



COLUMBIA | SOLER

Science of Learning Research Initiative

2021 Provost's SOLER Seed Grants Proposal Template

Section 1: Project Summary			
Award Year:	2021-2022		
Title of Study:	Comparing the effects of onsite and online simulation-based education on the development of clinical reasoning in student physical therapists: a crossover study		
Principal Investigator (PI) Information			
PI #1 Name:	Wing Fu		
PI #1 Title:	Assistant Professor		
PI #1 Department:	Department of Rehabilitation and Regenerative Medicine (Physical Therapy)		
PI #1 Email:	wf2214@cumc.columbia.edu		
Co-Investigator (CI) Information			
Use an asterisk (*) to denote any CI who will serve as a Co-PI.			
CI #1 Name:		CI #2 Name:	
CI #1 Title:		CI #2 Title:	
CI #1 Department:		CI #2 Department:	
CI #1 Email:		CI #2 Email:	
CI #3 Name:		CI #4 Name:	
CI #3 Title:		CI #4 Title:	
CI #3 Department:		CI #4 Department:	
CI #3 Email:		CI #4 Email:	
Abstract: Describe the project in non-technical language; articulate the project objective; specify what makes the project innovative; describe your assessment or evaluation plan to ascertain student impact or other insights. (Limit 250 words.)			
<p>The COVID-19 pandemic has forced many educators to replace onsite education with online education. As the end of the pandemic is expectantly approaching, it is imperative to compare the learning outcomes of onsite and online education in order to make informed decisions on selecting educational interventions appropriate for specific learning objectives in a post-confinement world. The overarching objective of this proposed crossover study is to compare the effects of onsite and online simulation-based education on the development of clinical reasoning (CR) in student physical therapists (SPTs). Clinical reasoning is a critical attribute that physical therapists must possess.¹ Simulated patients (one form of simulated-based education) appear to have an effect on developing physical therapy clinical practice competencies including CR.² They are typically used as onsite trainings. Despite the existence of virtual simulated patients, they are not in the form of recorded videos of simulated patient sessions, which the principal investigator used during the recent lockdown to replace the pre-lockdown onsite simulations in her course. To the principal investigator's knowledge,</p>			

no studies has been done to compare the effects of the pre-lockdown educational intervention and the in-lockdown educational intervention on the development of SPTs' CR. The effects will be assessed at levels I and II of the Kirkpatrick model,³ including SPTs' clinical reasoning competency, self-perceived clinical reasoning gain and their satisfaction with the respective educational interventions. The proposed study can help promote the implementation of evidence-based education, which is much needed, as we are about to enter the transformed post-pandemic educational era.

Section 2: Project Description

Please complete each subsection taking into consideration the accompanying guidelines.

Section 2a: Project Scope. (Limit 500 words.)

- Framing
 - State your overarching objective(s).
 - Identify specific aims and explain how they align with the overarching objective(s).
 - Describe the overall methodology that will be used in this study, covering such factors as retrospective vs. prospective data collection, interventional vs. non-interventional, randomized vs. non-randomized, observational, experimental, etc.
- Participants
 - Identify your target participants (e.g., students).
 - Specify how participants will be identified and contacted.
 - Estimate how many participants will be impacted during the grant period.
 - Briefly describe how the innovation will continue to benefit student cohorts beyond the PSSG duration (e.g., through curricular changes).

The overarching objective of the proposed study is to compare the effects of onsite and online simulation-based education on the development of CR in SPTs. The effects will be assessed at level II and level I of the Kirkpatrick model.³ Level II is "Learning." It measures the knowledge, skills, or attitudes changed as a result of the educational intervention. Level I is "Reaction," in which Alliger⁴ proposed to distinguish between the learners' self-perceived educational gains (reactions as utility judgments) and self reports of satisfaction with the educational intervention (reactions as affect). The specific aims of the proposed study align with the overarching objective as they compare the effects of onsite and online simulation-based education on the development of SPTs' CR and their satisfaction with the respective educational interventions, at the aforementioned level II and level I. The specific aims are:

1. To compare the effects of onsite and online simulation-based education on SPTs' CR competency. (Level II)
2. To compare the effects of onsite and online simulation-based education on SPTs' self-efficacy of CR. (Level I; reactions as utility judgments)
3. To compare the effects of onsite and online simulation-based education on SPTs' satisfaction with the respective educational interventions. (Level I; reactions as affect).

