PROGRESS THROUGH CALCULUS
NATIONAL SURVEY SUMMARY

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MAA PtC
Progress through Calculus

NSF Award #1430540

This work was supported by NSF grant DUE 1430540 & DUE 1432381. The opinions expressed in this report do not necessarily reflect those of the National Science Foundation.

THE PROGRESS THROUGH CALCULUS PROJECT

This report presents survey findings from the *Progress through Calculus* project, the second in a series of national studies of college calculus overseen by the Mathematical Association of America (MAA) and supported by the National Science Foundation (NSF). The first of these, 2009-2015, *was Characteristics of Successful Programs in College Calculus* (CSPCC, NSF DRL #0910240) which undertook a national survey of Calculus I instruction and conducted multi-day case study visits to 20 colleges and universities with interesting and, in most cases, successful calculus programs. The current project, 2015-2019, is *Progress through Calculus* (PtC, NSF DUE #1430540). This project broadens our study to the entire Precalculus to Calculus II (P2C2) sequence while focusing on cataloging the efforts currently underway to improve student success through this sequence and documenting what does and does not work in the actual implementation of these efforts. The goals of this study are to investigate the following questions:

1. What are the programs and structures of the P2C2 sequence as currently implemented?
    a. What programs and structures are currently in place and how common are they?
    b. What changes to these programs and structures are being implemented in Mathematics departments, either in pilot programs or as large-scale initiatives?
    c. What is the fine-grain structure of these programs and structures in practice?
2. How do characteristics of P2C2 programs relate to student success?
    a. How do departments of Mathematics characterize themselves in terms of implementation of the practices identified in CSPCC as characteristic of successful programs?
    b. What is the relationship between various structural, curricular, and pedagogical decisions (including differing levels of implementation of the practices identified in CSPCC) on student success in P2C2?

Phase I of the project involved a survey of all mathematics departments in the United States that offer a graduate degree (i.e., PhD, MA, MS) in mathematics. Phase II will involve the selection of 12 case study sites to investigate connections between various models (and implementations) for the P2C2 sequence and outcomes that include student persistence and student learning. Details of the CSPCC and PtC projects can be found online at http://www.maa.org/cspcc.

The PI team of PtC are David Bressoud (Macalester College), Chris Rasmussen (San Diego State University), Jessica Ellis (Colorado State University), Sean Larsen (Portland State University), Linda Braddy (Tarrant County College), and Estrella Johnson (Virginia Tech). This document was prepared by graduate research assistant, Naneh Apkarian, at San Diego State University. Individual institution reports were prepared by research assistants Naneh Apkarian, Matthew Voigt, and Kady Hanson at San Diego State University. The GTA section of the census survey was developed in collaboration with researchers associated with the *Improving the Preparation of Graduate Students to Teach Undergraduate Mathematics* project (NSF DUE #1432381).

UNDERSTANDING THIS REPORT

This document contains an overview of the results from the census survey. Our intention in sharing this information is for you to see how your institution compares with the national landscape. We are pleased to report that many institutions participated in our survey, which was distributed to every American institution that offers a

graduate degree in mathematics. Overall we had a 67.6% response rate (223/330), representing 75% (134/178) of the PhD-granting institutions and 59% (89/152) of the MA/MS-granting institutions that we contacted.

This report is organized into two main parts. The first deals with survey questions related to the nature of P2C2 programs across the country and their implementation, organized into five sections. The second deals with specific details of courses in the P2C2 sequence, covering selected topics expected to be of widespread interest.

The sections of this report are organized for clarity of reporting and do not exactly match the order in which questions were answered by participants. Note that the survey was adaptive, meaning that not everyone saw every question. For example, if an institution indicated that they do not have a teaching preparation program for graduate teaching assistants (GTAs), they were not asked about the details of such a program. A final note about the inclusion/exclusion of questions from this report: our analyses are still ongoing, and therefore certain responses (e.g., write-in responses) have been omitted from this document.

As you read through these data, you may notice that the *N*-size changes from question to question. This reflects the number of responses to each question. Thus, proportions should be read as "0.789 *of the institutions who answered this question* reported that students who do not meet the placement requirements are prevented from enrolling in the courses they wish to take." In each table of values, the *N* is indicated in parentheses (e.g., "All (218)"). Each value is reported both with a count and a proportion in parentheses (e.g., "41 (0.188)"). The proportion is based on the column total. For ease of reporting, "MA" is used to designated institutions whose highest mathematics degree is a master's degree, be it an MA or an MS.

PART I: PROGRAMMATIC OVERVIEW

The first section of the survey in this report looked at the structures and programs surrounding the Precalculus to Calculus 2 (P2C2) sequence. This included questions about how students are placed into their first course in the sequence, resources available to support students taking these introductory courses, the collection and review of local data to monitor the existing program, GTAs involvement and training, and the department's priorities with regard to their implementation of key features of their program. These themes were included in the PtC survey because they were identified as important elements of successful Calculus I programs in the CSPCC study. Project details and further reading on the results of the CSPCC project are available in the form of an MAA Notes volume available online at http://www.maa.org/cspcc.

Part I of this report consists of survey questions in their original wording and the responses of participating institutions. Responses are reported by institution type (PhD vs. MA) as well as in the aggregate.

