EVALUATION PLAN
Key Components

Grantee: Texas A&M University – Corpus Christi

Evaluation Plan Key Components

1. Evaluator Information

1.1. Contact Information

The evaluation of the First in the World (FITW) project at Texas A&M University–Corpus Christi (TAMUCC) will be conducted by Lawrence E. Letourneau, Ph.D. Dr. Letourneau can be reached by telephone at 702-491-6166 and by e-mail at leletourneau@outlook.com.

1.2. Independence

The Evaluator (Dr. Letourneau) resides in the State of Nevada and are entirely independent of and external to TAMUCC and the TAMUCC-FITW project). The Evaluator's findings will not be subject to the approval of the TAMUCC-FITW project director or the TAMUCC-FITW project staff.

The Evaluator will be responsible for randomly assigning all study participants to their respective groups (i.e., intervention and comparison).

All key outcomes of the study will be based on administrative records, which will be collected by the project's Data Manager and shared with the Evaluator.

The Evaluator will perform all analyses and report all findings.

1.3. Confidentiality protections

The TAMUCC-FITW project initially received approval for its protocol "STEM Online Supplemental Instruction Project (STEM-OSIP)" (IRB# 132-14) from TAMUCC's Institutional Review Board (IRB) on 1/6/15. This approval was granted for one year, so TAMUCC-FITW submitted an IRB Continuing Review Application to TAMUCC's IRB in November of 2015. This protocol has since been amended and re-approved twice: in December 2015 and in July 2016.

The project director (and her designees) and the Evaluator will keep all collected data secure by storing it in locked filing cabinets to which only they have keys and/or in encrypted electronic files to which only they have the passwords. This duration for which data will be kept and conditions under which it will be disseminated will be consistent with the requirements of the FITW program and with the administrative requirements specified in the Education Department General Administrative Regulations (EDGAR).

2. Summary of Intervention(s)

The purpose of the TAMUCC-FITW project is to test the relative effectiveness of online supplemental instruction (SI)--as compared to traditional, face-to-face SI--for undergraduates at TAMUCC taking historically difficult STEM courses (i.e., STEM courses where 30% or more of enrolled students earn a grade of D or F or withdraw prior to the end of the semester). The project will be conducted over six semesters (i.e., Fall 2015, Spring 2016, Fall 2016, Spring 2017, Fall 2017, and Spring 2018).

Each semester, a limited number of sections of historically difficult STEM courses will be selected to participate in the project. The selection of courses will be made by the project director prior to the start of each semester and be based on a variety of factors, including:

- The willingness of the course professor to cooperate with the SI Program Manager and SI Leaders;
- The willingness of the course professor to permit random assignment of his/her students to intervention (i.e., online) and comparison (i.e., face-to-face) SI groups;
- The number of sections of the course taught by the professor;
- The size (in terms of student head count) of each section;
- The degree to which the course is "historically difficult" (i.e., what percent of students typically earn a grade of D or F or withdraw prior to the end of the semester); and
- The ability of the project to secure a sufficient number of appropriately qualified SI Leaders that can conduct SI sessions in both the online and face-to-face.

The project director will focus on selecting courses that are introductory in nature, primarily enroll underclassmen, and often function as "gatekeeper" courses which students must pass in order to pursue a particular STEM major.

At the beginning of each semester, students enrolled in each selected course will be randomly assigned by the Evaluator to an SI group (either face-to-face or online) associated with the course. Participants in the face-to-face SI groups will have the option of attending 1-3, one-hour SI sessions per week on the TAMUCC campus. These three sessions will cover approximately the same content but be offered at various times of day and on various days during the week to accommodate students' scheduling needs. Participants in the online SI groups will have the option of attending 1-3, one-hour SI sessions per week online, from the location of their choosing. These three sessions will cover approximately the same content but be offered at various times of day and on various days during the week to accommodate students' scheduling needs.

The project will examine the performance of online and face-to-face SI recipients on the following outcomes:

a) Persistence in the course associated with the SI; and
b) Academic performance (i.e., final grade) in the course associated with the SI.

Furthermore, the project will examine the performance, by cohort*, of online and face-to-face SI recipients on the following outcomes:

c) Cumulative GPA;
d) Year-to-year persistence;
e) Baccalaureate degree completion; and
f) Baccalaureate degree completion in STEM fields.

