# Brainstorming And Researching Ideas The S.P.A.C.E. Framework

# Objectives

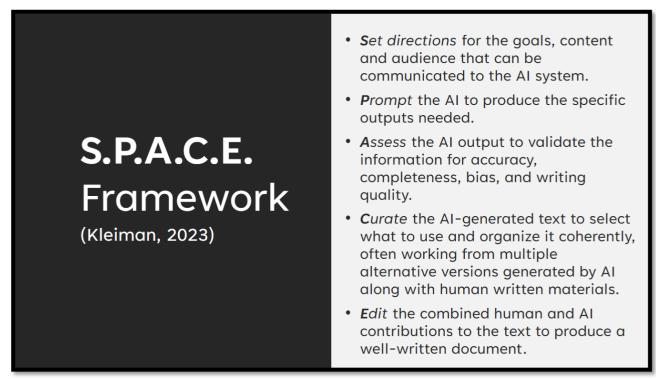
Leverage GenAI in the brainstorming and research process using the S.P.A.C.E. Framework

- Set directions that can be communicated to the AI system
- Prompt AI to produce specific outputs needed
- Assess AI output to validate the information
- Curate the AI-generated text to select what to use along with human written material
- Edit the combined human and AI contributions

# The S.P.A.C.E. Framework

To use GenAI purposefully and appropriately to facilitate personalised learning, students need to learn how to incorporate necessary steps into their research and writing process. The S.P.A.C.E. Framework introduced by Dr. Glenn Kleiman was designed to guide students' use of GenAI to support their writing and to foster discussions about how AI can be incorporated effectively into writing instruction. *Dr. Kleiman is a Senior Advisor at the Stanford Graduate School of Education where his work focuses on the* 

potential of AI to enhance teaching and learning.



Kleiman, G., Dr. (2023, January 5). *Teaching Students to Write with AI: The SPACE Framework*. The Generator. Retrieved June 30, 2023, from <u>https://medium.com/the-generator/teaching-students-to-write-with-ai-the-space-framework-f10003ec48bc</u>



#### GenAl@ELC

### **Example Activity: Brainstorming and Researching Ideas**

This activity is taken from a Discipline Specific Requirement ELC subject. This subject requires students to write professional proposals and deliver persuasive presentations based on original ideas, credible research, and discipline knowledge.

The following activity guides the students to use Dr. Kleiman's S.P.A.C.E. Framework in the process of brainstorming and researching ideas.

#### **Brainstorming Original Ideas and Research**

#### In groups

- decide on a specific target group
- research the problems/needs of your target group and select specific needs/problems you believe could be addressed (with reference to sources)
- brainstorm an original and feasible engineering solution
- justify the need/demand for your proposed idea (with reference to sources)
- justify the feasibility of your proposed idea (with reference to sources)

Target Group:		
Proposed Idea:		
Real Problems/Needs		
(embedded source links)		
Need/Demand		
(embedded source links)		
Feasibility		
(embedded source links)		

## GenAI Tip: Use Dr. Kleiman's S.P.A.C.E. Framework to facilitate your brainstorming process.

Below is an example based on past student work. The students had volunteered with the visually impaired, so they wanted to brainstorm a solution for the visually impaired community in Hong Kong.