A. PLACEMENT

How are entering students placed into the precalculus/calculus sequence? Mark all that apply.

	All (219)	PhD (134)	MA (85)
Placement exams developed by the department	104 (0.475)	80 (0.597)	24 (0.282)
Placement exams created by the state	16 (0.073)	2 (0.015)	14 (0.165)
ACT or SAT scores	116 (0.530)	60 (0.448)	56 (0.659)
Accuplacer	21 (0.096)	6 (0.045)	15 (0.176)
Compass	24 (0.110)	10 (0.075)	14 (0.165)
ALEKS	51 (0.233)	37 (0.276)	14 (0.165)
MAA placement exam	11 (0.050)	6 (0.045)	5 (0.059)
High school grades	37 (0.169)	10 (0.075)	27 (0.318)
AP exam results	155 (0.708)	96 (0.716)	59 (0.694)
Individual advising	74 (0.338)	44 (0.328)	30 (0.353)
Other	39 (0.18)	22 (0.164)	17 (0.200)

Is it usually the case that student who do not meet the placement requirements are prevented from enrolling in the class they wish to take?

	All (219)	PhD (133)	MA (86)
Yes	176 (0.804)	103 (0.774)	73 (0.849)
No	43 (0.196)	30 (0.226)	13 (0.151)

Other than ad hoc advising, does your department have a process in place to revisit and, as necessary, adjust student placement after the term begins?

	All (219)	PhD (133)	MA (86)
Yes	56 (0.256)	36 (0.271)	20 (0.233)
No	163 (0.744)	97 (0.729)	66 (0.767)

Is the department generally satisfied with the effectiveness of the placement procedures for the precalculus/calculus sequence?

	All (217)	PhD (132)	MA (85)
Yes	112 (0.516)	68 (0.515)	44 (0.518)
Procedures are adequate, but could be improved	85 (0.392)	55 (0.417)	30 (0.353)
No	20 (0.092)	9 (0.068)	11 (0.129)

What best characterizes the current status of your placement procedures? Mark all that apply.

	All (218)	PhD (133)	MA (85)
No significant changes are planned	106 (0.486)	67 (0.50)	39 (0.459)
Changes have recently/currently being implemented	67 (0.307)	42 (0.32)	25 (0.294)
Possible changes are being discussed	64 (0.294)	36 (0.27)	28 (0.329)

B. RESOURCES TO SUPPORT STUDENTS

Is there a university-wide tutoring center available to students in the precalculus/calculus sequence?

Response Item	All (218)	PhD (133)	MA (85)
No	41 (0.188)	28 (0.211)	13 (0.153)
Yes – for any course	95 (0.436)	62 (0.466)	33 (0.388)
Yes – specifically for mathematics courses	82 (0.376)	43 (0.323)	39 (0.459)

Is there a department-run tutoring center available to students in the precalculus/calculus sequence?

Response Item	All (219)	PhD (134)	MA (85)
No	49 (0.224)	25 (0.187)	24 (0.282)
Yes – for any math course	92 (0.420)	55 (0.410)	37 (0.435)
Yes – specifically for P2C2 courses	78 (0.356)	54 (0.403)	24 (0.282)

Note: responses to the first two questions, regarding the existence of university-wide and department-run tutoring centers, determined which, if any, of the following questions were visible to the participants.

Which of the following other supports are offered for students in the precalculus/calculus sequence? Mark all that apply.

Response Item	All (223)	PhD (134)	MA (89)
Space in the math building for students to gather	125 (0.561)	75 (0.56)	50 (0.562)
P2C2 study groups arranged outside the department	46 (0.206)	30 (0.224)	16 (0.18)
Resources specifically for "at-risk" groups	71 (0.318)	44 (0.328)	27 (0.303)
Optional supplemental instruction	86 (0.386)	53 (0.396)	33 (0.371)
Practice exams	74 (0.332)	62 (0.463)	12 (0.135)
Online tutoring	24 (0.108)	12 (0.09)	12 (0.135)
Online resources for content review	82 (0.368)	51 (0.381)	31 (0.348)
Other	25 (0.112)	16 (0.119)	9 (0.101)
No response	23 (0.103)	11 (0.082)	12 (0.135)

In what roles are undergraduates hired to support precalculus/calculus instruction? Mark all that apply.

Response Item	All (217)	PhD (133)	MA (84)
Graders	117 (0.539)	72 (0.541)	45 (0.536)
Tutors	174 (0.802)	99 (0.744)	75 (0.893)
Recitation leaders	44 (0.203)	32 (0.241)	12 (0.143)
Leaders of review sessions	32 (0.147)	22 (0.165)	10 (0.119)
Leaders of supplemental instruction	68 (0.313)	38 (0.286)	30 (0.357)
Other	16 (0.074)	7 (0.053)	9 (0.107)
Not hired	17 (0.078)	13 (0.098)	4 (0.048)

Which of the following services are available through the **department-run tutoring center**? Mark all that apply.