*Note: A cohort will consist of all students participating in TAMUCC-FITW-sponsored SI (both online and face-to-face) during a given semester

However, analytic findings from the first three cohorts (Fall 2015, Spring 2016, and Fall 2016) will be utilized only for purposes of performance reporting to the funding agency. Analytic findings from the second three cohorts (Spring 2017, Fall 2017, and Spring 2018) will be utilized for both performance reporting and research purposes.

3. Impact/Effectiveness Evaluation

The TAMUCC-FITW project will conduct a student-level RCT testing the relative impact of online SI on the proximal and distal outcomes noted in section 2. Random assignment will occur at the student-level and within courses and sections. For example, if the project selects three sections of BIOL 1406 (Biology 1) in a given semester, one-half of the students within each section will be randomly assigned to the intervention condition (i.e., online SI) and the other half to the comparison condition (i.e., face-to-face SI).

3.1. Research questions

The TAMUCC FITW project will investigate the extent to which participation in online supplemental instruction (SI) as beneficial or more beneficial than participation in face-to-face SI (i.e., the business as usual condition) for undergraduates enrolled in historically difficult STEM courses in terms. Thus, TAMUCC-FITW will address the following research questions:

a) What is the impact of online SI on students' STEM course completion relative to that of business-as-usual face-to-face SI?
b) What is the impact of online SI on students' academic performance (i.e., final grade earned) in STEM courses relative to that of business-as-usual face-to-face SI?
c) What is the impact of online SI on students' cumulative GPA relative to that of business-as-usual face-to-face SI?
d) What is the impact of online SI on students' year-to-year persistence in undergraduate studies relative to that of business-as-usual face-to-face SI?
e) What is the impact of online SI on students' baccalaureate-degree completion relative to that of business-as-usual face-to-face SI?
f) What is the impact of online SI on students' baccalaureate degree completion in STEM fields relative to that of business-as-usual face-to-face SI?

3.2. Comparison condition

The comparison condition will be face-to-face SI. Students assigned to face-to-face SI groups will have the option of attending 1-3, one-hour SI sessions per week on the TAMUCC campus. These sessions will be offered at various times of day and on various days during the week to accommodate students' scheduling needs.

3.3. Study sample and how intervention and comparison groups are selected/assigned

Students eligible for participation in the study will be undergraduates enrolled in the sections of the historically difficult STEM courses selected by the project director. Random assignment will occur at the

beginning of the semester, at the student-level and within courses and sections. For example, if the project selects three sections of BIOL 1406 (Biology 1) in a given semester, one-half of the students within each section will be randomly assigned by the Evaluator to the intervention condition (i.e., online SI) and the other half to the comparison condition (i.e., face-to-face SI). No other students will be assigned to either the intervention or the comparison condition after the Evaluator make the initial assignments. Thus, there will be no joiners in any cohort. The small number of students (i.e., historically less than 2% of the total enrollment in most courses) who add the course after initial assignments are made also will be randomly assigned to a group but not included in the analytic sample.

Each student assigned to online SI will be provided his or her own personal login information. Thus, the project will be able to track attendance at online SI sessions and be fairly certain that no comparison-to-intervention group crossover is occurring. Moreover, all attendees of face-to-face SI sessions will be required to print their A numbers on sign-in sheets, ensuring that any intervention-to-comparison group crossover is detected. However, such crossover is unlikely in that the schedule of face-to-face SI will be provided to comparison-group members only, and the project director will stress to students in both groups the importance of attending only the SI-type to which one has been assigned. Our original plan was to exclude from the analytic sample the small number of students (i.e., less than 1% of the total enrollment during the Spring 2015 pilot of this study) who crossover. However, the FITW Evaluation TA team, in a memo dated 10/9/15, expressed concern about this plan, noting that "this exclusion of students based on events that happen post-randomization could be interpreted as undermining the randomization." The TA team's recommendation for addressing this issue is an intent-to-treat analysis, whereby "students' treatment assignment status as the determined by the randomization [is] maintained in the analysis, regardless of whether they take up the treatment (for students randomized to the treatment condition) or cross-over (for students randomized to the control condition)." We will adopt this recommendation and conduct an intent-to-treat analysis for each outcome of interest. However, we will also conduct additional analyses with crossovers dropped. In these additional analyses, we will examine the extent to which differential and overall attrition has been exacerbated and to which baseline equivalence has been diminished (in accordance with the guidelines specified in the What Works Clearinghouse, *Procedures and Standards Handbook, Version 3.0*) by the exclusion of crossovers; if necessary (i.e., the effect size difference between groups at baseline is not ≤ 0.05) and appropriate (i.e, the effect size difference between groups at baseline is not > 0.25), we utilize a statistical adjustment for the baseline characteristics.