<u>S</u> et and <u>Prompt: Problems with reference to sour</u>	ces
What are the problems of blind people in Hong Kong. Support your answers with reference to research or reports.	•
What are the problems of blind people in Hong Kong. Support your answers with reference to research or reports.	
<ol> <li>Accessibility and Mobility:         <ul> <li>Problem: Navigating the urban environment in Hong Kong can be challenging for visually impaired individuals due to inadequate tactile paving, inconsistent audio signals at pedestrian crossings, and obstacles on sidewalks.</li> <li>Need: Improved urban planning and infrastructure, including more consistent tactile paving and audio signals, to enhance mobility and safety.</li> <li>Reference: Hong Kong Society for the Blind (HKSE)</li> </ul> </li> <li>Education and Employment         <ul> <li>Problem: Access to quality education is a significant challenge, with limited resources and support for visually impaired students in mainstream schools. Employment opportunities are also limited, with high rates of discrimination in the job market.</li> <li>Need: Enhanced support services in schools, including specialized teaching materials and assistive technologies, as well as greater support for vocational training and inclusive hiring practices.</li> <li>Reference: Hong Kong Blind Union</li> </ul> </li> <li>Social Isolation and Loneliness:         <ul> <li>Problem: Social Isolation and lack of inclusion in community activities are common issues faced by visually impaired individuals.</li> <li>Need: Community programs and initiatives to promote social inclusion, awareness campaigns to change societal attitudes, and accessible recreational facilities.</li> <li>Reference: Hong Kong Blind Union</li> </ul> </li> <li>Accessible recreational facilities.</li> <li>Reference: Hong Kong Society for the Blind (HKSE)</li> <li>Problem: Many visually impaired individuals lack companionship and assistance, which can affect their emotional well-being and daily functioning.</li> <li>Need: Support networks, volunteer programs, and assistive services to provide companionship and practical assistance.</li></ol>	
<ul> <li>Need: Improved accessibility in healthcare facilities, tr in and accessible health information.</li> <li>Reference: Hong Kong Society for the Blind (HKSB)</li> <li>Assess and <u>C</u>urate:</li> <li>Validate the information: Find up-to-date and credible sour</li> <li>Critically select what to use</li> </ul>	ces

Г

The group wanted to focus on addressing two problems: 1) Mobility and 2) Emotional well-being

#### Assess and Curate: Validate and critically select information that justifies the two problems

- 1. Mobility: Complex urban environment, inadequate tactile paving, inconsistent audio signals at crossings, insufficient public transportation accessibility, etc. (Labour and Welfare Bureau, 2022)
- 2. Emotional well-being: Numerous studies have established a strong correlation between vision impairment and depression (Demmin & Silverstein, 2020).

Source links:

Demmin, D.L. & Silverstein, S.M. (2020) Visual Impairment and Mental Health: Unmet Needs and Treatment Options, Clinical Ophthalmology, 14:, 4229-4251, DOI: <u>10.2147/OPTH.S258783</u>

Labour and Welfare Bureau of the Government of the Hong Kong Special Administrative Region. (2022). Consultancy Study for Enhancement of the Accessibility of Physical Environment in Hong Kong. Retrieved February 15, 2024, from <u>https://www.lwb.gov.hk/en/highlights/rpp/Final%20Report.pdf</u>



#### GenAl@ELC

### Edit: Combine your analysis and GenAI produced ideas

 The group wished to explore whether a robotic guide dog could potentially address the two problems.S.P.A.C.E. Framework: Brainstorming Robotic Guide Dog
 Set and Prompt

Is there need and demand for a robotic guide dog? Support your answer with market research or studies based on the situation in Hong Kong. Need and Demand for Robotic Guide Dogs in Hong Kong 1. Prevalence of Visual Impairment: According to the Census and Statistics Department of Hong Kong, there were approximately 174,800 people with visual impairments as of 2013. This significant population indicates a potential market for assistive technologies. 2. Limitations of Traditional Guide Dogs: • The Hong Kong Guide Dogs Association (HKGDA) faces challenges in meeting the demand for traditional guide dogs due to high costs and extensive training requirements. This limitation suggests a gap that robotic guide dogs could potentially fill. 3. Assistive Technology Adoption: • A study by the Hong Kong Society for the Blind (HKSB) indicates that visually impaired individuals in Hong Kong are increasingly adopting assistive technologies, showing a growing interest in innovative solutions. 4. Supportive Environment: The Hong Kong government and NGOs provide funding for assistive devices. Local research institutions such as the Hong Kong University of Science and Technology (HKUST), are active in robotics and Al development, creating a conducive environment for the adoption of robotic guide dogs. 5. User Acceptance: Surveys by the Hong Kong Blind Union reveal that many visually impaired individuals are open to trying new technologies that can improve their quality of life, indicating potential user acceptance for robotic guide dogs. Assess and Curate: Validate the information: Find up-to-date and credible sources Conclusion Critically select what to use Give me links to the sources you mentioned I apologize for any confusion, but as an Al, I don't have the capability to browse the internet in real-time or provide direct links to sources. However, I can guide you on how to find the information mentioned:

#### Assess and Curate: Validate and critically select information that justifies the need/demand

- 1. Hong Kong Guide Dog Association (2023): In 2021-22, there were more than 199, 000 people with visual impairment in Hong Kong, but only 34 guide dogs were in service.
- 2. Hong Kong Blind Union 2022-2023 Annual Report: Visually impaired individuals are open to trying new technologies and the government as well as NGOs in Hong Kong are supporting the research and development of innovative and technological solutions.
- 3. News.gov.hk. (2023, May 21): Smart Government Innovation Lab co-operated with a local startup to develop an indoor guiding robot. The robot will be tested in shopping malls and is expected to assist the blind more conveniently than guide dogs in indoor areas.