The proposed study is a prospective experimental study utilizing a crossover design. It is an interventional study with the intervention being either onsite or online simulation-based education. A sample of convenience will be randomly and evenly assigned to one of the two groups (group A and group B).

Student physical therapists taking the Complex Medical Conditions course in the fall of 2021 will be the target participants. Sixty students are expected to enroll in the course. They are the only students who will be impacted during the grant period as the Complex Medical Conditions course is merely offered once a year. The principal investigator is the director of the course. During the first class, she will explain the study to all the students taking the course and invite them to participate in the study. The

principal investigator will emphasize that the course contents (the 8 simulated patient cases), the formats of content delivery (onsite versus online) and the student assessments will be the same regardless of their decision to participate in the study or not. In addition, their decision will not result in any penalty or loss of benefits that they are entitled to as a student in the course and the Doctor of Physical Therapy (DPT) program. The comparison of the two different formats (onsite and online) of simulation-based education will help the principal investigator select the more optimal educational format for all the students taking the course in years to come. The principal investigator can also determine the cost effectiveness of either educational format. On a broader perspective, the proposed study may serve as an exemplar and promote the implementation of evidence-based education, which is beneficial and critical to current and future SPTs in the associated DPT program and the larger healthcare professional education community.

Section 2b: Rationale and Literature Review. (Limit 500 words.)

- Describe how the project aligns with national and/or Columbia strategic initiatives.
- Highlight key findings of relevant educational research. Include citations as appropriate.
- Describe any prior work your team has done in this space.

The current COVID-19 pandemic has transformed higher education in many ways. One of them was the sudden and wide adoption of online (synchronous or asynchronous) education as a replacement of onsite education during the lockdown. In addressing the transformation of higher education after the COVID disruption, Garcia-Morales⁵ advocated evidence-based decision-making and transparent assessment of learning outcomes. As the end of the pandemic is hopefully approaching and many universities including Columbia University are about to fully reopen their campuses, it is time to evaluate and compare the learning outcomes of onsite and online education. The findings will help faculty make evidence-based decisions on selecting educational interventions appropriate for specific learning objectives in a post-confinement world.

Physical therapist education programs are required to ensure CR as an educational outcome.^{6,7} Simulation-based education may be well suited for meeting the training need. Simulated patients are utilized as a means in providing simulation-based education. They are normal individuals who have been carefully coached to accurately portray specific patients.⁸ As per a systematic review, simulated patients appear to have an effect on developing physical therapy clinical practice competencies at a level comparable to other educational methods.² Due to the coronavirus disease, universities had to suspend all onsite activities. Torres et al⁹ reported the transition of their medical simulations from an onsite format to an online format and concluded that the latter format seemed to be sufficient in training medical students' critical thinking (a commonly interchangeable term with CR). However, no learning outcomes were provided.

Prior to the pandemic, the principal investigator offered the Complex Medical Conditions course using onsite simulated patients. The course aimed at enhancing SPTs' CR in managing patients with complex conditions. In 2018 and 2019, 65 and 59 students took the course respectively and were exposed to 8 simulated patients with complex conditions. During each simulation class, majority of the students were in the role of an engaged observer watching the simulation unfold in real time. Three students were rotating as a physical therapist working hands-on with the simulated patient, a physical therapy aide and a peer evaluator. Each simulation class ended with an immediate onsite debriefing. There was a statistically significant increase in students' overall scores on the Physical Therapist Self-Efficacy Scale for Clinical Reasoning following the course in 2018. Due to the pandemic, onsite simulation was not feasible in 2020. The principal investigator utilized the recorded videos of previous simulation classes as an online simulation-based educational tool. Students were required to watch the videos of the 8 simulated patients asynchronously prior to attending the respective synchronous debriefing sessions. The course evaluation showed that 97.73 percent of the survey responders either agreed or strongly agreed to the statement "My clinical reasoning was enhanced in the course." The positive responses were in line with the self-efficacy test result discussed earlier. To make an informed

decision on the most appropriate simulation format (onsite or online) in enhancing students' CR, it is warranted to do a crossover study, as proposed in this grant application.