Response Item	All (169)	PhD (108)	MA (61)
Computer-aided instruction	48 (0.284)	24 (0.222)	24 (0.393)
Organized small group tutoring or study sessions	52 (0.308)	30 (0.278)	22 (0.361)
Tutoring by undergraduate students	135 (0.799)	77 (0.713)	58 (0.951)
Tutoring by graduate students	144 (0.852)	96 (0.889)	48 (0.787)
Tutoring by mathematics faculty	46 (0.272)	25 (0.231)	21 (0.344)
Maple, Mathematica, or Matlab (or equivalent)	40 (0.237)	19 (0.176)	21 (0.344)
Review sessions	51 (0.302)	36 (0.333)	15 (0.246)
Other	5 (0.03)	3 (0.028)	2 (0.033)

Is your department generally satisfied with the **department-run** tutoring center?

Response Item	All (169)	PhD (108)	MA (61)
Yes	105 (0.621)	67 (0.620)	38 (0.623)
The center is adequate, but could be improved	62 (0.367)	41 (0.380)	21 (0.344)
No	2 (0.012)	0 (0.000)	2 (0.033)

What best characterizes the status of **your department's** tutoring center? Mark all that apply.

Response Item	All (167)	PhD (109)	MA (61)
No significant changes are planned	116 (0.695)	75 (0.701)	41 (0.683)
Changes have recently/currently being implemented	26 (0.156)	19 (0.178)	7 (0.117)
Possible changes are being discussed	29 (0.174)	17 (0.159)	12 (0.200)

Note: the following two questions were visible only if the participant indicated the presence of a university-wide tutoring center and the absence of a department-run tutoring center.

Is your department generally satisfied with the **university-wide** tutoring center?

Response Item	All (45)	PhD (22)	MA (23)
Yes	19 (0.422)	12 (0.545)	7 (0.304)
The center is adequate, but could be improved	20 (0.444)	9 (0.409)	11 (0.478)
No	6 (0.133)	1 (0.045)	5 (0.217)

What best characterizes the current status of the **university-wide** tutoring center?

Response Item	All (47)	PhD (23)	MA (24)
No significant changes are planned	32 (0.681)	17 (0.739)	15 (0.625)
Changes have recently/currently being implemented	8 (0.170)	3 (0.130)	5 (0.208)
Possible changes are being discussed	8 (0.170)	4 (0.174)	4 (0.167)

C. USE OF LOCAL DATA

Does your department have access to data to help inform decisions about your undergraduate program?

Response Item	All (215)	PhD (131)	MA (84)
No	10 (0.047)	6 (0.046)	4 (0.048)
Yes, but not readily available	107 (0.498)	63 (0.481)	44 (0.524)
Yes, readily available	98 (0.456)	62 (0.473)	36 (0.429)

*Note: if a participant indicated that they do **not** have access to data, the following question was not visible.*

Which types of data does your department review on a regular basis to inform decisions about your undergraduate program? Mark all that apply.

Response Item	All (202)	PhD (123)	MA (79)
Adherence to placement recommendations	87 (0.431)	55 (0.447)	32 (0.405)
Correlation with previous performance	94 (0.465)	60 (0.488)	34 (0.43)
Student performance (e.g., grades)	178 (0.881)	110 (0.894)	68 (0.861)
Student persistence on to the next course	82 (0.406)	50 (0.407)	32 (0.405)
Student evaluations	167 (0.827)	107 (0.87)	60 (0.759)
Student exit interviews	36 (0.178)	23 (0.187)	13 (0.165)
Communication with client disciplines	93 (0.46)	61 (0.496)	32 (0.405)
Other	18 (0.089)	11 (0.089)	7 (0.089)

Is the department generally satisfied with its use of local data (i.e., data collection and review)?

Response Item	All (214)	PhD (130)	MA (84)
Yes	95 (0.444)	62 (0.477)	33 (0.393)
Use is adequate, but could be improved	84 (0.393)	47 (0.362)	37 (0.440)
No (please explain):	35 (0.164)	21 (0.162)	14 (0.167)

What best characterizes the current status of your use of local data? Mark all that apply.

Response Item	All (213)	PhD (130)	MA (83)
No significant changes are planned	136 (0.638)	83 (0.638)	53 (0.639)
Changes have recently/currently being implemented	40 (0.188)	27 (0.208)	13 (0.157)
Possible changes are being discussed	43 (0.202)	23 (0.177)	20 (0.241)

D. GTAs IN THE PRECALCULUS-CALCULUS SEQUENCE

Is there a university-wide GTA teaching preparation program?

Response Item	All (213)	PhD (128)	MA (85)
Yes, required	57 (0.268)	45 (0.352)	12 (0.141)
Yes, strongly recommended	25 (0.117)	19 (0.148)	6 (0.071)
Yes, not strongly recommended	20 (0.094)	18 (0.141)	2 (0.024)
No	111 (0.521)	46 (0.359)	65 (0.765)

Is there a required, department-specific GTA teaching preparation program?

Response Item	All (215)	PhD (130)	MA (85)
Yes	148 (0.688)	108 (0.831)	40 (0.471)
No	67 (0.312)	22 (0.169)	45 (0.529)

Note: if a participant indicated that there is no required, department-specific GTA teaching preparation program, the following questions were not displayed.

WHO is the primary audience for your department's GTA teaching preparation program? Mark all that apply.

