

THE SCIENCE OF LEARNING (SOL) FUNDING INITIATIVE

Request for Proposal

1. TIMELINE

1.1 Submission Due Date(s):

<i>Whitepaper</i>	– 18 Oct 2021 (Mon), 1400 hrs
<i>Full Proposal (by invitation only)</i>	– Early Dec 2021

1.2 Whitepapers must be submitted to:

Permanent Secretary (Education)
[Attn: Mr Godwin Tang,
Director, Academic Research]
Ministry of Education

Email: MOE_ARD@moe.gov.sg
Cc: Ng_Weijie@moe.gov.sg; Fang_Wanru@moe.gov.sg

2. SUBMISSION PROTOCOL

- 2.1. Whitepapers and full proposals must be submitted to the Ministry of Education (MOE) by the Office of Research (ORE) of the host Institution, and the number of such applications should be within the submission quotas set by MOE. The OREs should work closely with the applicants in the preparation and submission of the documents. MOE will only liaise with the OREs for queries from applicants on the SoL proposals.
- 2.2. Instructions for the submission of Whitepapers by the ORE of the host Institution to MOE are as follows:
 - 2.2.1. Each Whitepaper should be submitted as an individual document (only in pdf. format), and ORE will need to consolidate all the Whitepapers in one submission at the email addresses provided above; and
 - 2.2.2. Unless stated otherwise, identities of the Lead Principal Investigator (PI) and other team members for each Whitepaper will be subject to review by MOE, SSG as well as experts appointed by MOE.
 - 2.2.3. The ORE of the host Institution should submit a cover letter for its deck of Whitepapers, explaining in brief how and why these Whitepapers have been selected for submission to MOE. This

cover letter should be endorsed by at least the Host Institution's Director of Research (DOR).

- 2.3. Applicants whose Whitepapers are shortlisted for the full proposal stage will need to submit their full proposals through MOE's online grants portal, unless otherwise advised.

3. GENERAL INFORMATION

- 3.1. The SoL programme seeks to support science-based research (which includes but is not limited to neuroscience, cognitive science and technology that augment human intelligence) that could explicate the principles, processes and mechanisms of learning and skills acquisition in order to generate implementable and scalable interventions that improve education and skills development, and hence advance Singapore's human potential. The 2021 SoL Grant call invites proposals which address the following challenges:

Challenge Statement 1

How might we leverage SoL to ensure that our children are well prepared and ready to learn when they are enrolled in school? In particular, how can we level-up students who face difficulties in learning in their early school years, e.g., from Primary 1-4, including those from disadvantaged backgrounds or with special needs, so that their learning trajectory is closer to that of their peers?

Challenge Statement 2

How might we leverage SoL to build and strengthen our students' socio-emotional skills, and mental health and well-being so that they are effective in facing challenges throughout the different milestones in their lives, especially during the puberty and adolescent period?

Challenge Statement 3

How might we leverage SoL to ensure effective transfer of learning from one domain to another and from one context to another? To elaborate, how can we leverage SoL to ensure that what our students/ workers learn throughout their education pathway can prepare them for a workplace that will be constantly changing throughout their life-course? What can SoL inform us about helping our workers transfer and cross-apply learning from one work context to other contexts and future jobs?

Challenge Statement 4

How might we leverage SoL, in areas such as neuroplasticity, neurocognition and social and emotional learning, to better understand and enhance how adults acquire and retain learning across different stages of adulthood, particularly in their 40s and 50s, and how acquired learning is translated to skills? In particular, how can adult learners (e.g. mature and vulnerable adults) maximise their learning and skills acquisition, taking into account neurological and physiological changes and challenges at different life stages?