Section 2c: Assessment and Evaluation Plan for Specific Aims. (Limit 250 words.)

- Describe novel or to-be-adapted measurement tools (e.g., surveys).
- Outline key comparisons and briefly describe data analysis procedures.

The outcome measure and the data analysis procedure for each specific aim are:

1. For specific aim #1, the SPTs' CR competency will be assessed by a rubric created by the principal investigator. Students will be required to answer guiding questions and type their thoughts to Canvas as they watch the simulations unfold onsite in real time or in videos asynchronously. Their answers represent their clinical reasoning competency or lack thereof. The rubric will be graded by two practicing physical therapists in a blind manner. A Wilcoxon Signed Rank test will be applied to compare the competency scores between the onsite and online simulation-based education groups.
2. For specific aim #2, the SPTs' self-efficacy of CR will be measured by a tool named Self-Assessment of Clinical Reflection and Reasoning, which is a 26-item questionnaire. It has been used to evaluate SPTs' self-perceived clinical reasoning in other studies.¹⁰⁻¹² A Wilcoxon Signed Rank test will be conducted to compare the self-efficacy scores between the onsite and online simulation-based education groups.
3. For specific aim #3, the SPTs' satisfaction with the respective educational interventions will be assessed by the course evaluation, which has Likert-scale items and open-ended questions designed by the principal investigator. A Wilcoxon Signed Rank test will be used to compare the overall scores from the Likert-scale items between the onsite and online simulation-based education groups. Thematic analysis will be performed by the principal investigator and another individual (e.g. a SOLER facilitator) to synthesize the qualitative data from the open-ended questions.

Section 2d: Role of Key Personnel. (Limit 150 words.)

- Specify the expectations and obligations of all project personnel.
- Outline expected needs for in-kind support from SOLER facilitators.

The principal investigator is responsible for submitting an application to the Institutional Review Board (IRB), explaining the proposed study to target participants, inviting target participants to participate in the study, creating the outcome measures for specific aims #1 and #3, collaborating with research assistants and SOLER facilitators, collecting and analyzing research data as well as writing up the manuscript for publication.