#### References:

- Hong Kong Blind Union (2023).2022-2023 Annual Report. Retrieved February 15, 2024, from https://www.hkbu.org.hk/uploads/files/Annual-Report-20240523023052-file\_en.pdf
- Hong Kong Guide Association. (2023). *Guide Dog Training*. Retrieved February 15, 2024, from <u>https://www.guidedogs.org.hk/services/#tab</u> -- guide-dog-training (2023, May 21).

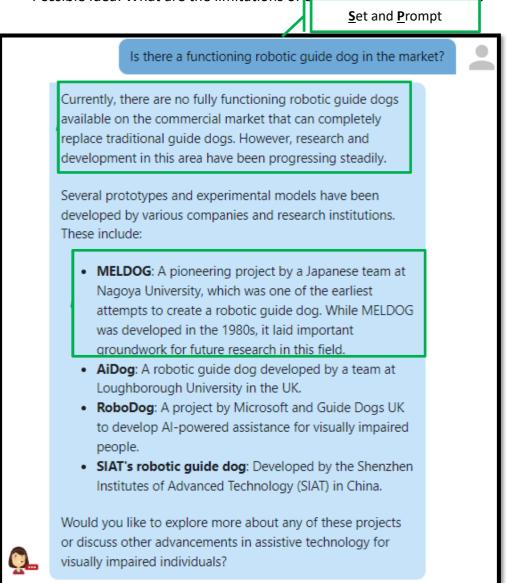
Robotics for a better life. Retrieved February 15, 2024, from https://www.news.gov.hk/eng/2023/05/20230518/20230518\_182459\_331.html



#### GenAl@ELC

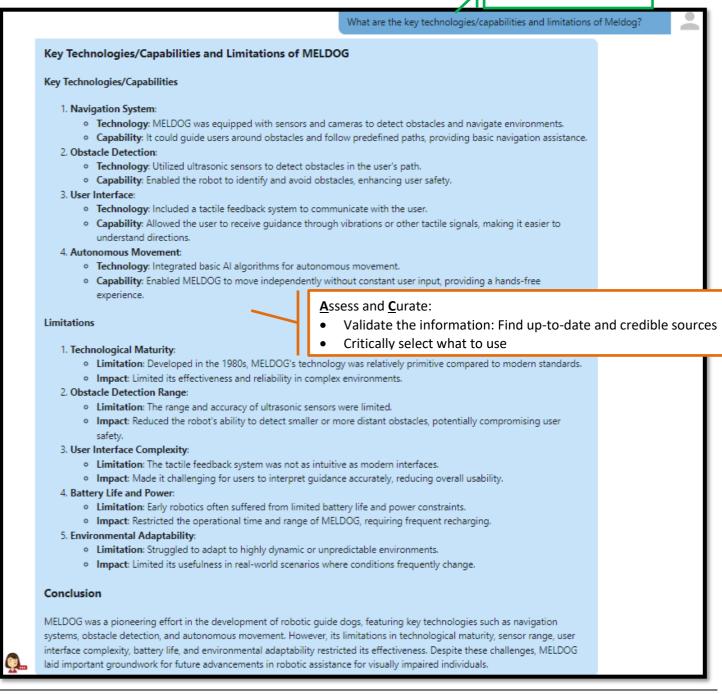
#### Edit: Combine your analysis and GenAI produced ideas

- Up-to-date news and reports show clear interest and demand from target group and support from gov and NGOs
- Project could leverage existing technology and development of robotic guide dogs in indoor areas
- Possible Idea: What are the limitations of existing robotic guide dogs?