- 3.2. Submitted proposals can focus on the following priority areas:
- 3.2.1. The science of literacy development – refers to the development of foundational skills that are key to lifelong learning. Literacy, in Singapore context, can cover two or more languages.
 - 3.2.2. The science of numeracy development – refers to the development of foundational mathematics skills that is core to the learning of complex mathematics and science-based subjects in later years.
 - 3.2.3. The science of social and emotional learning – refers to the core domain-general skills that are related to the socio-affective development, such as socio-emotional skills for 21CC, and emotion regulatory processes in maintaining positive mental health and well-being.
 - 3.2.4. Cognitive abilities and functions – refers to core domain-general abilities and functions necessary for learning, such as executive functions comprising working memory, cognitive flexibility and inhibition, visual, sensory and perceptual abilities; and higher-order abilities like metacognition, verbal/ non-verbal information processing, self-regulation.
 - 3.2.5. Adult brain plasticity and development – refers to understanding the brain structures and systems that are activated, and their functions over one's life span, such as how brain plasticity compensates for loss in cognitive functions and atypical development; and how neurocognitive mechanisms and processes of vulnerable mature learners are related to retention and transfer of learning.
 - 3.2.6. Other research that may not be within the 5 priority areas but is SoL related and have potential to advance human potential may also be proposed. This may include research on use of technology to augment intelligence and accelerate learning, which can also cover priority areas in paras 3.2.1 to 3.2.5.
- 3.3. All applicants are strongly encouraged to undertake empirical studies that can provide rigorous and relevant evidence to inform judgment and decision making in the public, private, and people sectors. Projects that pursue multi-disciplinary lines of inquiry are especially fruitful.

Where appropriate, applicants are encouraged to incorporate the following in their proposals:

- 3.3.1. Explain how the research questions are adequately addressed through data collection and analyses. These can be via

established methods in neuroscience, cognitive science, social sciences, and education research, and/or newer methods employing recent advances in fields like information technology, data and computational sciences, and artificial and augmented intelligence.

3.3.2. Relate the subject of study to Singapore’s socio-cultural contexts and compare local trends and dynamics to research findings in other countries in the region or the world.

3.3.3. Collaborate closely with potential users to foster the effective translation of research into policy or practice, or to promote the scaling of SoL informed intervention/programme across the education/adult education sector.

3.4. There are two types of SoL grant available, to support cutting-edge research, develop effective interventions/programmes, build a vibrant multi-disciplinary SoL research community and strengthen the research-policy-practice nexus.

3.4.1. Type A – Use-Inspired Basic and Applied Research for knowledge creation that can potentially lead to applications in teaching, learning and skills development

Sub-Type	Budget
A1 - Research programmes. Team-based efforts, with sub-projects.	Up to \$5M (including 30% Indirect Research Costs (IRC)) per award, over up to 5 years
A2 - Investigator-led projects	Up to \$2M (including 30% IRC) per award, over 3-5 years

3.4.2. Type B – Development and Translation, to develop implementable and scalable applications for teaching, learning and skills development and assess their efficacy and effectiveness.

Type	Budget
B1 - Programmes. Team-based efforts, with sub-projects.	\$4-5M (including overheads ¹ / 30% IRC) per award, over 4-5 years

3.5. The proposed scope must be credible and realistic in the proposed timeframe. Proposals may be viewed less favourably if they are overambitious or unrealistic.

¹ For Type B grants only, should PIs project that overhead expenses would be more than 30% of qualifying direct costs, the Office of Research should reach out to MOE by 30 Sep 2021.

- 3.6. Budgets should realistically reflect what is required to execute the scope of work that is proposed. Where possible, existing equipment and facilities should be used. Cost estimates should be credible and an inflated budget will weaken the proposal.

4. ELIGIBILITY INFORMATION

- 4.1. Lead PIs must hold a primary/joint appointment² in the Autonomous Universities, Polytechnics, Institute of Technical Education or A*STAR research institutes, including at the time of the application at the Whitepaper stage, as well as during the entire project duration³.
- 4.2. Researchers with primary/joint appointments⁴ in these as well as other publicly funded institutions, e.g. hospitals and Campus of Research Excellence and Technological Enterprise entities (CREATE), can participate in the call as Co-PIs.
- 4.4. Researchers in the private sector and other entities can only participate as collaborators.
- 4.5. Unless expressly allowed by MOE, SoL funding can only be spent on research conducted in Singapore, even if collaborators are based overseas.
- 4.6. Subject to the eligibility of the applicants, SoL allows for joint submission from institutions.
- 4.7. Submission of full proposals will be by invitation, and MOE has the discretion to request that a Type A1 Whitepaper be reworked as a Type A2 full proposal, or *vice versa*.

