RGC Ref. No.:
UGC/FDS15/H06/17
(please insert ref. above)

RESEARCH GRANTS COUNCIL
COMPETITIVE RESEARCH FUNDING SCHEMES FOR THE LOCAL SELF-FINANCING DEGREE SECTOR

FACULTY DEVELOPMENT SCHEME (FDS)

Completion Report
(for completed projects only)

Submission Deadlines:
1. *Auditor's report with unspent balance, if any: within **six** months of the approved project completion date.*
2. *Completion report: within **12** months of the approved project completion date.*

Part A: The Project and Investigator(s)

1. Project Title

Construction and validation of Chinese scale measuring statistics anxiety of university students

建立和驗證華人大學生的統計焦慮量表

2. Investigator(s) and Academic Department(s) / Unit(s) Involved

Research Team	Name / Post	Unit / Department / Institution
Principal Investigator	FU Wai / Associate Professor	Department of Counselling and Psychology, Hong Kong Shue Yan University
Co-Investigator(s)	N/A	N/A
Others	N/A	N/A

3. Project Duration

	Original	Revised	Date of RGC / Institution Approval *(must be quoted)*
Project Start Date	1st Jan 2018	N/A	N/A
Project Completion Date	31st Dec 2019	30th Jun 2020	20th Dec 2019
Duration *(in month)*	24 months	30 months	20th Dec 2019
Deadline for Submission of Completion Report	31st Dec 2020	30th Jun 2021	20th Dec 2019

Part B: The Final Report

5. Project Objectives

5.1 Objectives as per original application

1.	Delineate statistics anxiety based on the previously developed psychological constructs of mathematics anxiety.
2.	Construct and refine items for a scale of statistics anxiety suitable for use with Chinese undergraduate students.
3.	Validate the scale through item analysis, the establishment of criterion validity and confirmatory factor analysis.
4.	Disseminate the scale to members of the public, such as statistics educators, undergraduate students and postgraduate students.
5.	Develop the scale to facilitate teaching of statistics.
6.	Provide initiatives for further research on teaching of statistics and treatment of statistics anxiety.

5.2 Revised objectives

Date of approval from the RGC: N/A

Reasons for the change: N/A

Realisation of the objectives

(Maximum 1 page; please state how and to what extent the project objectives have been achieved; give reasons for under-achievements and outline attempts to overcome problems, if any)

The project is targeted to deliver three journal articles and two conference presentations. Also, the project aims at creating the tool for facilitating assessment and counselling in the context of statistics anxiety. The PI target is met with the submission of three journal papers and five conference presentations directly related to the project objectives, which is beyond the original target.

Objectives 1 and 2 have been fulfilled in the previous progress report. The presentation titled "Nosology and Assessment of Statistics Anxiety: A Preliminary Study" (conference #1) was completed at the 2018HKCPsych International Mental Health Congress. In addition, the paper titled "Experience of statistics anxiety: a qualitative comparison with existing criteria of assessment tools" was submitted to *Asia-Pacific Journal of Counselling and Psychotherapy* (article under review) (journal article #1).

Objective 3 (Validate the scale through item analysis, the establishment of criterion validity and confirmatory factor analysis) is achieved through the method of network analysis (e.g. Siew et al. 2019), which is presented in the paper "Network analysis of self-reported perceived symptoms of depression, anxiety and stress triggered by statistics learning experience" submitted to the *Statistics Education Research Journal* (published by International Association of Statistics Education) (Journal article #2). In this stage, the poster presentation titled "A Phenomenological Investigation of Statistics Anxiety among Undergraduate Students in Hong Kong" was given by the project PI in the 2019 American Psychological Association Annual Convention in Chicago (conference #2), in which the oral presentation of a historical review "A critical history of introduction of statistics in psychology curriculum: a case study of Hong Kong" (conference #3) was also completed. In addition to conference presentations, a theoretical paper on statistics anxiety titled "Tête-bêche of modern psychology: Søren Kierkegaard's Concept of Anxiety and its insight to a study on statistics anxiety." (Society of Theoretical and Philosophical Psychology, Chicago, 2019) is another direct output of this stage (conference #4).