Each semester, the project will target approximately 20 sections of historically difficult STEM courses. The number of courses and instructors to which these sections correspond will vary from one semester to the next. However, the number of students in the sample each semester will be approximately 1,500 (750 in online SI and 750 in face-to-face SI).

The sample utilized by TAMUCC-FITW will be fairly representative of the overall student population at TAMUCC, which is a Title V (Hispanic-serving) institution where in Fall 2014 nearly 48% of undergraduates were Hispanic, because the STEM courses selected by the project director will be gatekeeper courses in which many students enroll in order to meet one or more core curriculum requirements. The only foreseeable limitation in the external generalizability of this study's findings may emerge from the fact that the actual selection of courses targeted by TAMUCC-FITW will be non-random and probably will be less than comprehensive given the vast array of courses that typically fit under the STEM umbrella.

Six cohorts—i.e., SI participants in Fall 2015 (F15), Spring 2016 (S16), Fall 2016 (F16), Spring 2017 (S17), Fall 2017 (F17), and Spring 2018 (S18)—will be included in this study. The study's more proximal

outcomes—*a*) course persistence and *b*) academic performance in course—will be measured at the end of each semester for the cohort that received SI during that semester.

The study's other outcomes—*c*) cumulative GPA, *d*) year-to-year persistence, *e*) baccalaureate-degree completion, and *f*) baccalaureate-degree completion in STEM fields—will be measured for all cohorts. Outcome *c* (cumulative GPA) will be measured at the end of Spring:

- 2016, for the Fall 2015 and Spring 2016 cohorts;
- 2017, for the Fall 2015, Spring 2016, Fall 2016, and Spring 2017 cohorts; and
- 2018, for all five prior cohorts (Fall 2015 to Spring 2017).

Outcome *d* (year-to-year persistence) will be measured at the beginning of Fall:

- 2016, for the Fall 2015 and Spring 2016 cohorts;
- 2017, for the Fall 2015, Spring 2016, Fall 2016, and Spring 2017 cohorts; and
- 2018, for all five prior cohorts (Fall 2015 to Spring 2017).

Outcomes *e* (baccalaureate-degree completion) and *f* (baccalaureate-degree completion in STEM fields) will be measured at the end of Summer:

- 2017, for the Fall 2015 and Spring 2016 cohorts; and
- 2018, for Fall 2015, Spring 2016, Fall 2016, and Spring 2017 cohorts.

Note: Analytic findings from the first three cohorts (Fall 2015, Spring 2016, and Fall 2016) will be utilized only for purposes of performance reporting to the funding agency. Analytic findings from the second three cohorts (Spring 2017, Fall 2017, and Spring 2018) will be utilized for both performance reporting and research purposes.

In the event a student is a member of more than one SI cohort (e.g., s/he takes Organic Chemistry I in the Fall 2015 semester and Organic Chemistry II in the Spring 2016 semester and both courses have TAMUCC-SI sessions), our original plan was to have the student remain in the analytic samples associated with outcomes *a* (course persistence) and *b* (academic performance in course) but be dropped from the analytic samples associated with outcomes *c* (cumulative GPA), *d* (year-to-year persistence), *e* (baccalaureate degree completion), and *f* (baccalaureate degree completion in STEM fields). In each of these samples, the Evaluator were to measure the extent to which dropping students creates overall and differential attrition, as well as utilize (to the extent necessary and possible) baseline variables (e.g., pre-semester cumulative GPA, Pell eligibility, etc.) as covariates to establish (via statistical adjustment, if necessary) equivalence between the intervention and comparison groups and execute a quasi-experimental design.

3.4. Key measures and plan for obtaining data

Table 3.4 describes TAMUCC-FITW's key measures and plan for obtaining data.

Table 3.4 Key measures and associated data

Measure #	Type of Data:	Domain	Name of Measure (and subtest)	Unit of Measurement	Instrument Reference	Type of Scale:	Type of Score	Face Validity? Y/N	Normed or State Test Y/N	Test-Retest Reliability	Internal Consistency	Inter-rater Reliability	Overalignment? Y/N	Consistently Collected? Y/N	Collected When? (MM/YY) For Which Cohort?	Collected By Whom?	Collected from Where?	Satisfies WWC Criteria?	Explanations, notes, comments
1.	B	Academic achieve-ment	Cumulative undergra-duate GPA prior to receipt of treatment	Student	n/a	Ct	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	Some students have no SAT or ACT scores. Cumulative undergraduate GPA prior to receipt of treatment is the only baseline measure of academic achievement available for all participants
2.	B	Socio-economic Status	Pell Grant eligibility	Student	n/a	Bi	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	73.9% of TAMUCC undergraduates apply for financial aid (cf. item H2/ item B1 in *Common Data Set*, 2015-16).
3.	C	Demogra-phic	Gender	Student	n/a	Bi	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	<u>Valid Field Content:</u> Male, Female

