



# Significance of discussion facilities in collaborative problem solving

WOO, Mei Wa Esther

The University of Hong Kong

People's Republic of China

[esther.woo@hku.hk](mailto:esther.woo@hku.hk)

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## Purpose of study

To find out how students interact with the facilities and fellow students in discussion rooms, their perceptions about the impact of the facilities on their learning in particular the development and application of collaborative problem solving (CPS) skills





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## Background

- Global development in 21<sup>st</sup> century creates many challenges and issues
- New tasks are open-ended, involve unbounded sets of information, and require ongoing re-definition of their goal
- Renewal of education for a world society where human being need to learn living together under increasing competition and tension (UNESCO, 1996)
- Collaborative problem solving (CPS) becomes a critical skill set



## Evolverment of learning spaces

- Advancement in pedagogy and technology has enabled learning outside the classrooms, e.g. mobile learning and ubiquitous learning (Dumont & Istance, 2010; Shih, Chu, Hwang, & Kinshuk, 2011)
- Recognition of informal learning through re-thinking the design of non-classroom spaces (Jamieson, 2009, 2013)
- Research interest has shifted from formal learning spaces to those for informal and social learning (Boys, 2011)
- Many informal learning spaces have now incorporated open or closed spaces for group work



## Group work vs collaborative problem solving

<b>Group work (Douglas, 1976)</b>	<b>Collaborative problem solving (Griffin &amp; Care, 2015)</b>
Members cooperate to enhance the total output of an activity	All members contribute their own resources to the process and rely on each other to put forward information and resources for the common goal
Aims to cater for individual differences or to generate conforming standards of behavior and judgement	Aims to reach collective consent on the process and the solution
Task assessment focuses on the total output	Task assessment focuses on both the process and solution / outcome



## Assessment of group learning spaces

- Approaching learning as both an intellectual process and a collaborative activity
- Using a set of empirically validated developmental progressions of cognitive skills and social skills for CPS established by the Assessment and Teaching of Twenty-First Century Skills Project (ATC21S) (Griffin, Care, & McGaw, 2012)
  - Measurable
  - Theoretically derived
  - Validated through large scale assessment data in Australia, Finland, Portugal, Singapore and the United Kingdom (e.g. PISA 2015)



## Theoretical frameworks referenced by the ATC21S assessment approach for CPS

- Zone of proximal development (Vygotsky, 1980)
- Criterion-referenced interpretation (Caser, Chudowsky & Pellgrino, 2001)
- Probabilistic model for interpretation and empirical validation of competence levels by using latent trait theory and mathematical modelling (Rasch, 1980)



## Methodology

Creation of an observation checklist and an interview protocol for the subject groups using the above set of tool (Griffin, Care, & McGaw, 2012) to analyze the activities observed in group learning spaces and students' comments on the impact of group learning facilities on CPS.

<b>Cognitive skills</b>	<b>Social skills</b>
<ul style="list-style-type: none"><li>• Task regulation</li><li>• Learning and knowledge building</li></ul>	<ul style="list-style-type: none"><li>• Participation</li><li>• Perspective taking</li><li>• Social regulation</li></ul>