5. PROPOSAL EVALUATION INFORMATION

- 5.1. Proposals will be evaluated through a three-stage selection process:
- 5.1.1. **First Stage: Whitepaper** - The lead PI will submit a Whitepaper stating the vision of the proposed research project/programme and an indication of the resources and budget required, as well as short biographies of team members. Shortlisted applicants

² There should be a minimum time commitment of 9 months, per calendar year, in these institutions.

³ PIs who are awarded grants must continue to meet this criterion throughout the project period. Should such PIs be on No Pay Leave (or not serve duties at the institution) for more than 3 months in a Calendar Year during the project, they will no longer be eligible for the grant for that Calendar Year.

⁴ There should be a minimum time commitment of 9 months, per calendar year, at eligible institutions.

will be invited to submit a full proposal for evaluation under the Second Stage.

5.1.2. **Second Stage: Full Proposal** - Full proposals will be evaluated by an Expert Panel, with input from external reviewers, if required.

5.1.3. **Third Stage: Full Proposal** – Full proposals shortlisted by the Expert Panel will be evaluated by the Human Potential Steering Committee.

5.2. Proposals will be evaluated based on the following criteria:

5.2.1 Relevance: The relevance to the grant call's challenge statements (para 3.1) and the priority areas (para 3.2);

5.2.2. Potential Impact: The potential benefits of the research to Singapore, and potential contribution to knowledge and practice. An articulation of the potential pathways to impact and plans for involving and disseminating results to potential users/industry will strengthen the proposal;

5.2.3. Collaborations: Collaborations and synergies across existing research capabilities in the broader Singapore landscape and particularly for the Type B grant, across research translation/development, training/profession development capabilities and policy maker/practitioner communities. Applicants are encouraged to draw on the best research capabilities across Singapore and collaborate across institutions, agencies and discipline areas, including education and adult education particularly for the Type B grant;

5.2.4. Capability-Building: Potential to boost and catalyse the development of local SoL research capabilities in Singapore, including the development of human capital and expertise in important fields and sectors related to human learning through the life course, including the capacity to translate, implement and scale SoL informed interventions and programmes particularly for the Type B grant;

5.2.5. Technical Merit: Scientific and intellectual rigour, potential to create new and important knowledge, and appropriateness of research design and methods. The effective and appropriate use of innovative, novel and inter-disciplinary approaches that draw on new qualitative and quantitative tools not necessarily confined to either traditional STEM methods or traditional social science methods will strengthen the proposal. Particularly for the Type B grant, clearly demonstrate how the intervention/programme to be translated/developed is based on existing mature SoL findings and how findings from other relevant disciplines (e.g. Learning Sciences, Social Sciences)

are constructively integrated to increase its effectiveness and scalability;

5.2.6. Quality of Research Team: Capabilities and track record of the proposed research team; and

5.2.7. Execution: Coherence in the proposed execution plans, feasibility of carrying out the research within the given timeframe, and the cost-effectiveness and value for money of the research.

6. PROPOSAL PREPARATION

Whitepaper:

6.1. Refer to Annex A for the detailed requirements for the Whitepaper.

Full Proposal (by invitation only):

6.2. Applicants whose Whitepapers are shortlisted will need to submit their full proposals through MOE's online grants portal, unless advised otherwise. Refer to Annex B for the detailed requirements for the full proposals.

7. PRIVACY, CONFIDENTIALITY, AND DATA SHARING

7.1. Submission of the proposal and information within is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award. The information may be disclosed to members of the Human Potential Steering Committee, staff assistants, and other government agencies (e.g. the National Research Foundation) as part of the review process. Information about the researchers may be added to the reviewer database and used to select potential candidates to serve as future peer reviewers or advisory committee members with or without accreditation to the proposal.

7.2. Funded projects will be required to share data with government agencies. The datasets can then be used by public agencies, non-government entities and researchers to (a) further spur and expand research efforts into this area, (b) generate useful and applied interventions or products to develop human potential through public, academic and even potentially commercial sector collaborations, and (c) improve public policies and programmes.