Type of Data: Baseline (B), Covariate (C), Grouping (G), or Outcome (O)
Type of Scale: Continuous (Ct), Ordinal (Or), Binary (Bi), Nominal (N)
SIS: Administrative data collected from ARGOS, which is TAMUCC's electronic Student Information System

Measure #	Type of Data:	Domain	Name of Measure (and subtest)	Unit of Measurement	Instrument Reference	Type of Scale:	Type of Score	Face Validity? Y/N	Normed or State Test Y/N	Test-Retest Reliability	Internal Consistency	Inter-rater Reliability	Overalignment? Y/N	Consistently Collected? Y/N	Collected When? (MM/YY) For Which Cohort?	Collected By Whom?	Collected from Where?	Satisfies WWC Criteria?	Explanations, notes, comments
4.	C	Demographic	Ethnicity—Hispanic	Student	n/a	Bi	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	Valid Field Content: Yes, No
5.	C	Demographic	Race	Student	n/a	N	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	Valid Field Content: American Indian/Alaskan Native, Asian, Black/ /African American, White, Native Hawaiian or Other Pacific Islander, More than One Race
6.	C	Demographic	Class standing at time of participation in SI	Student	n/a	Or	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	Valid Field Content: Freshman, Sophomore, Junior, Senior
7.	C	n/a	STEM discipline of course with which SI is associated	Student	n/a	N	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Project Data Manager	SIS	Y	Valid Field Content: Biology, Chemistry, Physics, Computer Science, Engineering, Mathematics

Measure #	Type of Data:	Domain	Name of Measure (and subtest)	Unit of Measurement	Instrument Reference	Type of Scale:	Type of Score	Face Validity? Y/N	Normed or State Test Y/N	Test-Retest Reliability	Internal Consistency	Inter-rater Reliability	Overalignment? Y/N	Consistently Collected? Y/N	Collected When? (MM/YY) For Which Cohort?	Collected By Whom?	Collected from Where?	Satisfies WWC Criteria?	Explanations, notes, comments
8.	O (*a*)	Credit accumu-lation and Persistence	Persistence in STEM course	Student	n/a	Bi	Raw score	Y	N	n/a	n/a	n/a	N	Y	01/16 for F15 06/16 for S16 01/17 for F16 06/17 for S17 01/18 for F17 06/18 for S18	Project Data Manager	SIS	Y	Continued enrollment in STEM course associated with SI until end of semester. Note: No corresponding baseline measure.
9.	O (*b*)	Academic Achieve-ment	Grade earned in STEM course	Student	n/a	Or	Raw score	Y	N	n/a	n/a	n/a	N	Y	01/16 for F15 06/16 for S16 01/17 for F16 06/17 for S17 01/18 for F17 06/18 for S18	Project Data Manager	SIS	Y	Grade (A, B, C, D, F) earned in STEM course associated with SI by course completers. Note: No corresponding baseline measure.
10.	O (*c*)	Academic Achieve-ment	Cumulative GPA	Student	n/a	Ct	Raw score	Y	N	n/a	n/a	n/a	N	Y	05/16 for F15& S16 05/17 for F15 to S17 05/18 for all six cohorts	Project Data Manager	SIS	Y	Note: No correspond-ding baseline measure.
11.	O (*d*)	Credit accumu-lation and Persistence	Year-to-year persistence	Student	n/a	Bi	Raw score	Y	N	n/a	n/a	n/a	N	Y	09/16 for F15& S16 09/17 for F15 to S17 09/18 for all six cohorts	Project Data Manager	SIS	Y	Operationally defined as graduating or enrolling again in subsequent Fall semester Note: No correspond-ding baseline measure.