Objective 4 (disseminate the scale to members of the public) and Objective 5 (development of the scale to facilitate teaching of statistics) have been fulfilled by the creation of STAT-Protocol for differentiating mental health concerns in statistics-related experiences (hereinafter STAT-Protocol). The protocol covers 18 yes-no or binary-choice questions divided into six categories in order to understand if the respondents' situations attributed to purely educational/ pedagogical concerns or mental health concerns (depression, generalized anxiety disorder, panic disorder, and stress-related adaptation syndrome). The protocol, which is incorporated with updated DSM5 criteria, was presented in the journal article titled "STAT Protocol: a tool for differentiating typology of mental health concerns in statistics related experiences" (journal article #3) submitted to *Asia-Pacific Journal of Counselling and Psychotherapy*. Meanwhile, the STAT-Protocol has been sent to Asia-Pacific Counselling and Psychotherapy Association and Hong Kong General Union of School Counselling Professionals for professional member's circulation (appendix I).

Objective 6 has been fulfilled by the debut of the STAT-Protocol in the presentation of paper titled "Conceptualization, assessment and treatment of statistics anxiety among undergraduate students" (conference #5) for the 6th Asia-Pacific Confederation of Counsellors Congress (APCCC, 29-30 Brisbane, Australia) organized by Asia-Pacific Confederation of Counsellors and Australia Counselling Association. In the presentation, the project PI explained how the new tool could facilitate counselling professionals in dealing with students' statistics anxiety issues. Also, the PI has contacted Prof. Tse Chi-Shing (Department of Education, CUHK) for an invited submission Education Journal 50th volume issue, in which the PI will submit an article reporting findings from a pilot study related to STAT-Protocol (appendix II).

5.3 Summary of objectives addressed to date

Objectives *(as per 5.1/5.2 above)*	**Addressed** *(please tick)*	**Percentage Achieved** *(please estimate)*
1. Delineate statistics anxiety based on the previously developed psychological constructs of mathematics anxiety.	✓	100%
2. Construct and refine items for a scale of statistics anxiety suitable for use with Chinese undergraduate students.	✓	100%
3. Validate the scale through item analysis, the establishment of criterion validity and confirmatory factor analysis	✓	100%
4. Disseminate the scale to members of the public, such as statistics educators, undergraduate students and postgraduate students	✓	100%
5. Develop the scale to facilitate teaching of statistics	✓	100%
6. Provide initiatives for further research on teaching of statistics and treatment of statistics anxiety	✓	100%

6. Research Outcome

6.1 Major findings and research outcome
(Maximum 1 page; please make reference to Part C where necessary)

This project leads to the publication of three journal articles and five conference presentations. Major findings are listed as below:

The findings presented in Journal article #1 (Experience of statistics anxiety: a qualitative comparison with existing criteria of assessment tools) expanded the understanding of the constructs of "statistics anxiety". Previously, "statistics anxiety" was regarded as related to computational self-concept (i.e. the belief on one's ability in computation), attitudes towards statistics, and test anxiety. The findings generated from the in-depth interviews of 75 undergraduate and post-graduate students led to the discovery of new scopes of psychological and physiological signs in statistics related experiences. The data was analyzed with reflective thematic analysis (Braun & Clarke, 2019). The findings suggested that a large proportion (more than 40%) of respondents have physiological signs during statistics related experiences (e.g. headache, stomachache, perceived decreased immunity, faint, nausea, etc.) and majority (75%) of respondents revealed psychological distress including excessive worries, lack of concentration, panic, heart palpitation, excessive perspiration, misreading of statistical formulas, and failure to transform formula back to recitable material for revision.

The study in Journal article #2 (Network analysis of self-reported perceived symptoms of depression, anxiety and stress triggered by statistics learning experience) adopted a new methodology of network analysis (Pokorny et al. (2017); Siew et al. (2019)) for validation of items. The method is suitable for finding relationship among variables for the designing of questions for clinical interviewing procedures (Pokorny et al. (2017)). From centrality measures obtained in network analysis (betweenness, closeness, weighing), it is found that academic-related constructs (e.g. difficulty in understanding statistical formulas, prior mathematics performances) are not so related to mental health concern variables (depression, generalized anxiety disorder, panic disorder, and stress-related adaptation syndrome). Depression, panic disorder and stress-related health concerns in the network are presenting an antagonistic pattern (i.e. all of them are having negative association with each other), while generalized anxiety disorder is quite distant from these mental health concerns. It is found that procrastination, which is the note of highest betweenness score (centrality = 2.24), acts as a link between academic variables and mental health concerns. The findings support the necessity to develop typology-orientated measurement tools. In addition, it is found that clinical interview procedures (Allen & Becker, 2019) could be extended to the context related to statistics. Finally, concerning the issues involved in statistics experiences, the PI suggests changing the name of "statistics anxiety" to "mental health concerns in statistics-related experiences" in order to accommodate the diversity of mental health concerns evolved during statistics-related experiences (e.g. class, assignment, teaching and learning, examination, use of computer software, manual calculation).