8. MISCELLANEOUS

8.1 The above guidelines are for reference, and may be changed at MOE's discretion and communicated to the respective Host Institutions.

ANNEX A**GENERAL INSTRUCTIONS FOR WHITEPAPER SUBMISSION**

1. In response to a call for proposal, applicants should first submit a Whitepaper of **up to six pages (single-spaced in Arial, 12-point font)**, including figures, tables and charts.
2. Only bios⁵ (2 pages per team member) and references (up to 2 pages per Whitepaper) may be attached as annexes. Both the cover page and the annexes are not subjected to the six-page limit.
3. While there is no prescribed format for the Whitepaper, it should address the following points:
 - 3.1. Objectives of the proposed project/programme and how the proposed project/programme addresses the Challenge Statements;
 - 3.2. Significance of the research;
 - 3.3. Conceptual framework of the project/programme and how it compares with the current state of the art in that field;
 - 3.4. Areas of expertise, roles and contributions⁶ of the team members;
 - 3.5. Resources and indicative budget required;
 - 3.6. Overview of the groups (if any) that will be working together in the project/programme and how they will complement one another⁷; and
 - 3.7. Host Institution's plan for the space and building infrastructure requirements for the project/programme, and its commitment to provide support for the use of space and facilities.

⁵ Bios should include but are not limited to: academic qualifications and employment history, current research interests, relevant publications and patents, academic awards and honors (if any), and notable entrepreneurship activities (if any).

⁶ Please provide time commitment for Lead PI and co-PIs, in terms of percent effort devoted to the proposed project/programme (i.e. x% of the individual investigator's time) as well as number of months in Singapore. Each team member's concrete role in advancing the research objectives must be articulated clearly.

⁷ All team members should have well-motivated and concrete roles in advancing the research objectives, and the quality of engagement is more important than the quantity of team members.

ANNEX B**GENERAL INSTRUCTIONS FOR FULL PROPOSAL SUBMISSION**

1. Applicants will need to fill in all the mandatory sections in MOE's online grants portal.
2. In addition, applicants will have to upload a detailed proposal of **not more than 12 pages for A2 applications, and no more than 20 pages for A1 and B1 applications. These proposals should be single-spaced in Arial, 12-point font, and in pdf format. The page limits** exclude Annexes.

Format of detailed proposal

3. The proposed name of the project/programme and its host Institution must be shown on the header of every page. If a proposal exceeds the page limit, it may be returned without review.
4. The format should be as follows (*keeping to total page limit stipulated in para 2, the number of pages for each section below are recommended*)
 - I. Cover sheet (not counted in page limit) – The proposed name of the Project/Programme and its host institution must be shown.
 - II. Proposal Summary (2 pages) – The summary should be written in the third person and should make a compelling case for the project/programme. It should be informative to persons working in the same or related field, but insofar as possible, understandable to a scientifically or technically literate lay reader. It should clearly describe the objectives of the project/programme and provide highlights of the proposed research, and briefly indicate the uniqueness of the project/programme, and the cross-disciplinary composition.
 - III. Table of Contents (not counted in page limit)
 - IV. Project/Programme Description – These sections should be prepared with reference to the information, evaluation criteria and guidelines provided in this document.
 - a. Vision and Rationale
 - i. State the vision of the project and explain the key research problem(s) and hypotheses, the priority areas it focuses on and how it contributes to the challenge statements.
 - ii. Summarise how the project would add value to the local research landscape and be of relevance to Singapore and/or the region.
 - iii. For Type A grant - Summarise how the project will add to existing research/literature and make a contribution to knowledge in the area. This includes how Singapore-focused research can contribute to the global body of knowledge, evidence and theory.