Response Item	All (148)	PhD (108)	MA (40)
Graders	45 (0.304)	35 (0.324)	10 (0.250)
Tutors	52 (0.351)	36 (0.333)	16 (0.400)
Recitation leaders	103 (0.696)	88 (0.815)	15 (0.375)
Primary instructors	120 (0.811)	85 (0.787)	35 (0.875)
In-class instructional assistants	54 (0.365)	39 (0.361)	15 (0.375)

HOW MANY of your GTAs participate in the department's teaching preparation program?

Response Item	All (148)	PhD (108)	MA (40)
All	118 (0.797)	88 (0.815)	30 (0.750)
Most	24 (0.162)	19 (0.176)	5 (0.059)
Less than half	4 (0.027)	1 (0.009)	3 (0.035)
Just a few	2 (0.014)	0 (0.000)	2 (0.024)

WHEN do GTAs participate in the department's teaching preparation program? Mark all that apply.

Response Item	All (148)	PhD (108)	MA (40)
Before teaching for the first time	129 (0.872)	95 (0.88)	34 (0.85)
During their first teaching term	78 (0.527)	57 (0.528)	21 (0.525)
During their second teaching term	29 (0.196)	21 (0.194)	8 (0.200)
At some later point (e.g., ongoing seminars)	29 (0.196)	18 (0.167)	11 (0.275)
Other	1 (0.007)	1 (0.009)	0 (0.000)

Which of the following best describes the FORMAT of your main activity in the GTA teaching preparation program? Mark all that apply.

Response Item	All (147)	PhD (108)	MA (39)
Short workshop/orientation	41 (0.279)	27 (0.250)	14 (0.359)
One-day workshop	22 (0.150)	14 (0.13)	8 (0.205)
Multi-day workshop	48 (0.327)	38 (0.352)	10 (0.256)
Term-long course or seminar	84 (0.571)	67 (0.620)	17 (0.436)
Occasional seminars or workshops	23 (0.156)	18 (0.167)	5 (0.128)
Other	15 (0.102)	11 (0.102)	4 (0.103)

Which of the following activities, related to providing **feedback** on GTA's teaching, does your program FORMALLY include? Mark all that apply.

Response Item	All (156)	PhD (112)	MA (44)
GTAs practice teaching and receive feedback on their teaching	105 (0.673)	83 (0.741)	22 (0.500)
GTAs are observed by an experienced instructor while teaching in the classroom and receive feedback on their teaching	117 (0.750)	85 (0.759)	32 (0.727)
New GTAs are observed by experienced GTAs while teaching in the classroom and receive feedback on their teaching	41 (0.263)	37 (0.330)	4 (0.091)
New GTAs teaching in the classroom are videotaped for review and discussion with a mentor or experienced instructor.	22 (0.141)	22 (0.196)	0 (0.000)
GTAs are paired with a mentor to discuss teaching	56 (0.359)	39 (0.348)	17 (0.386)
Other	11 (0.071)	8 (0.071)	3 (0.068)
No response	12 (0.077)	6 (0.054)	6 (0.136)

Which of the following activities, related to **evaluating** GTA's teaching, does your program FORMALLY include? Mark all that apply.

Response Item	All (156)	PhD (112)	MA (44)
Faculty observation	116 (0.744)	83 (0.741)	33 (0.750)
Student evaluations required by the university/department	136 (0.872)	101 (0.902)	35 (0.795)
Student evaluations separate from required student evaluations	35 (0.224)	28 (0.25)	7 (0.159)
Other	5 (0.032)	3 (0.027)	2 (0.045)
No response	12 (0.077)	6 (0.054)	6 (0.136)

Which of the following other teaching preparation activities does your program FORMALLY include? Mark all that apply.

Response Item	All (156)	PhD (112)	MA (44)
Watching/reading cases of others' teaching	53 (0.340)	37 (0.330)	16 (0.364)
Observing experienced GTAs in the classroom	22 (0.141)	19 (0.170)	3 (0.068)
Developing lesson plans	64 (0.410)	48 (0.429)	16 (0.364)
Learning about classroom assessment methods	62 (0.397)	45 (0.402)	17 (0.386)
Learning about research about student learning of mathematics	35 (0.224)	28 (0.250)	7 (0.159)
Other	11 (0.071)	9 (0.080)	2 (0.045)
No response	54 (0.346)	36 (0.321)	18 (0.409

What **best** describes the source of instructional materials and activities used in your teaching preparation program? Mark all that apply.

Response Item	All (155)	PhD (111)	MA (44)
Materials created by the people who provide teaching preparation	129 (0.832)	97 (0.874)	32 (0.727)
Published materials	59 (0.381)	45 (0.405)	14 (0.318)
Materials adopted from another institution's program	15 (0.097)	10 (0.090)	5 (0.114)
Other	6 (0.039)	4 (0.036)	2 (0.045)

WHO is responsible for facilitating the teaching preparation program? Mark all that apply.