The findings accumulated from journal article #1 and journal article #2 led to the construction of 18-item STAT-Protocol for differentiating mental health concerns in statistics-related experiences. The tool is designed to help respondents to evaluate what are the major concerns that hinder their learning of statistics (depression, panic disorder, generalized anxiety disorder, stress-related adaptation syndrome, or educational and pedagogical factors). This is a paradigm shift compared to Statistics Anxiety Rating Scale (Cruise et al., 1985) which aims at finding summation scores for assessing the degree of the construct but not the typology of mental-health-related issues. The STAT-Protocol is suitable for self-administering as well as suitable for being an intake interview protocol for counselling professions to deal with statistics-related mental health concerns.

6.2 Potential for further development of the research and the proposed course of action
(Maximum half a page)

The study leads to the development of STAT-Protocol, a tool for helping the respondents to gain insights to the typology of their own mental health issue. To follow up on this study, the PI is planning to introduce STAT-Protocol to undergraduate students (PSY103 Statistics in Psychology) and master students of Social Sciences in Counselling Psychology (CP516 Research Methods in Counselling Psychology and CP518 Research Seminars in Counselling Psychology). A pilot study on the efficacy of using STAT-Protocol to promote statistics performance among master students will be conducted under the PI's capacity as the research coordinator of concerned program. A further study on investigation of efficacy of STAT-Protocol as an intake interview protocol for counselling will also be conducted in late 2021 with the collaboration with local professional bodies (e.g. Asia-Pacific Counselling and Psychotherapy Association and Hong Kong General Union of School Counselling Professionals).

7. Layman's Summary

(Describe in layman's language the nature, significance and value of the research project, in no more than 200 words)

Statistics Anxiety was a term to describe the situation that one is having difficulty with learning statistics.

Nature of the project: This study expands the idea of "statistics anxiety" into a new terminology called "mental health concerns in statistics-related experiences", which incorporates various mental concerns, including depression, generalized anxiety disorder, panic disorder, and stress-related adaptation syndrome, for the understanding of difficulty in learning statistics.

Significance of the project: Previous measurement tools in statistics anxiety (e.g. Cruise et al. 1985) could only assess students' attitudes towards statistics and their confidence in mathematics as a whole. However, it could not provide any information on other mental health concerns such as generalized anxiety disorder, panic disorder, depression and stress-related adaptation syndrome triggered by statistics-related experiences. This study fills in the gap by creating a new tool called "STAT Protocol", an 18-item protocol that is able to help respondents to understand the reasons for their resistance to statistics.

Value of the project: Counselling professionals and students who concerned about difficulty in overcoming statistics-related concerns could use this protocol to increase their awareness of the concerned mental health issues. (193 words)

Part C: Research Output

8. Peer-Reviewed Journal Publication(s) Arising Directly From This Research Project
(Please attach a copy of the publication and/or the letter of acceptance if not yet submitted in the previous progress report(s). All listed publications must acknowledge RGC's funding support by quoting the specific grant reference.)

The Latest Status of Publications				Author(s) *(denote the corresponding author with an asterisk*)*	Title and Journal / Book *(with the volume, pages and other necessary publishing details specified)*	Submitted to RGC *(indicate the year ending of the relevant progress report)*	Attached to this Report *(Yes or No)*	Acknowledged the Support of RGC *(Yes or No)*	Accessible from the Institutional Repository *(Yes or No)*
Year of Publication	**Year of Acceptance** *(For paper accepted but not yet published)*	**Under Review**	**Under Preparation** *(optional)*						
		✓		**FU Wai**	Experience of statistics anxiety: a qualitative comparison with existing criteria of assessment tools *Asia-Pacific Journal of Counselling and Psychotherapy*	**30th Jun 2021**	**Yes** (Journal Article 1)	**Yes**	**Yes**
		✓		**FU Wai**	Network analysis of self-reported perceived symptoms of depression, anxiety and stress triggered by statistics learning experience *Statistics Education Research Journal*	**30th Jun 2021**	**Yes** (Journal Article 2)	**Yes**	**Yes**
		✓		**FU Wai**	STAT Protocol: a tool for differentiating typology of mental health concerns in statistics related experiences *Asia-Pacific Journal of Counselling and Psychotherapy*	**30th Jun 2021**	**Yes** (Journal Article 3)	**Yes**	**Yes**