Measure #	Type of Data:	Domain	Name of Measure (and subtest)	Unit of Measurement	Instrument Reference	Type of Scale:	Type of Score	Face Validity? Y/N	Normed or State Test Y/N	Test-Retest Reliability	Internal Consistency	Inter-rater Reliability	Overalignment? Y/N	Consistently Collected? Y/N	Collected When? (MM/YY) For Which Cohort?	Collected By Whom?	Collected from Where?	Satisfies WWC Criteria?	Explanations, notes, comments
12.	O (*e*)	Attainment	Baccalaureate-degree completion	Student	n/a	Bi	Raw score	N	N	n/a	n/a	n/a	N	Y	08/17 for F15& S16 08/18 for F15, S16, F16, & S17	Project Data Manager	SIS	Y	Operationally defined as graduating with a bachelor's degree Note: No correspond-ding baseline measure.
13.	O (*f*)	Attainment	Baccalaureate-degree completion in STEM discipline	Student	n/a	Bi	Raw score	N	N	n/a	n/a	n/a	N	Y	09/17 for F15& S16 09/18 for F15, S16, F16, & S17	Project Data Manager	SIS	Y	Operationally defined as graduating with a bachelor's degree in a STEM discipline Note: No corresponding baseline measure.
14.	G	n/a	Group assignment	Student	n/a	Bi	Raw score	N	N	n/a	n/a	n/a	N	Y	09/15 for F15 02/16 for S16 09/16 for F16 02/17 for S17 09/17 for F17 02/18 for S18	Evalua-tors	n/a	Y	Intervention or Comparison group. Assignments randomly made by Evaluator from course rosters provided by Project Data Manager.

Note: The Evaluator will conduct an annual audit of implementation and outcome data collected by the Project Data Manager. This audit will consist of comparing a randomly selected sample (no less than 2% but up to 10%) of the data provided by Project Data Manager with the original documentation from which the data originated. For example, for their examination of measure #12 (cumulative GPA) in the 2015-16 audit, the Evaluator will randomly select no less than 60 students from the F15 and S16 cohorts and compare the students' cumulative GPAs as shown in the data provided by the Project Data Manager with the students' cumulative GPAs as displayed on their actual transcripts.

3.5. Statistical analysis of impacts

For each impact that will be estimated, Table 3.5a briefly describes the intervention and comparison samples; specifies the outcome domain, outcome measures and timing of outcome measurement; specifies the baseline-equivalence measures and timing of baseline measurement; and notes the subgroups whose performance will be examined.

Note: Analytic findings from the first three cohorts (Fall 2015, Spring 2016, and Fall 2016) will be utilized only for purposes of performance reporting to the funding agency. Analytic findings from the second three cohorts (Spring 2017, Fall 2017, and Spring 2018) will be utilized for both performance reporting and research purposes.

Table 3.5a Information regarding impacts to be estimated

Sample	**Outcome**				**Baseline**			**Sub groups**
Intervention; Comparison	Domain	Measures	Unit	Timing	Measures	Unit	Timing	
STEM students in online SI compared to STEM students in face-to-face SI (**Fall 2015** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Fall 2015	Pell status Cumulative GPA just prior to start of Fall 2015	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 12/2015				
		(c) Cumulative GPA		6/2016, 6/2017, 6/2018				
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2016				
	Attainment	(e) Baccalaureate-degree completion		9/2017, 9/2018				
		(f) Baccalaureate-degree completion in STEM discipline		9/2017, 9/2018				

Sample	**Outcome**				**Baseline**			**Sub groups**
Intervention; Comparison	Domain	Measures	Unit	Timing	Measures	Unit	Timing	
STEM students in online SI compared to STEM students in face-to-face SI (**Spring 2016** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Spring 2016	Pell status Cumulative GPA just prior to start of Spring 2016	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 5/2016				
		(c) Cumulative GPA		6/2016, 6/2017, 6/2018				
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2016				
	Attainment	(e) Baccalaureate-degree completion		9/2017, 9/2018				
		(f) Baccalaureate-degree completion in STEM discipline		9/2017, 9/2018				
STEM students in online SI compared to STEM students in face-to-face SI (**Fall 2016** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Fall 2016	Pell status Cumulative GPA just prior to start of Fall 2016	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 12/2016				
		(c) Cumulative GPA		6/2017, 6/2018				
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2017				
	Attainment	(e) Baccalaureate-degree completion		9/2018				

Sample	**Outcome**				**Baseline**			**Sub groups**
Intervention; Comparison	Domain	Measures	Unit	Timing	Measures	Unit	Timing	
		(f) Baccalaureate-degree completion in STEM discipline		9/2018				
STEM students in online SI compared to STEM students in face-to-face SI (**Spring 2017** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Spring 2017	Pell status Cumulative GPA just prior to start of Spring 2017	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 5/2017				
		(c) Cumulative GPA		6/2017, 6/2018				
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2017				
	Attainment	(e) Baccalaureate-degree completion		9/2018				
		(f) Baccalaureate-degree completion in STEM discipline		9/2018				

