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Preparing students for the future collaborative economy:

a solution for assessing and motivating groupwork for an industrial design studio module

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Overview

- Background
- Context and challenges
- The research question
- Research design
- Research methods
- Results / Discussion
- Conclusions / Implications

Background

- Teamwork is essential to the future collaborative / social economy (McKinsey, 2012)
- Industrial design is becoming multi-disciplinary and inter-disciplinary (Aboelela et al., 2007)
- The need to incorporate teamwork as part of the programme intended learning outcomes (ILOs) for accreditation (e.g. CSD (UK), IED (UK))
- According to an outcome-based approach (OBA) to teaching and learning (Biggs & Tang, 2011) , programme/module ILOs related to teamwork should be assessable
- Groupwork assessment is an important topic in higher education research

Working definitions

- Teamwork (the ability to work in a team effectively)
- Groupwork (part of a module assessment)
- Peer reviews (peer- and self-assessment, based on individual responses to a self-reporting questionnaire submitted after a group project)
- Research-led teaching (an evidence-based approach to modify T&L in order to improve student performance)

Let’s recall our own groupwork experience in college

Context (students at XJTLU)

- Passed the highly competitive National Higher Education Entrance Examination (Gaokao)
- Possess certain knowledge / skills / dispositions before attending XJTLU

(Crick & Yu, 2008) (Dewey, 1933)

As Dewey (1933, 30) said:

> Knowledge of methods alone will not suffice: there must be the desire, the will, to employ them. This desire is an affair of personal disposition.

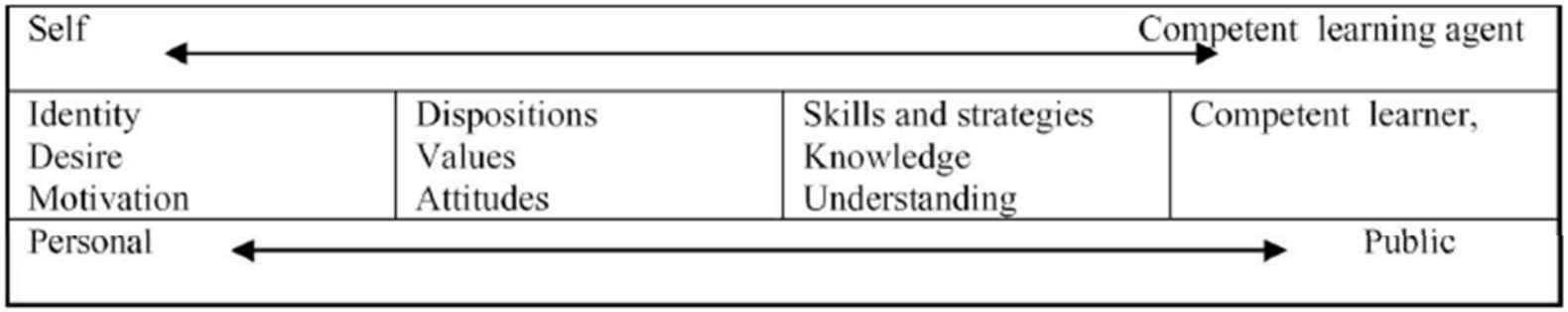


Figure 1. Dispositions as complex and embedded.

Challenges

- A Yr2 introductory design studio (IND101) with a 100% groupwork assessment component in its conception
- Past experience suggested that the gold standard of peer assessment did not seem to work in the mainland Chinese context
- Typical complaints & issues: members not participating in project activities, assigned work not being completed on time, request to be switched to another group, members' refusal to communicate with one another, requests to carry out the group project individually, compartmentalize groupwork components, etc.
- How can groupwork be assessed reliably in this context?

With an all-seeing eye ?

Literature review

Aiming to improve the module by reviewing the literature

- Self- / Peer- / Tutor-based assessment (Boud, 1995; Brew, 1999; Dochy, Segers, & Sluijsmans, 1999)
- Formative and summative feedback (Bennett, 2011; Carless, 2013; Nicol & Macfarlane-Dick, 2006; Rust, Price, Handley, O'Donovan, & Millar, 2013)
- Visible learning (Hattie, 2008, 2011)
- Active training (Silberman & Biech, 2015)

Disadvantages of these potential solutions:

- Resources (time, manpower, expertise) intensive / additional training required / drastic change of an existing teaching style
- The potential benefits and investments (risks) are not justified.