Response Item	All (146)	PhD (108)	MA (38)
Experienced graduate students	27 (0.185)	26 (0.241)	1 (0.026)
One or more individuals for whom this is a multi-year assignment	123 (0.842)	88 (0.815)	35 (0.921)
One or more individuals for whom this is a single-year assignment	22 (0.151)	20 (0.185)	2 (0.053)
Department committee	24 (0.164)	18 (0.167)	6 (0.158)
Other	0 (0.000)	0 (0.000)	0 (0.000)

How well does your teaching preparation program prepare new GTAs for their roles in the precalculus/calculus sequence?

Response Item	All (140)	PhD (106)	MA (34)
Very well	30 (0.214)	20 (0.189)	10 (0.127)
Well	55 (0.393)	44 (0.415)	11 (0.139)
Adequately	54 (0.386)	41 (0.387)	13 (0.165)
Poorly	0 (0.000)	0 (0.000)	0 (0.000)
Very poorly	1 (0.007)	1 (0.009)	0 (0.000)

What resources would be most helpful to you in strengthening your GTA preparation program, if desired? Mark all that apply.

Response Item	All (156)	PhD (112)	MA (44)
Online library of tested resources	58 (0.372)	44 (0.393)	14 (0.125)
Research-based information about best practices	93 (0.596)	67 (0.598)	26 (0.232)
Tools for evaluating effectiveness of program	77 (0.494)	61 (0.545)	16 (0.143)
Professional development for teaching preparation staff	66 (0.423)	46 (0.411)	20 (0.179)
Collegial network for teaching preparation staff	75 (0.481)	55 (0.491)	20 (0.179)
Other	11 (0.071)	7 (0.063)	4 (0.036)
No response	27 (0.173)	19 (0.170)	8 (0.182)

Is the department generally satisfied with the effectiveness of the GTA teaching preparation programs currently in place?

Response Item	All (160)	PhD (118)	MA (42)
Yes	107 (0.669)	75 (0.636)	32 (0.762)
The programs are adequate, but could be improved	48 (0.300)	38 (0.322)	10 (0.238)
No	5 (0.031)	5 (0.042)	0 (0.000)

What best characterizes the current status of your GTA teaching preparation programs? Mark all that apply.

Response Item	All (210)	PhD (130)	MA (80)
No significant changes are planned	144 (0.686)	86 (0.662)	58 (0.725)
Changes have recently/currently being implemented	42 (0.200)	28 (0.215)	14 (0.175)
Possible changes are being discussed	28 (0.133)	19 (0.146)	9 (0.113)

E. PRIORITIES

Note: Due to the complexity of question design, the data for the next two questions are presented in a slightly different format than in previous sections. Rather than combine counts and proportions into a single table, they are separated into two table to facilitate reading and comprehension.

How **important** are the following features to having a successful precalculus/calculus program?

Counts table	All (219)			PhD (132)			MA (87)		
Features	Very	Some what	Not	Very	Some what	Not	Very	Some what	Not
Challenging courses	99	108	12	56	71	5	43	37	7
Uniform components	121	84	14	77	46	9	44	38	5
Instructor meetings	60	112	47	43	63	26	17	49	21
Monitoring local data	87	115	17	54	66	12	33	49	5
Student placement	190	26	3	111	18	3	79	8	0
GTA preparation	110	69	40	86	43	3	24	26	37
Student support programs	147	72	0	85	47	0	62	25	0
Active learning	97	102	20	55	61	16	42	41	4

Proportions table	All (219)			PhD (132)			MA (87)		
Features	Very	Some what	Not	Very	Some what	Not	Very	Some what	Not
Challenging courses	0.452	0.493	0.055	0.424	0.538	0.038	0.494	0.425	0.080
Uniform components	0.553	0.384	0.064	0.583	0.348	0.068	0.506	0.437	0.057
Instructor meetings	0.274	0.511	0.215	0.326	0.477	0.197	0.195	0.563	0.241
Monitoring local data	0.397	0.525	0.078	0.409	0.500	0.091	0.379	0.563	0.057
Student placement	0.868	0.119	0.014	0.841	0.136	0.023	0.908	0.092	0.000
GTA preparation	0.502	0.315	0.183	0.652	0.326	0.023	0.276	0.299	0.425
Student support programs	0.671	0.329	0.000	0.644	0.356	0.000	0.713	0.287	0.000
Active learning	0.443	0.466	0.091	0.417	0.462	0.121	0.483	0.471	0.046

How successful is **your program** at implementing the following features in the precalculus/calculus sequence?

Note: if participants indicated that a feature was not applicable to them, they were not included in that feature's totals for success – hence the varying N values.

Counts	All				PhD				MA			
Features	*N*	Very	Some what	Not	*N*	Very	Some what	Not	*N*	Very	Some what	Not
Challenging courses	**214**	91	110	13	**130**	53	66	11	**84**	38	44	2
Uniform components	**210**	131	74	5	**127**	89	36	2	**83**	42	38	3
Instructor meetings	**195**	42	98	55	**119**	33	57	29	**76**	9	41	26
Monitoring local data	**212**	38	127	47	**128**	24	77	27	**84**	14	50	20
Student placement	**215**	83	126	6	**129**	49	78	2	**86**	34	48	4
GTA preparation	**185**	63	93	29	**127**	46	67	14	**58**	17	26	15
Student support programs	**216**	91	120	5	**130**	52	75	3	**86**	39	45	2
Active learning	**199**	30	133	36	**117**	15	77	25	**82**	15	56	11