Sample	**Outcome**				**Baseline**			**Sub groups**
Intervention; Comparison	Domain	Measures	Unit	Timing	Measures	Unit	Timing	
STEM students in online SI compared to STEM students in face-to-face SI (**Fall 2017** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Fall 2017	Pell status	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 12/2017	Cumulative GPA just prior to start of Fall 2017			
		(c) Cumulative GPA		6/2018				
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2018				
	Attainment	(e) Baccalaureate-degree completion		n/a				
	Attainment	(f) Baccalaureate-degree completion in STEM discipline		n/a				
STEM students in online SI compared to STEM students in face-to-face SI (**Spring 2018** cohort)	Credit accumulation & Persistence	(a) Persistence in STEM course	Students	Enrollment status in course on last day of Spring 2018	Pell status	Students	Immediately prior to students' random assignment to online SI or face-to-face SI	Males; Females; Hispanics; STEM subject
	Academic Achievement	(b) Grade earned in STEM course		Final official grade assigned in 5/2018	Cumulative GPA just prior to start of Spring 2018			
		(c) Cumulative GPA		6/2018				

Sample	Outcome				Baseline			Sub groups
Intervention; Comparison	Domain	Measures	Unit	Timing	Measures	Unit	Timing	
	Credit accumulation & Persistence	(d) Year-to-year persistence		9/2018				
	Attainment	(e) Baccalaureate-degree completion		n/a				
		(f) Baccalaureate-degree completion in STEM discipline		n/a				

Impact Analysis Models: Table 3.5b specifies the models that will be utilized to estimate the impact of online SI relative to face-to-face SI.

Table 3.5b Statistical models to be utilized to estimate impact of intervention

Outcome		Statistical Models
Domain	Measures	
Credit accumulation & Persistence	Persistence in STEM course	Linear regressions $Y = \beta_0 + \beta_1(Treatment) + \beta_2(PreTCumGPA) + \beta_3(PellEligible) + \sum_{k=4}^{k} \beta_k + \varepsilon$ Where Y is the student outcome; β_0 is the covariate-adjusted outcome in the control group (i.e., the intercept); β_1 is the dummy variable signifying treatment assignment; (1 if randomized to online SI; 0 if face-to-face SI); β_2 is the effect of the baseline measure of student achievement (i.e., pre-treatment, cumulative GPA); β_3 is the effect of the baseline measure of SES (i.e., Pell eligibility); β_4 to β_k are the effects of other factors, such as student ethnicity (1=Hispanic, 2=non-Hispanic), student gender (1=females, 0=male), college (FG) status, and STEM subject; ε is the error term.

<table>
<tr><th colspan="2">Outcome</th><th rowspan="2">Statistical Models</th></tr>
<tr><th>Domain</th><th>Measures</th></tr>
<tr><td rowspan="2">Academic Achievement</td><td>Grade earned in STEM course</td><td>Ordinal regressions
$\ln(\theta_j) = \alpha_j - \beta_1(Treatment) - \beta_2(PreTCumGPA) - \beta_3(PellEligible) - \sum_{k=4}^{k} \beta_j + \varepsilon$
Where
θ_j is the probability of a grade $\leq j$ divided by the probability of a grade $> j$;
$\ln(\theta_j)$ is the student outcome;
α_j is the threshold value (i.e., intercept) for logit j;
β_1 is the dummy variable signifying treatment assignment;
β_2 is the effect of the baseline measure of student achievement (i.e., pre-treatment, cumulative GPA);
β_3 is the effect of the baseline measure of SES (i.e., Pell eligibility);
β_4 to β_k are the effects of other factors (e.g., ethnicity, gender, FG status, and STEM subject);
ε is the error term.</td></tr>
<tr><td>Cumulative GPA</td><td>Linear regressions
$Y = \beta_0 + \beta_1(Treatment) + \beta_2(PreTCumGPA) + \beta_3(PellEligible) + \sum_{k=4}^{k} \beta_k + \varepsilon$</td></tr>
<tr><td>Credit accumulation & Persistence</td><td>Year-to-year persistence</td><td rowspan="3">Linear regressions
$Y = \beta_0 + \beta_1(Treatment) + \beta_2(PreTCumGPA) + \beta_3(PellEligible) + \sum_{j=4}^{j} \beta_j + \varepsilon$</td></tr>
<tr><td rowspan="2">Attainment</td><td>Baccalaureate-degree completion</td></tr>
<tr><td>Baccalaureate-degree completion in STEM discipline</td></tr>
</table>

Note: Impact analyses that combine cohorts, incorporating cohort dummy variables to account for time period differences, will be conducted when the Evaluator are reasonably certain that the online SI has been implemented in a similar fashion across the combined cohorts.