9. Recognized International Conference(s) In Which Paper(s) Related To This Research Project Was / Were Delivered

(Please attach a copy of each conference abstract)

Month / Year / Place	**Title**	**Conference Name**	**Submitted to RGC** *(indicate the year ending of the relevant progress report)*	**Attached to this Report** *(Yes or No)*	**Acknowledged the Support of RGC** *(Yes or No)*	**Accessible from the Institutional Repository** *(Yes or No)*
Dec 2018Hong Kong	Nosology And Assessment Of Statistics Anxiety: A Preliminary Study	2018 HKCPsych International Mental Health Congress (The Congress is organized by the Hong Kong College of Psychiatrists with support of the Royal College of Psychiatrists (UK) and the Royal Australian and New Zealand College of Psychiatrists, and the Tavistock and Portman NHS Trust in the UK. It is also supported by the Department of Psychiatry of the Chinese University of Hong Kong and the University of Hong Kong.	30 Sep 2019	Yes (Conference 1)	Yes	Yes
Sep 2019 Brisbane Australia	Conceptualization, assessment and treatment of statistics anxiety among undergraduate students	6th Asia-Pacific Confederation of Counsellors Congress (APCCC, 29-30 Brisbane, Australia) Organized by Asia-Pacific Confederation of Counsellors and Australia Counselling Association	30 Sep 2019	Yes (Conference 5)	Yes	Yes
Aug 2019 Chicago USA	A Phenomenological Investigation of Statistics Anxiety Among Undergraduate Students in Hong Kong.	Poster presentation at American Psychological Association Annual Convention 2019 (Organized by American Psychological Association), Chicago, IL, US.	30 Jun 2021	Yes (Conference 2)	Yes	Yes
Aug 2019 Chicago USA	Critical History of Introduction of Statistics in In Psychology Curriculum: The Case of Hong Kong.	Oral presentation at American Psychological Association Annual Convention 2019 (Organized by American Psychological Association), Chicago, IL, US.	30 Jun 2021	Yes (Conference 3)	Yes	Yes
Aug 2019 Chicago USA	Tête-bêche of modern psychology: Søren Kierkegaard's Concept of Anxiety and its insight to a study on statistics anxiety.	Oral presentation at STPP Annual Conference (Organized by Society of Theoretical and Philosophical Psychology and Division 24 of American Psychological Association), Chicago, IL, US.	30 Jun 2021	Yes (Conference 4)	Yes	Yes

10. Whether Research Experience And New Knowledge Has Been Transferred / Has Contributed To Teaching And Learning

(Please elaborate)

The STAT-Protocol is disseminated to undergraduate students (through PSY214 Qualitative Research Methods class) and postgraduate degree students (through CP516 Research methods in counselling psychology, CP518 Research seminars in counselling psychology, and GRS101 introduction to research methods for research postgraduate students). Also, the STAT protocol has been disseminated to the counsellor's network in Asia-Pacific Counselling and Psychotherapy Association.

11. Student(s) Trained

(Please attach a copy of the title page of the thesis)

Name	Degree Registered for	Date of Registration	Date of Thesis Submission / Graduation
N/A	N/A	N/A	N/A

12. Other Impact

(e.g. award of patents or prizes, collaboration with other research institutions, technology transfer, teaching enhancement, etc.)

The STAT-Protocol is adopted to help Master of Social Sciences in Counselling Psychology students in Hong Kong Shue Yan University who have difficulty in statistics to understand the typology of mental health related issues. The failure rate of CP518 in year 2020-2021 was zero after intervening with student concerned with STAT-Protocol. An exploratory study on the impact of applying STAT-Protocol as a teaching and self-exploratory tool will be conducted for 2021-2022 cohort of Master of Social Sciences in Counselling Psychology students.

13. Statistics on Research Outputs

	Peer-reviewed Journal Publications	Conference Papers	Scholarly Books, Monographs and Chapters	Patents Awarded	Other Research Outputs (please specify)	
No. of outputs arising directly from this research project	3	5	N/A	N/A	Type	No.
					STAT Protocol (see appendix I)	1

14. Public Access Of Completion Report

(Please specify the information, if any, that cannot be provided for public access and give the reasons.)

Information that Cannot Be Provided for Public Access	**Reasons**
N/A	