Proportions	All				PhD				MA			
Features	*N*	Very	Some what	Not	*N*	Very	Some what	Not	*N*	Very	Some what	Not
Challenging courses	**214**	0.425	0.514	0.061	**130**	0.408	0.508	0.085	**84**	0.452	0.524	0.024
Uniform components	**210**	0.624	0.352	0.024	**127**	0.701	0.283	0.016	**83**	0.506	0.458	0.036
Instructor meetings	**195**	0.215	0.503	0.282	**119**	0.277	0.479	0.244	**76**	0.118	0.539	0.342
Monitoring local data	**212**	0.179	0.599	0.222	**128**	0.188	0.602	0.211	**84**	0.167	0.595	0.238
Student placement	**215**	0.386	0.586	0.028	**129**	0.380	0.605	0.016	**86**	0.395	0.558	0.047
GTA preparation	**185**	0.341	0.503	0.157	**127**	0.362	0.528	0.110	**58**	0.293	0.448	0.259
Student support programs	**216**	0.421	0.556	0.023	**130**	0.400	0.577	0.023	**86**	0.453	0.523	0.023
Active learning	**199**	0.151	0.668	0.181	**117**	0.128	0.658	0.214	**82**	0.183	0.683	0.134

PART II: COURSE DETAILS

The census survey also asked participants to identify all the courses that are part of their department's mainstream P2C2 sequence. This included classes that are considered immediate preparation to take single variable calculus and all single variable calculus courses. In this context, *mainstream* was defined as courses that count as prerequisites for further mathematics courses (e.g., differential equations, linear algebra). The original survey data was cross-referenced and updated to the extent possible by a comprehensive search of publicly-available course catalogs. This led us to a collection of 1108 courses from 223 institutions, with details supplied for 895 of these courses by 205 institutions.

In the pages that follow, data is broken down both by institution type (as before, PhD, MA, and aggregate) as well as by course type. In keeping with the survey format, courses that are considered final preparatory courses for single variable calculus are denoted PC, first courses in single variable calculus are denoted C1, and all further single variable calculus course are denoted C2.

VARIATIONS IN COURSE STRUCTURE

Alongside the traditional course structure of introductory mathematics courses, we identified a number of variations, described in the table below. We highlight these alternative structures because they represent options for students of varying levels of preparedness and interest level, rather than a "one-size-fits-all" approach.

Modular precalculus	Two or more courses which, when taken together, are intended to prepare students for single variable calculus (*e.g., College Algebra + Trigonometry)*. These courses usually also give students more course credits than a single-course precalculus equivalent.
Co-calculus	A course taken concurrently with a single variable calculus course that covers selected pre-calculus topics, coordinated with the content of the calculus course.
Stretched out Calculus	Two courses which, when taken together, are the equivalent of a single calculus course. These courses usually give students more course credits than their single-course equivalent.
Stretched out Calculus 1 & 2	Three courses which, when taken together, are equivalent to a standard two-course single variable calculus sequence. The first course in these sequences was considered with other "first calculus" (C1) courses; the second and third are considered "further calculus" (C2).
Calculus infused with precalculus	A calculus course which explicitly includes attention to requisite pre-calculus topics. These courses usually give students more credits than an equivalent course without precalculus.
Calculus for biology	A mainstream calculus course designed explicitly for students in biological or life science majors.
Calculus for engineering	A mainstream calculus course designed explicitly for students in engineering majors.
Calculus for another subject	A mainstream calculus course designed explicitly for students in a non-STEM major.
Calculus for first-timers	A calculus course explicitly designed for students who have not seen calculus before.

Accelerated Calculus — A calculus course explicitly designed for students who have taken calculus in high school (usually with AP credit). These courses cover mainly material that would be considered "Calculus 2," but also include Calculus I material that may not have been covered in sufficient depth in an AP course.

Transition to mainstream — A course which serves to transition students from a non-mainstream precalculus/calculus sequence into mainstream calculus or upper-division mathematics courses.

Other — Further variations that were not common enough to warrant their own code. These include courses designed to divert less-prepared students mid-term; precalculus courses which include a preview of calculus topics; courses designed for transfer students; applied courses; courses offered only in summer; and more.

The table below indicates how many institutions offer courses of these variations.

Variation	Overall (222)	PhD (133)	MA(89)
Modular precalculus*	62 (0.279)	33 (0.248)	29 (0.326)
Co-calculus	3 (0.014)	2 (0.015)	1 (0.011)
Stretched out calculus**	20 (0.090)	13 (0.098)	7 (0.079)
Stretched out Calculus 1 & 2	7 (0.032)	6 (0.045)	1 (0.011)
Calculus infused with precalculus	11 (0.050)	7 (0.053)	4 (0.045)
Calculus for biology	15 (0.068)	11 (0.083)	4 (0.045)
Calculus for engineering	14 (0.063)	14 (0.105)	0
Calculus for another subject	3 (0.014)	3 (0.023)	0
Calculus for first-timers	1 (0.005)	1 (0.008)	0
Accelerated/AP Calculus	14 (0.064)	12 (0.090)	2 (0.022)
Transition to mainstream	3 (0.014)	2 (0.015)	1 (0.011)
Other	9 (0.041)	8 (0.060)	1 (0.011)

*Refers only to institutions where a two-course preparation for calculus is offered as an *alternative* to a single precalculus course – not those where students have no option. In addition to the 62 institutions identified in the table above, 18 institutions offer modular precalculus as the only preparation for single variable calculus.