Each skill is subdivided into elements with specific indicators



## Research site

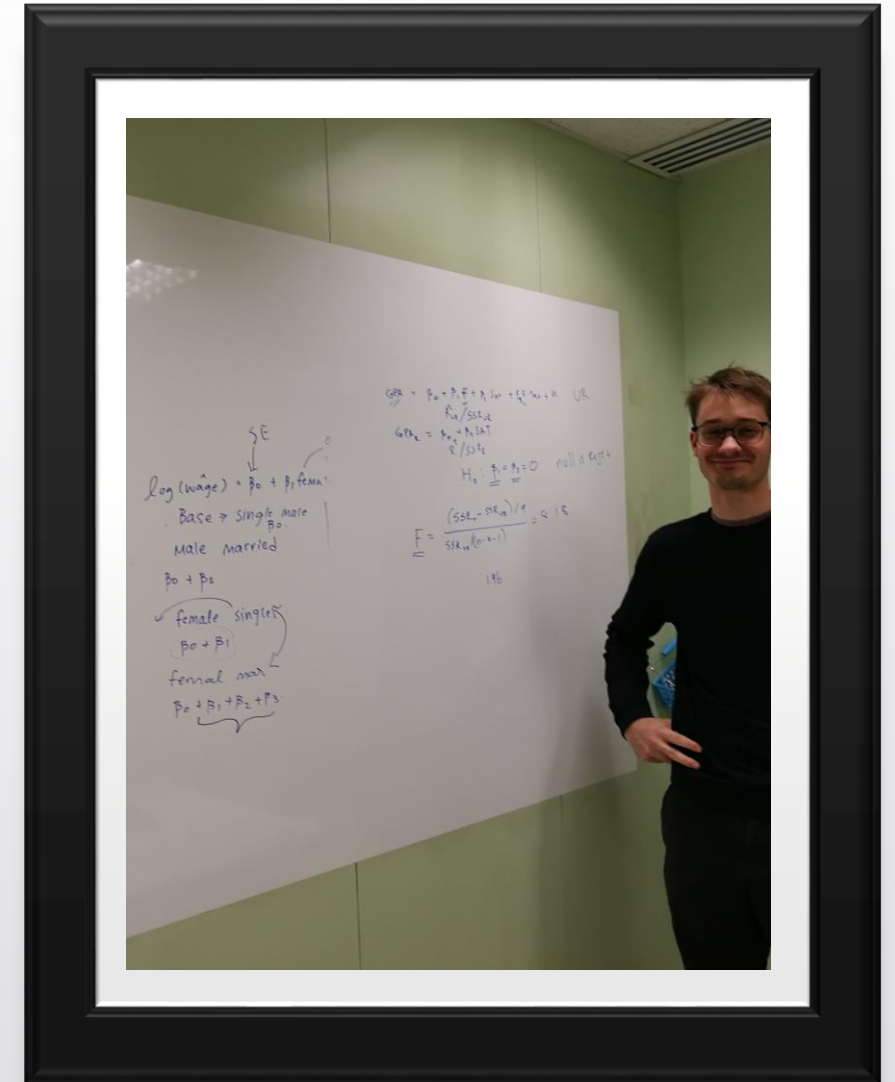
A comprehensive research university in Hong Kong with 25% of UG students and 50% of PG students from Mainland China and other countries

## Subjects

13 groups of students mostly UG from various disciplines were invited for participation on voluntary basis

## Qualitative research

442 mins of observations for group discussion (n=9) + 276 mins of semi-structured interviews (n=10)



# Observations with video recording in discussion facilities

- Rooms with ordinary to good sound proof mainly in two learning commons
- One table and up to 12 chairs / room
- A projection system connectible with users' own laptops or the computers provided on site
- Some of the rooms are equipped with electronic and/or manual whiteboards



<b>Group</b>	<b>Major purposes of visit and/or activities carried out</b>	<b>Facilities and mobile devices used</b>	<b>Averaged duration per visit</b>
G1 (SocSc & Archi)	Group projects, class assignments	Laptops, smartphone, WiFi, projection system	2 – 6 hours
G2 (Med)	Class assignments	Laptops, WiFi, projection system	1 – 2 hours
G3 (Misc)	Extracurricular activities	Whiteboard, computer, WiFi	N/A
G4 (Arts)	Class presentations	Laptops, WiFi, power sockets	N/A
G5 (Archi)	Class assignments, group projects, preparation for competition or interviews	Video recorder, whiteboard, laptop, WiFi, projection system, power sockets	Depending on needs
G6 (Sc, Bus&Econ)	Class and examination revision, group projects, class assignments, extracurricular activities	Laptops, WiFi, power sockets, projection system, whiteboard	2 – 10 hours depending on needs
G7 (Sc)	Class assignments	Laptops, smartphone, WiFi	N/A
G8 (Eng)	Group projects, class presentations, extracurricular activities, private study	Laptops, iPad, smartphone, WiFi, projection system, whiteboard, e-whiteboard, power sockets	1 – 2 hours
G9 (Sc & SocSc)	Group projects, class assignments, extracurricular activities, hangout with peers	Laptops, smartphone, WiFi, whiteboard, projection system, power sockets	1 – 2 hours
G10 (Law)	Class assignments, extracurricular activities	Laptops, WiFi, whiteboard, power sockets	2 hours
G11 (Edu)	Group projects, class presentations	Laptop, iPad, WiFi, projection system, whiteboard, power sockets	4 hours or more
G12 (Law)	Group project, group revision	Laptops, WiFi, whiteboard, e-whiteboard, projection system, power sockets	1 – 2 hours
G13 (Med)	Class presentations, discussion of class materials	Laptops, WiFi	1 – 2 hours

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## Findings from group interviews



- A majority of the students expressed the basic needs of **an isolated space with efficient network connection and power supply**.
- The **formal setting, reservation requirement and acoustics** of discussion rooms in LC favourable qualities that helped to engage users in terms of punctuality, commitment and concentration.