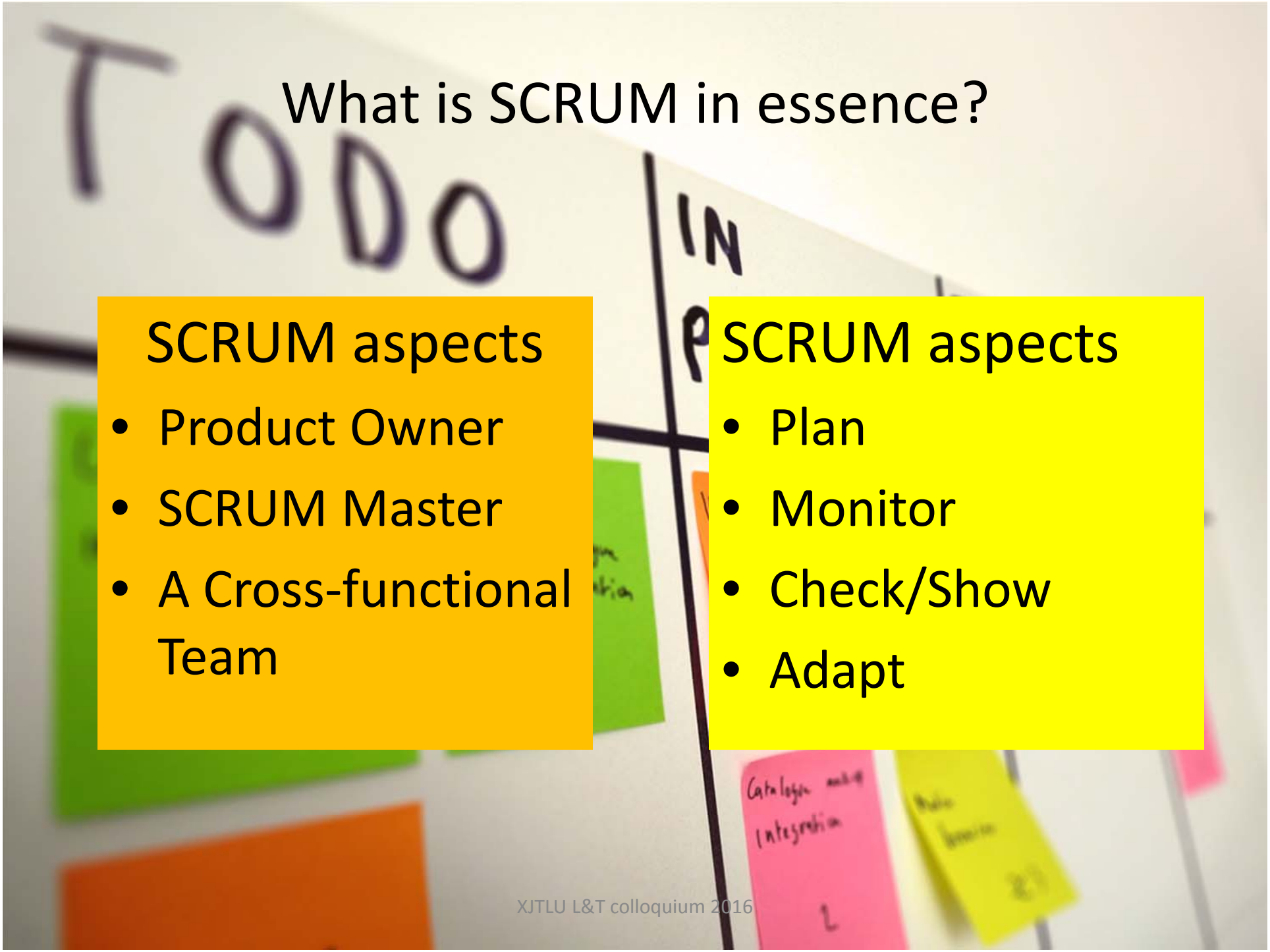
Top 10 education interventions ranked according to the effect size (Hattie, 2008)

