributions

	Never		1 or 2 times		3 to 5 times		5 or more times		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Asked questions … participated in discussions	65	78	22	17	6	2	4	2	2	2
Contributed to class discussion	73	78	10	12	2	2		2	14	5
Prepared 2+ drafts of paper	14	27	22	28	37	33	22	8	4	3
Worked on a paper or a project	10	5	8	7	33	51	47	34	2	3
Included diverse perspectives different races	37	43	29	27	12	10	8	2	14	18
Came unprepared to class	24	15	6	17	20	18	43	47	6	4
Worked with students during class	49	46	20	23	12	14	8	11	10	6
Worked with classmates outside class	10	83	41	5	31	2	16	2	2	7
Integrated ideas from different courses	22	7	33	34	27	34	18	23		2
Tutored or taught other students	53	24	22	39	14	26	8	10	2	2
Used an electronic medium list serv chat group	31	53	18	25	18	16	31	5	2	1
Discussed grades with instructor	55	66	22	18	8	10	8	4	6	2
Discussed ideas with faculty outside class	14	13	20	36	24	23	41	26		2

	Never		Once		Twice		Twice or more		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Discussed ideas from readings with instructor out of class	59	81	16	11	14	3	8	3	2	1
How often did you prepare written papers or reports of more than 5 pages in length?	18	14	29	54	33	18	18	13	2	2

In a typical week in your class, how many homework assignments take you more than one hour each to complete?	2	7	55	69	27	13	10	5	6	6
In a typical week, how often do you spend more than 3 hours preparing for your class	20	23	20	41	27	22	33	14		
How many times have you been absent?	24	15	35	30	29	28	12	26		
How often have you participated in a study partnership with a classmate in your class?	22	27	16	14	31	24	29	33	2	1
How often have you attended a review session	18	65	27	21	20	7	33	4	2	3

	Never		Sometimes		Often		Very often		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
Received prompt written or oral feedback on assignments	45	46	27	29	12	14	12	6	4	5
Worked harder than you thought you could to meet instructors expectations	10	17	37	35	39	30	12	13	2	6
To what extent do the exams challenge you to do your best work?	6	5	6	8	12	34	73	51	2	2
How frequently do you take notes in your class?	4	5	8	13	18	17	69	64		1
How often do you review your notes prior to the next scheduled meeting in your class?	41	52	39	31	10	9	10	6		2
Memorizing facts, ideas, or methods from your courses and readings		2	14	13	35	35	51	50		
Analyzing the basic elements of an idea, experience, or theory	4	7	39	27	31	44	27	22		
Synthesizing and organizing ideas, information, or experiences	6	12	39	30	33	42	22	16		
Making Judgments about the value of	14	17	31	36	39	31	16	17		

information, arguments, or methods										
Applying theories or concepts to practical problems or in new situations	10	12	31	27	24	31	35	30		
	Very uninterested		Uninterested		Interested		Very		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How interested are you in learning course material?	8	6	22	17	55	63	14	13		
	Uncomfortable		Somewhat		Comfortable		Very		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How comfortable are you talking with the instructor of your class?	4	10	14	15	39	42	31	23	12	10
	Easy		Somewhat		Difficult		Very		Does not apply	
	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG	SLG	Non-SLG
How difficult is the course material in your class?	2	4	31	41	35	45	33	10