<b>Time</b>	<b>Skill in CPS</b>	<b>Activity</b>
05:10	Organises, set goals, action	Discussed project requirements and consented on goals. Schedule meeting with teacher by email.
05:20	Collects elements of information	Shared laptop screens to verify information/data/interesting ideas.
06:00	Collects elements of information	Checked overseas major geo hotels' websites.
08:50	Collects elements of information	Double checked information retrieved on different websites.
09:20	Self evaluation, interaction, adaptive responsiveness	Drafted and revised an email to course instructor. Conducted cheerful discussion and showed harmonious rapport.
14:00	Action Resource management	Sent email to course instructor and opened Google Doc to create project document(s).
14:30	Self evaluation	Checked calculations for length of project report.
15:00	Responsibility initiative	S8 shared experience of past projects.
15:40	Resource management	Shared workload of project paper between members.
16:10	Systematicity	Verified teacher's requirements of project including human impact as well as site visit details.
16:32	Transactive memory, relationships	S8 asked how to relate discussion and evaluation to members' ideas for the project.
17:14	Self evaluation, interaction	Members made suggestions and comments on S8's ideas.
23:05	Systematicity, resource management	Brainstormed ideas for discussion, evaluation methods and perspectives. S8 recorded data on library PC.



## Commonly recognised contributing factors

“I feel that we will be more focused without other distraction... Because in a **confined space**, you will be realized by others if you play idle.” (G5)

“...it’s like when we meet we need **an atmosphere to be like official or formal**. The same like for study, if you study outside like Delifrance (food outlet) you can be like no mood. It’s very casual.” (G6)

“But when we **book the room**, everyone’s on time, because there’s a **time limit**. But when it’s outside, without a time limit, people don’t mind being late, but the time limits here are better... It makes us more concise and more efficient with time.” (G13)



# Application of social skills for CPS

Element	Indicator	G1	G2	G5	G6	G10	G11	G12	G13	G14	G15	Total
<b>Participation</b>												
Action	Activity within environment	1	1	1	1		1	1			1	<b>7</b>
	Interacting with, prompting and responding to the contributions of others	1	1	1	1	1	1	1	1	1	1	<b>10</b>
Task completion/ perseverance	Undertaking and completing a task or part of a task											
	individually	1	1	1	1	1	1				1	<b>7</b>



# Application of cognitive skills for CPS

Element	Indicator	G1	G2	G5	G6	G10	G11	G12	G13	G14	G15	Total
<b>Task regulation</b>												
Organises (problem analysis)	Analyses and describes a problem in familiar language	1		1	1			1	1			5
Sets goals	Sets a clear goal for a task	1	1	1	1			1			1	6
Resource management	Manages resources or people to complete a task			1	1	1	1	1			1	6
Flexibility and ambiguity	Accepts ambiguous situations	1		1	1						1	4
Collects elements of information	Explores and understands elements of the task	1			1			1	1	1		5
Systematicity	Implements possible solutions to a problem and monitors progress		1	1	1			1				4



## Association between facilities in discussion rooms and CPS skill development/application

- Mostly mentioned social skills - “interaction” (10), “action” (7), “task completion/perseverance” (7) and “negotiation” (6)
- Social skills mentioned by half of the groups (5) – “audience awareness”
- Mostly mentioned cognitive skills – “set goals” (6), “resource management” (6)
- Cognitive skills mentioned by half of the groups (5) – “organises (problem analysis)”, “collects elements of information” and “relationships (represents and formulates)”



## Value of whiteboards

- Whiteboards were often mentioned by interviewees with positive comments associated with CPS skills:

**Organises** - “The whiteboard can help to list out the points of discussion systematically. And also some examples can be clearly shown under each point.” (G10)

**Collects elements of information and resource management** - “First of all, I will use the whiteboard to breakdown the elements of information by writing it down and showing it to everybody. Then if I need to gather information, I will go to Google... Usually, we will distribute the works by separating the elements and then assign tasks to different members.” (G5)

**Relationships** - “...because with the whiteboard you can use mind maps and list everything out clearly. It also relates to “identifies connections and patterns between and among elements of knowledge.” (G12)



## Use of whiteboards (manual vs electronic)

- Students with technology background such as Group 8 (Engineering) tend to find the e-whiteboards useful. However, other students were not enthusiastic in using it.