For the Type B grant - Summarise how the project will contribute to the development of an effective and implementable intervention/programme that can address the challenge statement(s). This includes how the intervention/programme is ready to be implemented/scaled in Singapore school/adult education settings and is supported by a community of researchers, policy makers and practitioners.

b. Research Plan

- i. Provide details on the objectives of the project and the scientific/ground challenges to be addressed. Highlight how new knowledge would be created/frontiers of science would be pushed or how new approaches to address key education problems can be developed and adopted within high fidelity on the ground.
- ii. Account for the current state of the art in the subject, including existing comparable work conducted in other research institutions, and explain in detail how the proposed project contributes to knowledge in the area.
- iii. Provide a full and detailed description of the research design and proposed research methods or evaluation plan to demonstrate the effectiveness of the interventions. Highlight, in particular, the novelty of the approach, and the potential to create breakthroughs.
- iv. For projects comprising multiple project clusters or sub-projects, explain how the individual project clusters or sub-projects will be integrated. Highlight cross-dependencies, inter-disciplinary synergies and plans to strengthen research-policy-practice nexus and to build a tight researcher-practitioner community in support of successful implementation and scaling, wherever appropriate. The latter is required for Type B projects.

c. Data Collection Plan

- i. Elaborate on the data required for the research, the sources of such data, and strategies for data collection. Where relevant, provide supporting evidence to demonstrate the feasibility of the data collection plan. This could include samples of preliminary data sets that have been collected by the research team, or written confirmation from data sources that the relevant data will be made available for the research.
- ii. Elaborate on other sources of data that would be useful for the research or that would help to improve the quality of analysis, but which are currently unavailable or difficult to collect. Please be as specific as possible in the description of such data sets. Elaborate on the reasons and challenges faced in obtaining such data. Explain how such limitations could be overcome, and state if there are any budget implications in doing so.

d. Potential Impact

- i. Outline the pathway to impact, and identify potential users of the research outside of the academic community, such as non-profit organisations, public agencies, and industry partners which are

supportive of and interested in the findings of their research. Especially for the Type B grant, to outline the importance and relevance of the intervention to the Singapore education practitioners and the practical impact it can make in addressing the challenge statements.

- ii. Provide a clear dissemination strategy for the research to show how the research outcomes will be communicated to interested parties, including potential users.

e. Research Team and Organisational Structure

- i. Describe the proposed organisational structure and include an organisational chart.
- ii. Explain how the core team would be embedded within the local research scene. For the Type B grant, to explain how education practitioners (including professional development practitioners and trainers, as appropriate) will be constructively involved in the project to increase the chance of project success.
- iii. Explain how the research team possesses the skills and competencies required to successfully execute the research work, and for the Type B grant, translation, development and community building.
- iv. Highlight the relevant track record and capabilities of individual PIs, their international standing and any unique competitive advantages that they bring to the team.
- v. Account for existing collaborations (local/international) with other research entities, or any plans to leverage on such collaborations.

f. Equipment and Infrastructure

- i. Discuss the laboratories, shared facilities and equipment currently available for the project.
- ii. Discuss those that will be offered by the Host Institution and other institutions for use (if applicable).
- iii. Explain if existing infrastructure would be sufficient to conduct the proposed research project.

g. Financial Plan and Support

- i. Discuss the Host Institution's in-kind contributions, including its plan to share space and facilities.
- ii. Wherever applicable, discuss the strategy for gaining other forms of financial support (for example, from industry or public agencies).

h. Ethics and Risks

- i. Discuss any ethical issues that might be raised by the research and how you will address these.
- ii. List any risks that you anticipate in bringing the project to completion, and state the actions to be taken to mitigate these risks.

- V. Preliminary Timeline and Schedule– Include approximate start date of research and other activities. Projects/Programmes are expected to

commence operation no later than six months from the award of the project/programme.

VI. Programme Deliverables and Key Performance Indicators (KPIs) – Lead PI should provide full details of any relevant KPIs for their project/programme. This could include the following:

- i. Manpower training. PI should describe how the research project contributes to the development of research talent and human capital in the SoL research ecosystem in Singapore (e.g. number of PhD, Masters, and undergraduate students trained, development of local talent in multi-disciplinary field of SoL research, etc.). For the Type B grant, PI should also describe how the research project contributes to the professional development of education practitioners to increase the likelihood of the successful implementation and scaling of the intervention/programme developed.
- ii. Research Quality and Impact. PI should describe, in quantitative and qualitative terms, the demonstrable contribution that the research project will make to knowledge and practice in the field (e.g. number and type of policy papers, papers, books, book chapters and reports published; number and type of conferences and workshops held to disseminate findings; number of data sets shared; number of practitioner trained to conduct the interventions/programmes; number of students/adult learners that receive the interventions; how the research findings may be used for policy and societal impact in Singapore; etc.).
- iii. Collaboration with industry/user communities. PI should describe any collaboration with industry or user communities that the project/programme will undertake (e.g. research collaboration agreements), and the desired outcomes of such collaborations.