In each of the statistical models specified in Table 3.5b, the hypothesis test for β_1 provides the covariate-adjusted estimate of the impact of online SI relative to that of face-to-face SI. Additionally, as part of each analysis, we will calculate a standardized effect size by dividing the value of β_1 by the pooled, unadjusted SDs of the online and face-to-face SI groups.

Treatment of Missing Data: No imputation of missing data will be necessary, as TAMUCC-FITW will have complete baseline, covariate, and outcome data for all cases.

Adjusting for Multiple Comparisons: In situations where multiple tests are conducted on outcomes in the same domain, we will adjust the statistical-significance threshold utilizing the Benjamini-Hochberg correction in order to reduce the risk of obtaining "false positive" findings.

For long-term outcomes (cumulative GPA, year-to-year persistence, receipt of a baccalaureate degree, receipt of a baccalaureate degree in STEM), we will address the issue of crossover by assigning any student who enrolls in more than one TAMUCC-FITW SI-associated course (either within the same semester or across multiple semesters) to the same SI condition for each course. For example, if a student is randomly assigned to online SI for a biology course and then also enrolls (either during the same semester or a subsequent one) in a TAMUCC-FITW SI-associated chemistry course, s/he will be assigned to online SI for the chemistry course.

Finally, I will utilize an intent-to-treat (ITT) analysis for all outcomes, meaning that any student who has or does crossover will be treated, for analytic purposes, as a member of the SI group to which s/he was first assigned.

3.6. Attrition (RCTs only)

Nearly all of the outcome data will be collected from TAMUCC administrative records, so little (if any) attrition is expected. Still, it is possible that some students will withdraw their consent or leave the institution entirely, making it difficult or impossible to collect data on them relative to certain outcomes.

For outcomes *a* (course persistence) and *b* (academic performance), potential attrition may occur between randomization (which occurs less than two weeks before the start of each semester) and the first day of class. Typically, a handful of students whose names appear on course rosters during randomization drop the course before the first class period. Any students who drop after the first day of class will, for purposes of analysis, be treated as non-completers on outcome *a* and coded as "0" (the same as "F") on outcome *b*.

For outcome c (cumulative GPA), data will be designated as missing when a student leaves the institution without finishing a baccalaureate degree. In the case of a student that exits with a baccalaureate degree, his/her cumulative GPA upon graduation will be utilized.

For outcomes *d* (year-to-year persistence in undergraduate studies), *e* (baccalaureate degree completion), and *f* (baccalaureate degree completion in STEM), data will be considered missing for students who leave the institution without finishing a baccalaureate degree and who do not, according to the National Student Clearinghouse, enroll in another postsecondary institution that offers undergraduate programs of study.

In the event that attrition (overall or differential) in a given analytic sample is high relative to the liberal standard established by the What Works Clearinghouse (cf., WWC *Procedures and Standards Handbook, Version 3.0*, III, B, 2), we will assess the baseline equivalence of the online and face-to-face SI groups

3.7. Baseline equivalence testing (QEDs and RCTs with high attrition)

Baseline equivalence testing for a sample that exhibits high attrition will be performed by comparing the online SI and face-to-face SI groups on a measure of academic achievement (specifically, cumulative GPA prior to the semester that SI is delivered) and a measure of socioeconomic status (specifically, Pell eligibility status during the semester that SI is delivered). I will calculate Hedge's *g* in order to ascertain the magnitude of the baseline difference between the groups in terms of cumulative GPA and calculate Cox's *d* to gauge the baseline difference between the groups in terms of Pell status. Groups will be considered equivalent if both of these calculated effect size statistics are less than or equal to 0.25.

4. Implementation Evaluation

4.1. Logic model for the intervention(s)

The purpose of TAMUCC's FITW project is to determine if supplemental instruction (SI) provided online can be as effective or more effective than SI provided face-to-face in enhancing the academic performance, persistence, and degree attainment of undergraduates enrolled in historically difficult STEM courses, which are defined as courses where typically 30% or more of enrolled students earn a grade of D or F or withdraw prior to the end of the semester. SI is an activity that occurs in conjunction with specific courses, with the aim of providing enrolled students with additional (i.e., outside of normal class time), routine (i.e., several times per week throughout the semester), structured (i.e., carefully planned out in advance) opportunities for exposure to and engagement with course content.