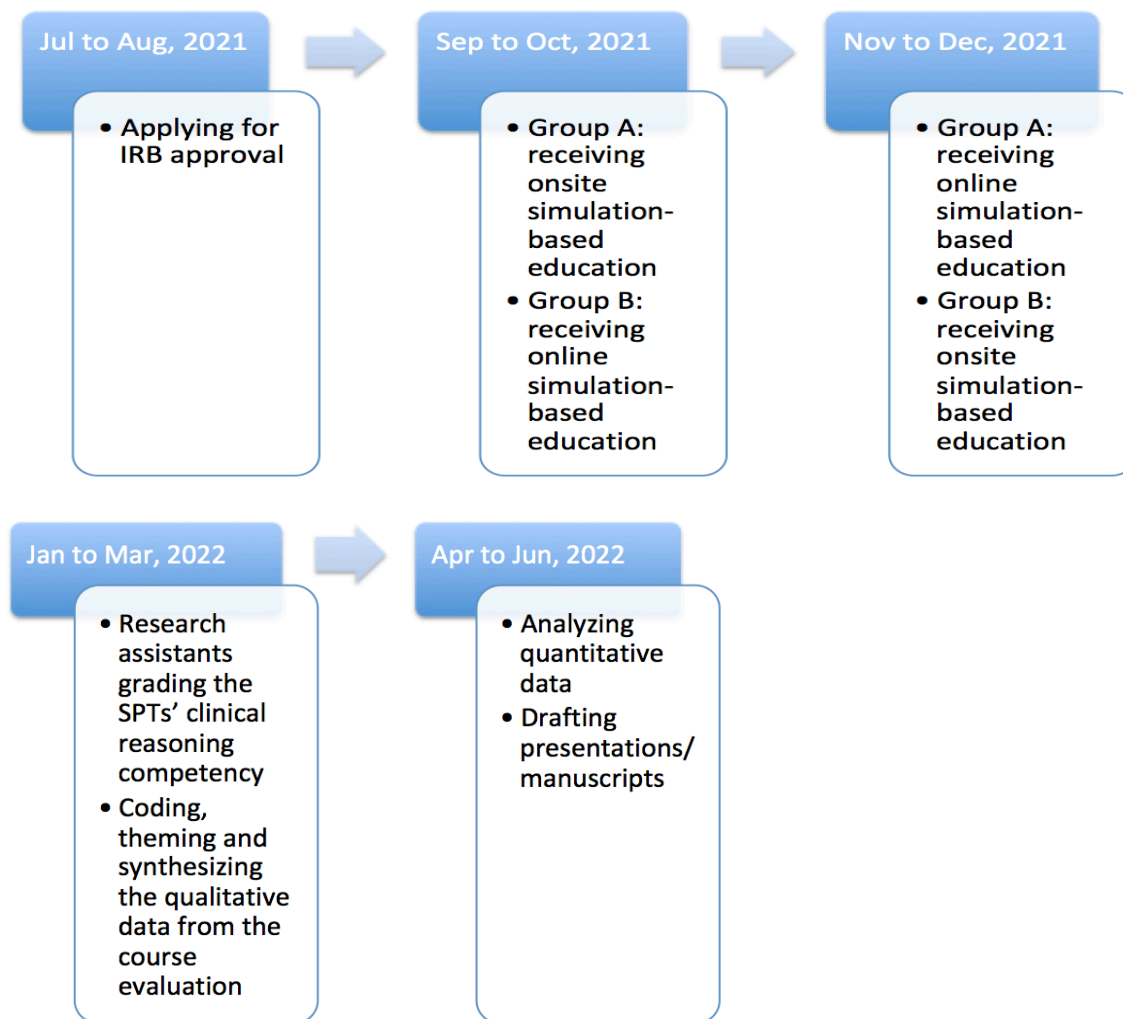
Research assistants (two practicing physical therapists) will be responsible for evaluating the SPTs' clinical reasoning competency in a blind manner by using the corresponding rubric.

The expected needs for in-kind support from SOLER facilitators include:

1. Providing consultation on preparing the application for IRB's approval
2. Applying qualitative research methods and steps (coding, theming and the use of NVivo and NVivo Collaboration Cloud) in analyzing the narrative data from the course evaluation)
3. Providing feedback on drafted presentations and manuscripts associated with the proposed study

Section 3: Graphical Project Timeline

Use a graphical timeline to depict the schedule for your project. The timeline should include start and finish dates for your project as well as the dates or periods during which various project tasks will occur. Indicate how you will monitor the effectiveness of the project as it evolves. All elements of the project should be completed within 12 months of receiving funds.



If I were awarded the Provost's SOLER Seed grant, the proposed study will be started right after the receipt of funding as it takes time to apply for the IRB's approval. The Complex Medical Conditions course will start in September 2021 and finish in December 2021. Those four months from September to December will be the time for data collection. Research data (qualitative and quantitative) will be analyzed from Jan to Jun, 2022 with an expectation of drafting associated presentations or manuscripts taking place from April to Jun. The principal investigator will keep close communication with any external parties in order to monitor the effectiveness and progression of the project. The monitoring is especially important during the processes of grading and data analysis. The principal investigator will communicate with the research assistants and the individual (e.g. a SOLER facilitator), who helps analyze the qualitative data, frequently then.

The time commitment from the principal investigator is reasonable for this project. It also works out that more project-related work is scheduled for the spring semester, which is the time of a year that the principal investigator's teaching load is lighter.

Section 4: Budget Overview and Justification.

Provide a detailed budget and justification for funds. Funding can be used for expenses such as equipment, shipping, media development, compensation for study participants (typically students), compensation for research assistants, and conference registration. Please mention all other sources of funding, if any. The total budget requested should not exceed the maximum award amount of \$5,000.