5. **Budget** - The budget, submitted through MOE's online grants portal, should include the in-kind contributions⁸ by the host institution and the amount of funding to be sourced/provided for externally.⁹ A list of non-fundable items is found in Enclosure 1 of the administrative guidelines. The following paragraphs provide further elaboration:

- a. Expenditure on Manpower (EOM), includes personnel costs and benefits for research fellows, associates and other research staff. These include salaries, allowances, Central Provident Fund (CPF) contributions and bonuses. **SoL does not support the salaries of PIs and co-PIs.**

⁸ They include the costs of providing the following support: Infrastructure Development Administration; Graduate Student Office Administration; Technology Transfer, Legal Services, Corporate Communication Administration; General Library Services; and Lab Safety Management.

⁹ The budget for the research proposal should be prepared according to the guidelines stipulated by the host institution's ORE, a copy of which should be made available to the applicant. These guidelines should not deviate from the institution's human resource (HR) policies and financial guidelines.

- b. Research Scholarships. This covers stipends and tuition fees of PhD/MRes students in the Autonomous Universities.
- c. Other Operating Expenditure (OOE), includes equipment maintenance cost, consumables cost, imputed rental and utilities, IT cost, cost of organising conferences and workshops, conference travel and other travel cost, cost of industrial meetings, cost of technology transfer activities, and administrative costs.
- d. Indirect research cost (IRC), is provided up to a maximum of 30%¹⁰ of the total qualifying direct costs (i.e. less Exceptional Item) of each newly approved SoL project/programme, and **must be budgeted within the overall cap of Types A and B grant**. There is only one Exceptional Item: Research scholarships.¹¹
- e. Unless expressly allowed by MOE, SoL funds can only be used to fund Singapore-based PIs' facilities/equipment and research activities in Singapore. While overseas collaborators are allowed to participate in the project/programme, the lead PI would need to seek alternative sources of funding if it were to pay any foreign party. This is to ensure that SoL funds are not used to subsidise research activities of external parties, whether intentionally or not. Subcontracting a portion of the research to an external party is subject to explicit approval by MOE, and would only be allowed if appropriate and on an exceptional basis.
- f. Budget Clarification Exercise. Upon in-principle approval for the SoL project/programme, MOE will embark on a budget clarification exercise to engage the OREs and Lead PIs for more detailed justification on the budget, before finalising the budget to be supported.

6. Annexes¹²

- a. Declaration of Other Funding Support – Provide details of all grants currently held or being applied for by the PI, Co-PIs or collaborators under the proposed programme, in related areas of work.
- b. List of Academic and Research Persons Involved as Participants and Supporters of the programme – This list will enable MOE to determine if potential reviewers have conflicts-of-interest.
- c. Curricula Vitae (CV) and Letters of Commitment (no more than 3 pages per participant, with the letter of commitment no more than 1 page) – Required for each team member. Up to 10 publications with high levels

¹⁰ The 30% IRC rate applies for projects awarded from the 2021 call onwards.

¹¹ While MOE encourages Postgraduate by Research (PGR) scholars to gain as much exposure to research as possible, MOE does not allow any PGR students on SoL scholarship to receive stipend and be concurrently employed (and receive salaries) on other MOE-funded grants, i.e. there should be no double-dipping of stipend and salary from MOE-funded grants.

¹² Not included in overall page limit.

of relevance to the proposal may be listed in each biographical sketch.¹³ The letters of commitment should indicate if their current employers are aware of their intention to participate in the proposed project/programme. The suggested format for the letter of commitment is shown in Appendix 1.

- d. References Cited (2 pages per proposal) – This may include publications cited, for example.

¹³ Bios should include but are not limited to: academic qualifications and employment history, current research interests, relevant publications and patents, academic awards and honors (if any), and notable entrepreneurship activities (if any).