**Includes three institutions who offer stretched out C2 courses as well stretched out C1 courses, and 17 institutions who offer only stretched-out C1 courses.

Overall, 125 (56.3%) of the institutions have at least one course variation. That figure refers to 80 (60.2%) of the PhD institutions and 45 (50.6%) of the MA institutions. Excluding the most common variation, modular precalculus, 75 (33.8%) of institutions have at least one calculus course variation. That figure refers to 56 (42.1%) of the PhD-granting institutions and 19 (21.3%) of the MA-granting institutions.

VARIATIONS IN INSTRUCTIONAL FORMAT

The course structure variations presented in the previous section were identified, in part, through a comprehensive investigation of introductory mathematics programs. The following sections return to the survey data, where 205 institutions provided data about 895 mainstream P2C2 courses. Each section presents two tables: one giving the breakdown of instructional format by institution type, and one giving the breakdown of instructional format by variations in course structure.

PREPARATION FOR CALCULUS (PC)

177 institutions provided detailed information for 264 courses that function as direct preparation for single variable calculus. Of these, data about instructional format was provided for 258 courses, which the following tables break down first by institutions type and then by PC course variation.

What is the primary instructional format during regular class meetings (not recitation sections)?

Response Item	All (258)	PhD (150)	MA (108)
Lecture and answering student questions	151 (0.585)	87 (0.580)	64 (0.593)
Lecture incorporating some active learning techniques (e.g., clickers, student to student interaction)	47 (0.182)	28 (0.187)	19 (0.176)
Minimal lecture with mainly active learning (includes flipped)	10 (0.039)	9 (0.060)	1 (0.009)
Lecture plus computer based instruction	16 (0.062)	6 (0.040)	10 (0.093)
Too much variation across sections to select one style	19 (0.074)	8 (0.053)	11 (0.102)
Other	15 (0.058)	12 (0.080)	3 (0.028)

In the table below we present figures only for variations which had three or more representatives.

Instructional format response items	Overall (258)	Standard PC (158)	Modular PC (95)
Lecture and answering student questions	151 (0.585)	90 (0.57)	59 (0.621)
Lecture incorporating some active learning techniques (e.g., clickers, student to student interaction)	47 (0.182)	30 (0.19)	15 (0.158)
Minimal lecture with mainly active learning (includes flipped)	10 (0.039)	7 (0.044)	3 (0.032)
Lecture plus computer based instruction	16 (0.062)	9 (0.057)	7 (0.074)
Too much variation across sections to select one style	19 (0.074)	14 (0.089)	5 (0.053)
Other	15 (0.058)	8 (0.051)	6 (0.063)

CALCULUS I & VARIATIONS (C1)

197 institutions provided detailed information for 331 courses that are the first calculus course in a mainstream single variable calculus sequence. Of these, data about instructional format was provided for 327 courses, which the following tables break down first by institutions type and then by C1 course variation.

What is the primary instructional format during regular class meetings (not recitation sections)?

Response Item	All (327)	PhD (216)	MA (111)
Lecture and answering student questions	208 (0.636)	151 (0.699)	57 (0.514)
Lecture incorporating some active learning techniques (e.g., clickers, student to student interaction)	56 (0.171)	29 (0.134)	27 (0.243)
Minimal lecture with mainly active learning (includes flipped)	9 (0.028)	7 (0.032)	2 (0.018)
Lecture plus computer based instruction	7 (0.021)	1 (0.005)	6 (0.054)
Too much variation across sections to select one style	39 (0.119)	23 (0.106)	16 (0.144)
Other	8 (0.024)	5 (0.023)	3 (0.027)

In the table below we present figures only for variations which had three or more representatives.

Instructional format response items	Overall (327)	Standard C1 (255)	Honors C1 (46)	Stretched C1 (26)	Stretched Out C1/C2 (7)	C1 infused with PC (10)	C1 for Bio (14)	C1 for Engineering (9)	C1 for other subjects (3)
Lecture and answering student questions	208 (0.636)	164 (0.643)	32 (0.696)	13 (0.500)	4 (0.571)	7 (0.700)	10 (0.714)	7 (0.778)	2 (0.667)
Lecture incorporating some active learning techniques	56 (0.171)	42 (0.165)	8 (0.174)	7 (0.269)		2 (0.200)	3 (0.214)	1 (0.111)	1 (0.333)
Minimal lecture with mainly active learning	9 (0.028)	7 (0.027)	2 (0.043)		1 (0.143)				
Lecture plus computer based instruction	7 (0.021)	5 (0.020)	1 (0.022)		1 (0.143)			1 (0.111)	
Too much variation across sections to select one style	39 (0.119)	30 (0.118)	1 (0.022)	6 (0.231)	1 (0.143)	1 (0.100)			
Other	8 (0.024)	7 (0.027)	2 (0.043)				1 (0.071)		

CALCULUS II & CONTINUED SINGLE VARIABLE CALCULUS (C2)

192 institutions provided detailed information for 301 single variable calculus courses that follow a first calculus course. Of these, data about instructional format was provided for 298 courses, which the following tables break down first by institutions type and then by C2 course variation.