<u>Set and</u> Prompt



# Assess and Curate: Validate and critically select information that justifies the capabilities and limitations of MELDOG

Key features of MELDOG include: obstacle detection, route planning, and object recognition. These functions can solve limitations brought by the white cane, but the inaccuracy of navigation and the bulky design was problematic (Tachi Lab, 2021).

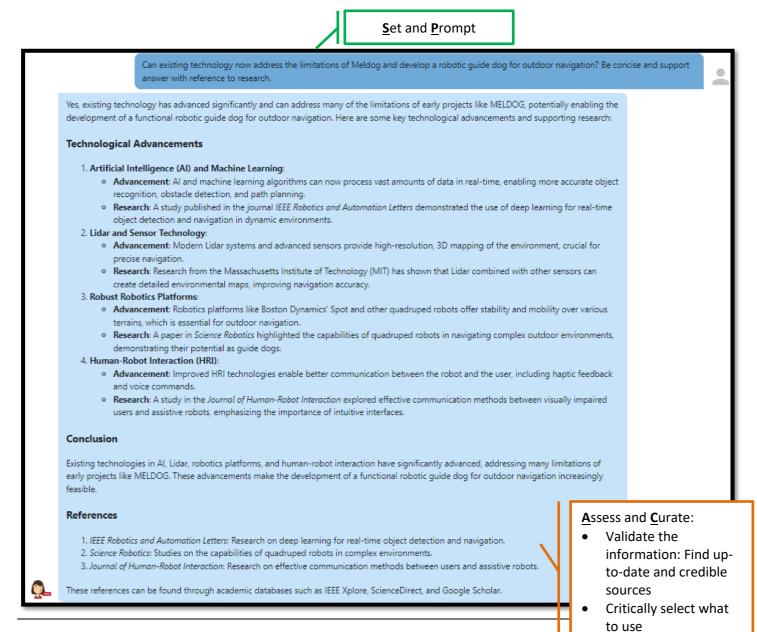
Reference:

Tachi Lab. Tachi Lab - Guide Dog Robot (MELDOG). (2021). Retrieved March 10, 2023, from https://tachilab.org/en/projects/meldog.html



### Edit: Combine your analysis and GenAI produced ideas

 Uniqueness: Is it possible for us to develop a robotic guide dog that could facilitate outdoor navigation? Can the design of the robotic guide dog provide emotional support?



# Assess and Curate: Validate and critically select information that justifies the feasibility of outdoor navigation supported by existing technology.

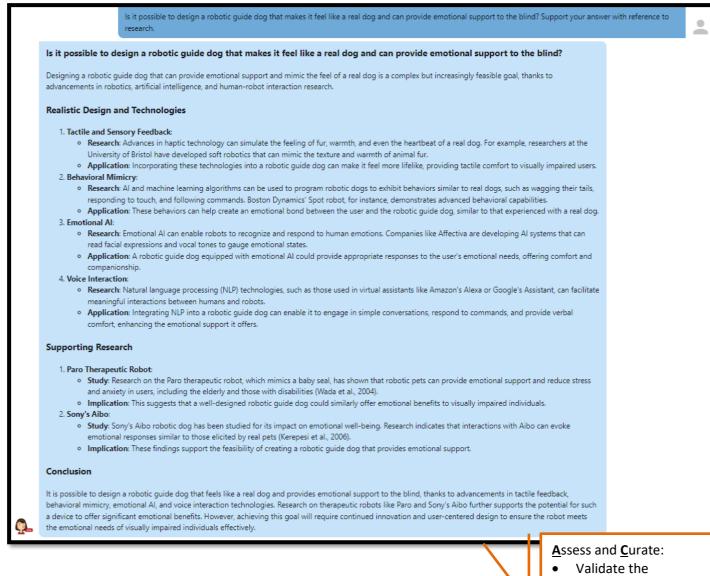
Findings from Wei, Kou and Lee's 2014 research into guide-dog robot system in an urban setting, and other research areas such as using 3D gully monitoring with GIS (Marzolff & Poesen, 2009) and satellite positioning system to track gait parameters (Terrier & Schutz, 2005), support the feasibility of the proposed idea.