Budget Proposal		
Item	Description	Cost
SPSS (one-year license through Columbia University Information Technology)	Performing statistical analyses of the quantitative data, e.g. CR competency score and self-efficacy of CR score	\$85
NVivo for Mac (2 full licenses through Columbia University Information Technology)	Performing analyses of the qualitative data; one license for the principal investigator and one license for the individual (e.g. SOLER facilitator) who helps analyze the qualitative data	\$960 (\$480 per license)
NVivo Collaboration Cloud for Mac (1-year subscription through Columbia University Information Technology)	Enabling collaborative qualitative data analyses between the principal investigator and the individual (e.g. SOLER facilitator) who helps analyze the qualitative data	\$499
Two research assistants	Acting as the two blind assessors in grading students' clinical reasoning competency (Done by both research assistants; approximately 30 hours per assistant)	\$3000 (\$1500 each)
Conference registration	American Physical Therapy Association Combined Sections Meeting	\$450
Total		\$4994

References:

1. Edwards I, Jones M, Carr J, Braunack-Mayer A, Jensen G. Clinical reasoning strategies in physical therapy. *Phys Ther.* 2004;84(4):312-330.
2. Pritchard SA, Blackstock FC, Nestel D, Keating JL. Simulated patients in physical therapy education: systematic review and meta-analysis. *Phys Ther.* 2016;96(9):1342-1353.
3. Kirkpatrick D. Great ideas revisited: revisiting Kirkpatrick's four-level model. *Training Dev.* 1996;50(1):54-57.
4. Alliger GM, Tannenbaum SI, Bennett WJr, Traver H, Shotland A. A meta-analysis of the relations among training criteria. *Personnel Psychol.* 1997;50:341-358.
5. Garcia-Morales VJ, Carrido-Moreno A, Martin-Rojas R. The transformation of higher education after the COVID disruption: emerging challenges in an online learning scenario. *Front Psychol.* 2021;12:1-6. 10.3389/fpsyg.2021.616059
6. *A Normative Model of Physical Therapist Professional Education: Version 2004.* Alexandria, VA: American Physical Therapy Association; 2004.
7. Commission on Accreditation in Physical Therapy Education. Standards and required elements for accreditation of physical therapist education programs. http://www.capteonline.org/uploadedFiles/CAPTEorg/About_CAPTE/Resources/Accreditation_Ha

- ndbook/CAPTE_PTStandardsEvidence.pdf - search=%22standards%20required%20elements%22. Accessed August 29, 2020.
8. Barrows HS. An overview of the uses of standardized patients for teaching and evaluating clinical skills. *Acad Med*. 1993;68(6):443-451.
 9. Torres A, Domańska-Glonek E, Dzikowski W, Korulczyk J. Transition to online is possible: solution for simulation-based teaching during the COVID-19 pandemic. *Med Educ*. 2020;54(9):858-859. 10.1111/medu.14245
 10. Seif G, Brown D, Annan-Coultas D. Fostering clinical-reasoning skills in physical therapist students through an interactive learning module designed in the Moodle learning management system. *J Phys Ther Educ*. 2013;27(3):32-40.
 11. Trommelen R, Karpinski A, Chauvin S. Impact of case-based learning and reflection on clinical reasoning and reflection abilities in physical therapist students. *J Phys Ther Educ*. 2017;31(1):21-30.
 12. Willis BW, Campbell AS, Sayers SP, Gibson K. Integrated clinical experience with concurrent problem-based learning is associated with improved clinical reasoning among physical therapy students in the United States. *J Educ Eval Health Prof*. 2018;15(30). <https://doi.org/10.3352/jeehp.2018.15.30>



COLUMBIA UNIVERSITY

*College of Physicians
and Surgeons*

Programs in Physical Therapy

617 W. 168th Street
New York, NY 10032

212-305-0470 Tel

212-305-4569 Fax

www.columbiaphysicaltherapy.org

June 27, 2021

SOLER Seed Grant Committee
Office of the Provost
Columbia University

Dear Committee Members:

I am pleased to offer my strong support for Dr. Wing Fu's application for the 2021 Provost's SOLER Seeds Grant. Her advanced training in academia, teaching experience and skills, along with her dedication in educational research and scholarly work, make her an outstanding candidate for the grant.