SI delivered face-to-face has a long track record of success. For example, data collected by the University of Missouri-Kansas City from 69 institutions of higher education from 2002 to 2013 has shown SI participants exhibit higher course persistence rates, earn higher course grades, and post higher cumulative GPAs than SI non-participants across nearly every discipline (http://www.umkc.edu/asm/si/si-docs/National%20Data%20updated%20slides_09-13-2013.pdf). Unfortunately, face-to-face SI can be very challenging to implement on many higher-education campuses, as the classroom space required to do so is often in short supply and/or not available at times or in locations that are easily accessible to students. Consequently, a project that effectively implements SI online and produces compelling evidence that online SI is efficacious alternative to face-to-face SI has tremendous value to the colleges and universities across the nation.

The key resource will be the SI Leaders who will actually implement all SI sessions. Each SI Leader will be responsible for conducting six SI sessions per week--three online and three face-to-face—per course for which s/he provides SI. Each SI Leader will be required to attend every class meeting of the course with which his/her SI associated and, for his/her SI sessions, develop lesson plans and learning materials related to the content that the professor covered during these class meetings. The SI Leaders will consult with the course professors during the development of these lesson plans and materials to ensure that the content covered during the SI sessions is accurate and relevant.

To ensure the SI Leaders utilize sound SI practices and (for online SI sessions) effectively utilize the technology platform, the SI Leaders will be trained and supervised by the project's SI Program Manager. Moreover, the SI Program Manager will evaluate and coach the SI Leaders twice a semester for employment purposes only. This information is used for the end of semester employment evaluation.

Table 4.3 Data collection and measurement for implementation fidelity

Question	Data Source(s)			Implementation Fidelity (IF	
	What is the data?	Who collects it?	How is it transferred to Evaluator?	How is IF measured?	What is the threshold for determining IF?
1. Each semester, how many and what percentage of sessions are held, per course, in the: a. Online format? b. Face-to-face format?	Documents: **i)** Session schedules **ii)** List of sessions actually held **iii)** Session sign-in sheets	SI Program Manager, TAMUCC FITW Project	SI Program Manager saves sources **i** & **ii**, as they become available, to google drive she shares with the Evaluator. At least once per year, Evaluator randomly select a sample of source **ii** lists & requests corresponding source **iii** sign-in sheets.	# of online SI sessions that are held per course per semester; # of face-to-face SI sessions that are held per course per semester	Data must indicate, for each course each semester, the <u>number of online and face-to-face SI sessions held were nearly equal</u> (i.e., # of online sessions is 95% to 105% of the # of face-to-face sessions.)
2. Each semester, what is the mean and median number of SI sessions that students attend in the: a. Online format? b. Face-to-face format?	Documents: **i)** # of sessions each student attended, as recorded in database **ii)** Session sign-in sheets	Database Manager for source **i**; SI Program Manager for source **ii**.	Database manager sends copy of database to Evaluator after each semester concludes; At least once per year, Evaluator randomly selects a sample of source **i** students & requests corresponding source **ii** sign-in sheets.	Mean and median number of SI sessions that students attend in each treatment condition.	Data must indicate the <u>mean and median numbers of SI sessions attended</u> by students in the <u>online</u> SI group are <u>no less than</u> the corresponding <u>mean and median numbers of SI sessions attended</u> by students in the <u>face-to-face</u> SI group.

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4.2. Analysis approach

Table 4.4 describes how the fidelity data will be analyzed to address the research questions.

Table 4.4 Analysis of implementation-fidelity data

Question	Analysis
1. Each semester, how many and what percentage of sessions are actually held, per course, in the: a. Online format? b. Face-to-face format?	The Evaluator will be reviewing the documents described in Table 4.3 to ascertain, for each semester, the number of online and face-to-face SI sessions that were scheduled and the number that were actually held.
2. Each semester, what is the mean and median number of SI sessions that students attend in the: a. Online format? b. Face-to-face format?	The Evaluator will be reviewing the documents described in Table 4.3 to ascertain, for each semester, the mean and median numbers of SI sessions attended by students in the online SI group and the corresponding mean and median numbers of SI sessions attended by students in the face-to-face SI group.

5. Other Investigations

No other investigations are planned at this time.