References:

Marzolff, I., & Poesen, J. (2009). The potential of 3D gully monitoring with GIS. using high-resolution aerial photography and a digital photogrammetry system. *Geomorphology*, *111*(1-2), 48-60.

https://www.sciencedirect.com/science/article/pii/S0169555X09001421

- Terrier, P., & Schutz, Y. (2005). How useful is satellite positioning system (GPS) to track gait parameters? A review. *Journal of neuroengineering and rehabilitation*, 2(1), 1-11. <u>https://pubmed.ncbi.nlm.nih.gov/16138922/</u>
- Wei, Y., Kou, X., & Lee, M. C. (2014, July). A new vision and navigation research for a guide-dog robot system in urban system.
   In 2014 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (pp. 1290-1295).
   IEEE. <u>https://ieeexplore.ieee.org/document/6878260</u>



- information: Find upto-date and credible sources
- Critically select what to use

•

# Assess and Curate: Validate and critically select information that justifies the feasibility of a realistic robotic guide dog that provides emotional support.

- PARO Realistic Therapeutic Robotic Seal (Hung et al. 2019)
- Thermoelectric and Peltier devices (Wavelength Electronics, 2020) can be used to maintain a warm temperature.
- Soft robotic shell design could also enhance the realistic touch (Osawa, 2021).

#### References:

Hung, L., Liu, C., Woldum, E. *et al.* (2019). The benefits of and barriers to using a social robot PARO in care settings: a scoping review. *BMC Geriatr* **19**, 232. <u>https://doi.org/10.1186/s12877-019-1244-6</u>

Osawa, Y., Kinbara, Y., Kageoka, M. et al. Soft robotic shell with active thermal display. Sci Rep 11, 20070 (2021). https://doi.org/10.1038/s41598-021-99117-y

Wavelength Electronics. (2020, February 11). *Temperature Controller Basics*. Wavelength Electronics. Retrieved March 6, 2023, from <u>https://www.teamwavelength.com/temperature-controller-basics/</u>



#### Edit: Combine your analysis and GenAI produced ideas

After following Dr. Kleiman's S.P.A.C.E. Framework, the group then drafted an overview of their proposed idea.

Target Group: Visually impaired community in Hong Kong		
	prototype for a robotic guide dog that can assist with outdoor navigation and provide	
Real Problems/ Needs (embedded source links)	<ol> <li>Navigation and Mobility: Complex urban environment, inadequate tactile paving, inconsistent audio signals at crossings, insufficient public transportation accessibility, etc. (<u>Labour and Welfare Bureau, 2022</u>).</li> <li>Emotional well-being: Numerous studies have established a strong correlation between vision impairment and depression (<u>Demmin &amp; Silverstein, 2020</u>).</li> </ol>	
Need/Demand (embedded source links)	<ol> <li><u>Hong Kong Guide Dog Association (2023)</u>: In 2021-22, there were more than 199, 000 people with visual impairment in Hong Kong, but only 34 guide dogs were in service.</li> <li><u>Hong Kong Blind Union 2022-2023 Annual Report</u>: Visually impaired individuals are open to trying new technologies and the government as well as NGOs in Hong Kong are supporting the research and development of innovative and technological solutions.</li> <li><u>News.gov.hk. (2023, May 21)</u>: Smart Government Innovation Lab co-operated with a local startup to develop an indoor guiding robot. The robot will be tested in shopping malls and is expected to assist the blind more conveniently than guide dogs in indoor areas.</li> </ol>	
Feasibility (embedded source links)	<ul> <li>Outdoor Navigation</li> <li>Technology and development of indoor navigation robots: <ul> <li>Indoor navigation robot developed by Smart Government Innovation Lab (news.gov.hk, 2023)</li> <li>MELDOG (Tachi Lab, 2021)</li> </ul> </li> <li>Existing Technology: <ul> <li>Wei, Kou and Lee's 2014 research of guide-dog robot system in an urban setting</li> <li>Using 3D gully monitoring with GIS (Marzolff &amp; Poesen, 2009) and satellite positioning system to track gait parameters (Terrier &amp; Schutz, 2005)</li> </ul> </li> <li>Emotional Well-being Support <ul> <li>PARO Realistic Therapeutic Robotic Seal (Hung et al. 2019)</li> <li>Thermoelectric and Peltier devices (Wavelength Electronics, 2020) can be used to maintain a warm temperature.</li> <li>Soft robotic shell design could also enhance the realistic touch (Osawa, 2021).</li> </ul> </li> </ul>	