What is the primary instructional format during regular class meetings (not recitation sections)?

Response Item	All (298)	PhD (202)	MA (96)
Lecture and answering student questions	216 (0.725)	153 (0.757)	63 (0.656)
Lecture incorporating some active learning techniques (e.g., clickers, student to student interaction)	38 (0.128)	21 (0.104)	17 (0.177)
Minimal lecture with mainly active learning (includes flipped)	3 (0.010)	3 (0.015)	0 (0)
Lecture plus computer based instruction	9 (0.030)	3 (0.015)	6 (0.063)
Too much variation across sections to select one style	25 (0.084)	16 (0.079)	9 (0.094)
Other	7 (0.023)	6 (0.03)	1 (0.01)

In the table below we present figures only for variations which had three or more representatives.

	Overall	Standard C2	Honors C2	Stretched Out C1/C2	C2 infused with PC	C2 for Bio	C2 for Engineering	Accelerated Calculus
	(298)	(248)	(44)	(12)	(6)	(10)	(10)	(11)
Lecture and answering student questions	216 (0.725)	177 (0.714)	32 (0.727)	7 (0.583)	5 (0.833)	9 (0.900)	8 (0.800)	10 (0.909)
Lecture incorporating some active learning techniques	38 (0.128)	31 (0.125)	5 (0.114)	2 (0.167)	1 (0.167)	1 (0.100)	1 (0.100)	1 (0.091)
Minimal lecture with mainly active learning	3 (0.010)	3 (0.012)	1 (0.023)					
Lecture plus computer based instruction	9 (0.030)	6 (0.024)	1 (0.023)	2 (0.167)			1 (0.100)	
Too much variation across sections to select one style	25 (0.084)	24 (0.097)	2 (0.045)	1 (0.083)				
Other	7 (0.023)	7 (0.028)	3 (0.068)					

DFW RATES ACROSS THE P2C2 SEQUENCE

The following section reports on the DFW (D, F, Withdraw) rates for courses in the P2C2 sequence as reported in the survey data. These values are broken down across institutions type and course structure variation.

PREPARATION FOR CALCULUS (PC)

Overall, data was provided for 264 preparation for calculus courses offered at 177 institutions. Of these, 236 reported DFW rates. The numbers in parentheses refer to the number of courses for which DFW rates were reported, which were then averaged. Note that we present figures only for variations which had three or more representatives.

	All	PhD	MA
All PC Courses	27.3% (236)	27.0% (137)	27.7% (99)
Standard PC	27.5% (144)	27.0% (80)	28.1% (64)
Modular PC	27.2% (89)	27.4% (55)	26.9% (34)

CALCULUS I & VARIATIONS (C1)

Overall, data was provided for 331 C1 courses from 197 institutions. Of these, 294 reported DFW rates. The numbers in parentheses refer to the number of courses for which DFW rates were reported, which were then averaged. Note that we present figures only for variations which had three or more representatives.

	All	PhD	MA
All C1 Courses	21.9% (294)	20.8% (193)	24.1% (101)
Standard C1	22.0% (233)	20.9% (146)	23.7% (87)
Honors C1	9.9% (40)	11.0% (29)	7.00% (11)
Stretched C1	20.5% (19)	15.3% (14)	35.2% (5)
Stretched C1/C2	15.4% (7)	17.8% (6)	-
C1 infused with PC	24.4% (8)	23.2% (5)	26.3% (3)
C1 for Biology	24.6% (13)	23.7% (9)	26.8% (4)
C1 for Engineering	28.3% (8)	28.3% (8)	-
C1 for other subjects	14.7% (3)	14.7% (3)	-

CALCULUS II & CONTINUED SINGLE VARIABLE CALCULUS (C2)

Overall, data was provided for 301 C2 courses from 192 institutions. Of these, 268 reported DFW rates. The numbers in parentheses refer to the number of courses for which DFW rates were reported, which were then averaged. Note that we present figures only for variations which had three or more representatives.

	All	PhD	MA
All C2 Courses	19.8% (268)	18.0% (182)	23.9% (86)
Standard C2	21.4% (223)	19.6% (142)	24.5% (81)
Honors C2	7.9% (34)	8.1% (28)	7.00% (6)
Stretched C1/C2	7.9% (10)	7.9% (10)	-
C2 infused with PC	11.8% (6)	9.3% (3)	14.3% (3)
C2 for Biology	14.9% (9)	14.3% (8)	-
C2 for Engineering	16.3% (10)	16.3% (10)	-
Accelerated C2	9.1% (8)	9.1% (8)	-

ACKNOWLEDGEMENT

We would like to thank all the participants for taking the time to complete our survey and for their contributions to the growing body of knowledge surrounding current models of precalculus and calculus instruction at the university level.

If you have any questions about this report or the Progress through Calculus project, please contact Chris Rasmussen at crasmussen@mail.sdsu.edu or David Bressoud at bressoud@macalester.edu.