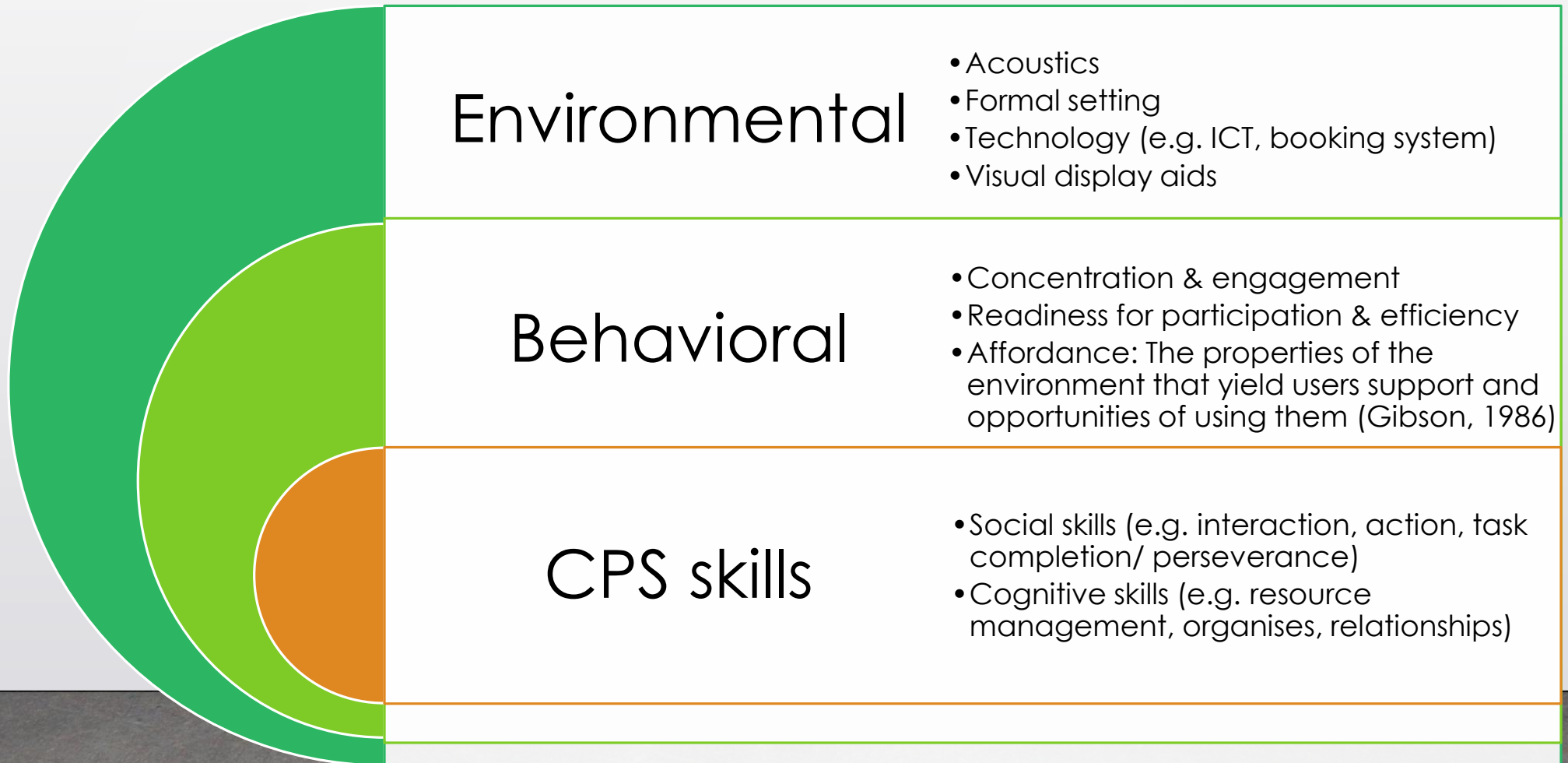
“Don’t know how to use it. That’s the reason...There is no need to use such a high level [equipment]...Google Doc can also fulfil similar purposes.” (G1)

“[I will usually] take a photo [of the contents on whiteboard] with mobile phone, WhatsApp and then go.” (G2)

“I never use electronic ones. I use just white... you just need some time and stuff. But when you want to write something quick...convenience, quick access I would say.” (G6)

# Major findings

Contributing factors of discussion rooms to collaborative problem solving



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## Conclusion

- Based on user perceptions, space that was controlled and organized in terms of its availability, physical environment and functionality would increase their affordances.
- Similar finding was reported by Quinnell (2015) about students' tendency to complete difficult assignments and subjects in spaces where affordances were obvious and users had control over the environment.
- Significance of a whiteboard in group work and CPS could be far beyond its financial value among other facilities.

**Technology can enhance learning as long as it is provided with affordance in mind.**





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