Rank	Domain	Influence	*d*
1	Student	Self-report grades	1.44
2	Student	Piagetian programs	1.28
3	Teaching	Providing formative evaluation	0.90
4	Teacher	Micro teaching	0.88
5	School	Acceleration	0.88
6	School	Classroom behavioral	0.80
7	Teaching	Comprehensive interventions for learning disabled students	0.77
8	Teacher	Teacher clarity	0.75
9	Teaching	Reciprocal teaching	0.74
10	Teaching	Feedback	0.73

Raising a new research question

- Unfortunately, the original research question cannot be tackled with the given constraints (e.g. time / manpower / expertise).
- A non-trivial twist -- reframing the assessment question into a question related to student productivity (effectiveness and efficiency)
- Specifically, how can student productivity be improved significantly in a teamwork environment?
- The issue has been reframed relating to team management and project management
- SCRUM (agile development) used in large-scale software development projects promises to deliver a 400% improvement; "Getting twice as much done in half the time (Sutherland, 2014)"

What is SCRUM in essence?

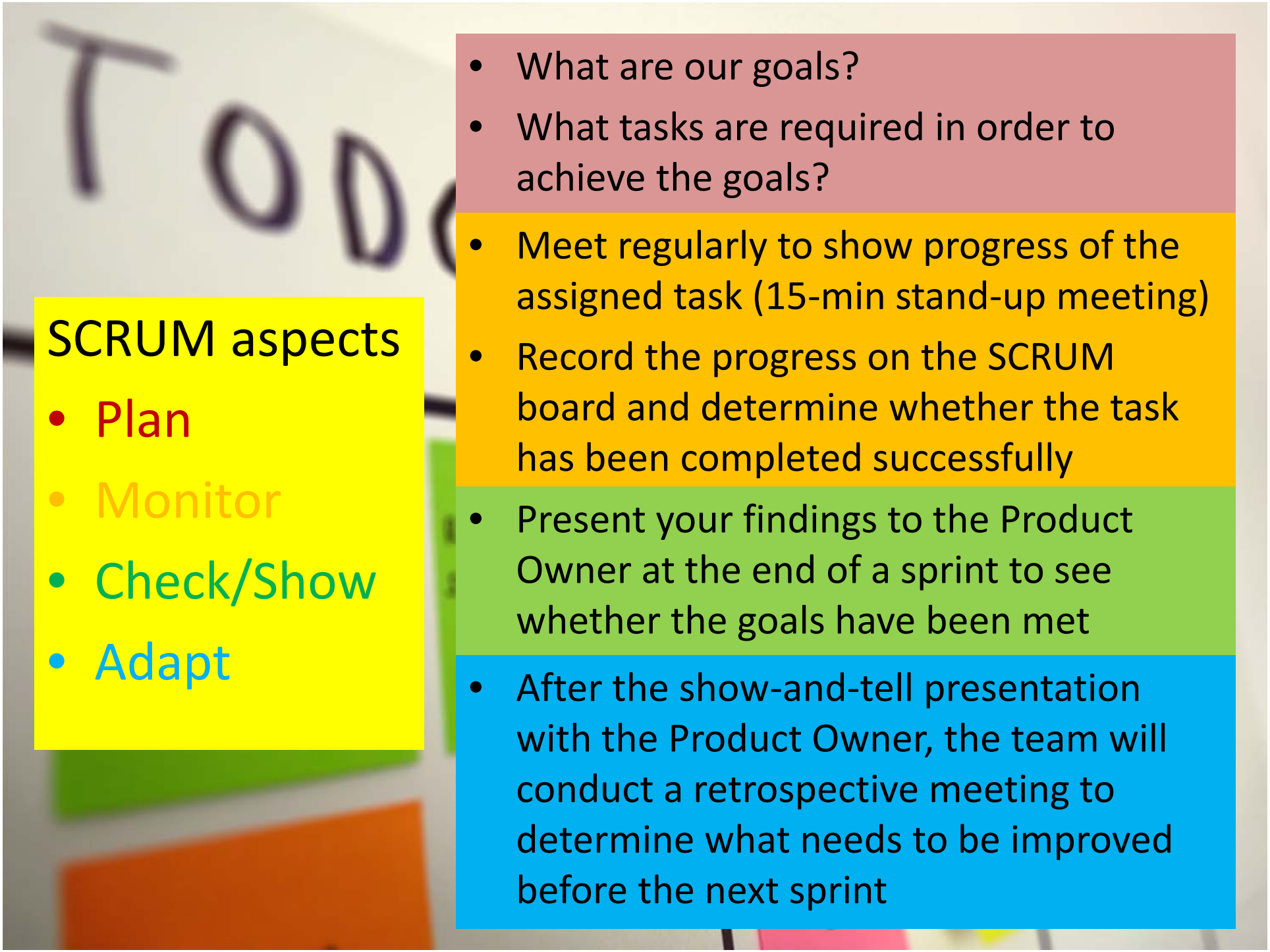


SCRUM aspects

- Product Owner
- SCRUM Master
- A Cross-functional Team

SCRUM aspects

- Plan
- Monitor
- Check/Show
- Adapt



SCRUM aspects

- Plan
- Monitor
- Check/Show
- Adapt

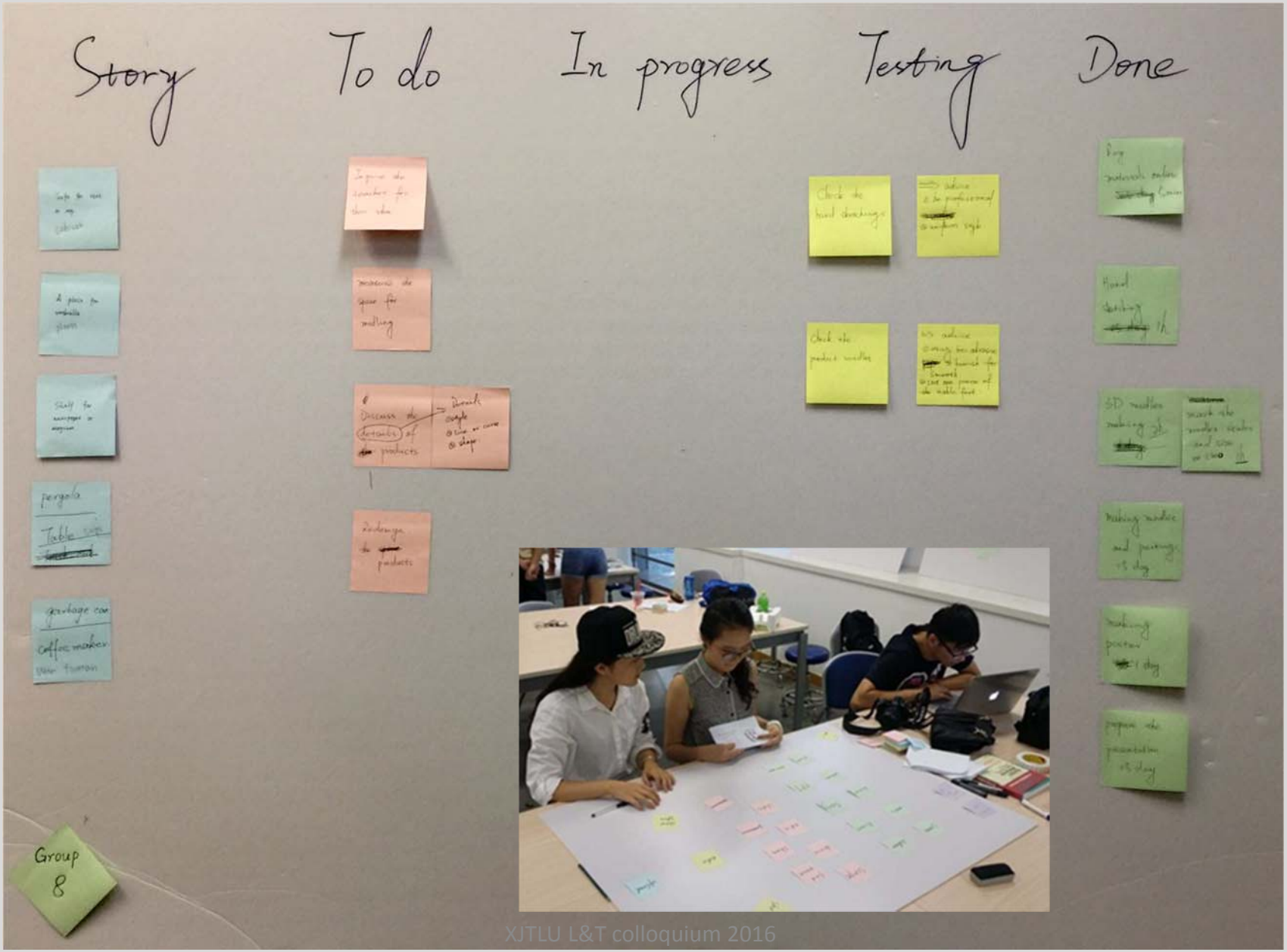
- What are our goals?
- What tasks are required in order to achieve the goals?