Dr. Fu's academic pursuit demonstrates her focused passion and commitment towards education. She finished her Doctor of Philosophy (PhD) degree in Physical Therapy from Nova Southeastern University in 2013 and devoted her doctoral dissertation to an innovative educational research. To advance her knowledge and skills in academia, Dr. Fu completed a 3-year Medical Educator Fellowship Program and became a fellow in 2016. The program was offered by the International Association of Medical Science Educators with its trainings focused on curriculum design, teaching methods and strategies, assessment, educational scholarship, and leadership.

Dr. Fu is a seasoned academician with 20 years of experience. In 2015, she took a position as Teaching Faculty in the Department of Regenerative and Rehabilitative medicine within the entry-level Program in Physical Therapy for which I serve as the Assistant Dean and Director. Dr. Fu has demonstrated excellence in and commitment to student learning. Students and peers rated her teaching highly. In 2018, Dr. Fu single-handedly redesigned the Complex Medical Conditions course in our program. The course is one of the key courses in the last didactic semester and aims to enhance students' clinical reasoning in managing complex patients through simulation-based education. The course was well received by the students. There was also a statistically significant increase in the students' self efficacy of clinical reasoning following the course.

Clinical reasoning is not only Dr. Fu's primary teaching area but also her research and scholarly focus. The innovative educational research study she did to complete her PhD dissertation led to a publication in a peer-reviewed journal and her receipt of the Feitelberg Journal Founder's Award presented by the American Physical Therapy Association Education Section. In redesigning the Complex Medical Conditions course, she applied and was granted the Hybrid Learning Course

Redesign and Delivery Award offered by the Provost's office. The manuscript regarding the redesigned course is currently under review by the Journal of Physical Therapy Education. Dr. Fu was also the author of two chapters in a book titled *Clinical Reasoning and Decision Making in Physical Therapy: Facilitation, Assessment and Implementation*. Currently, Dr. Fu is taking the lead on two educational research projects. Dr. Fu is leading a team of physical therapist faculty nationwide in conducting a systematic review, which explores the effects of educational interventions designed to develop physical therapist learners' clinical reasoning. She is also working with another team of physical therapist faculty in exploring the application of the Master Adaptive Learning model, a new conceptual model guiding medical students' skill acquisition, in physical therapist education.

Due to the pandemic, Dr. Fu was not able to provide onsite simulations for students taking the Complex Medical Conditions course last year. She used the recorded simulations from the previous two years as online educational tools to achieve the learning objectives of the course. The course was again well received by the students. The course evaluation showed that 97.73 percent of the survey responders either agreed or strongly agreed to the statement "My clinical reasoning was enhanced in the course." The positive responses towards the course, regardless of the format of the simulations (onsite in 2018 and 2019 versus online in 2010), lead to Dr. Fu's interest in comparing the effects of the two formats on the development of students' clinical reasoning. She plans to do a crossover study for the comparison. Dr. Fu's proposal of comparing the onsite and online formats is, in my opinion, timely and appropriate. As we approach the end of a pandemic, it is time to evaluate our educational approaches including those we used before the pandemic and those we adopted during the pandemic, and decide on the most optimal methods for students to achieve specific learning objectives. As the Program Director, one of my main initiatives is to establish a comprehensive research program. Dr. Fu's research plan and grant application align with my initiative and contributes to the implementation of evidence-based physical therapist education.

I am thrilled that Dr. Fu is part of our faculty helping to enhance student learning and contributing to our research program. Based on her skills and dedication in teaching and educational research, I highly recommend Dr. Fu's grant application and look forward to her contributes.

Sincerely,



Debra Clayton-Krasinski, PT, PhD, MS
Assistant Dean, College of Physicians and Surgeons, Columbia University
Vice Chair, Department of Rehabilitation & Regenerative Medicine at CUMC
Director & Associate Professor, Program in Physical Therapy