- Meet regularly to show progress of the assigned task (15-min stand-up meeting)
- Record the progress on the SCRUM board and determine whether the task has been completed successfully

- Present your findings to the Product Owner at the end of a sprint to see whether the goals have been met

- After the show-and-tell presentation with the Product Owner, the team will conduct a retrospective meeting to determine what needs to be improved before the next sprint

A SCRUM board



Research design

- 4 design tutors, 60 Yr2 design students (4 stud/grp, 15 grps)

Module outline	Old module	New module (SCRUM)
Schedule	13 weeks	13 weeks
No. of project	1 project	4 projects (sprints) + Intro to SCRUM
Coursework assessment	3 assignments (individual+group)	1 assignment (group)
	Interim presentation (individual) Final presentation (individual) Final report (group)	4 presentations (group+individual) Final report (group) 5 bi-weekly online quizzes (40 questions) (individual)
CAD models and prototypes	CAD models and prototypes (group)	CAD models and prototypes (individual+group)
Mode of delivery	Weekly lectures and tutorials	All tutorials (with online lectures/slides)

Research methods

Qualitative

- Time-based tutor diary, each entry is entered shortly after a tutorial has been conducted.

Quantitative

- Module feedback questionnaires (MFQ)
- Student final grade
- Student attendance

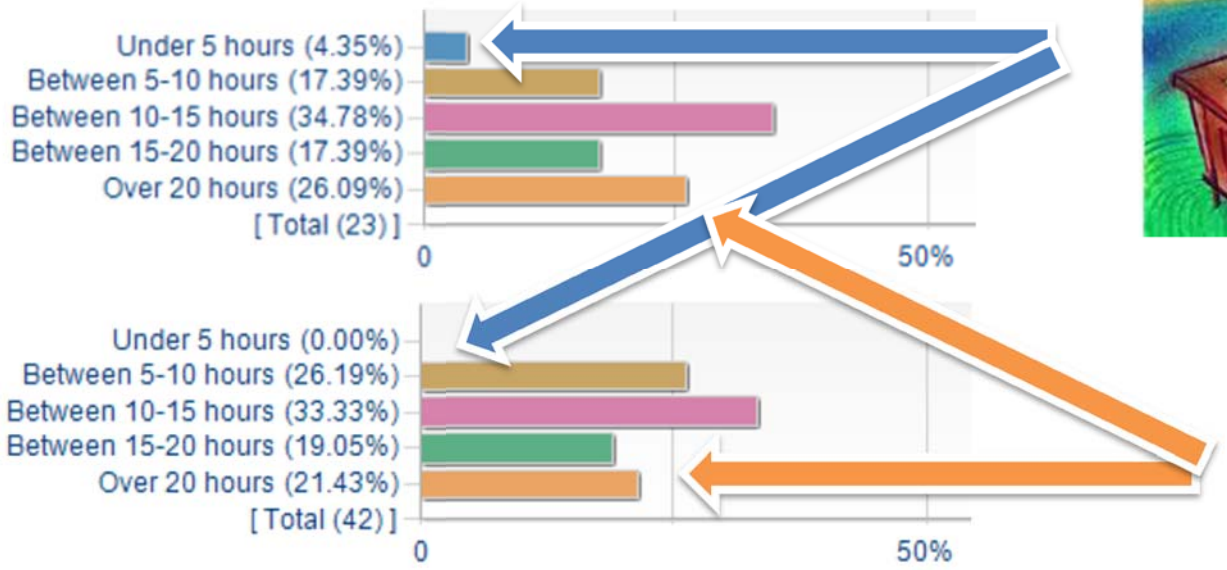
Mixed methods

- Responses from the retrospective questionnaires after each sprint (project)
- Student deliverables

Results (MFQ)

MFQ	Old module design	New module design (SCRUM)
Total # of students registered	41	60
# of students responded	23	42
Response percentage	56.1%	70%
Response for the tutor	14	18

OUTSIDE of Class, I spent the following amount of hours per week (on average) on the module:

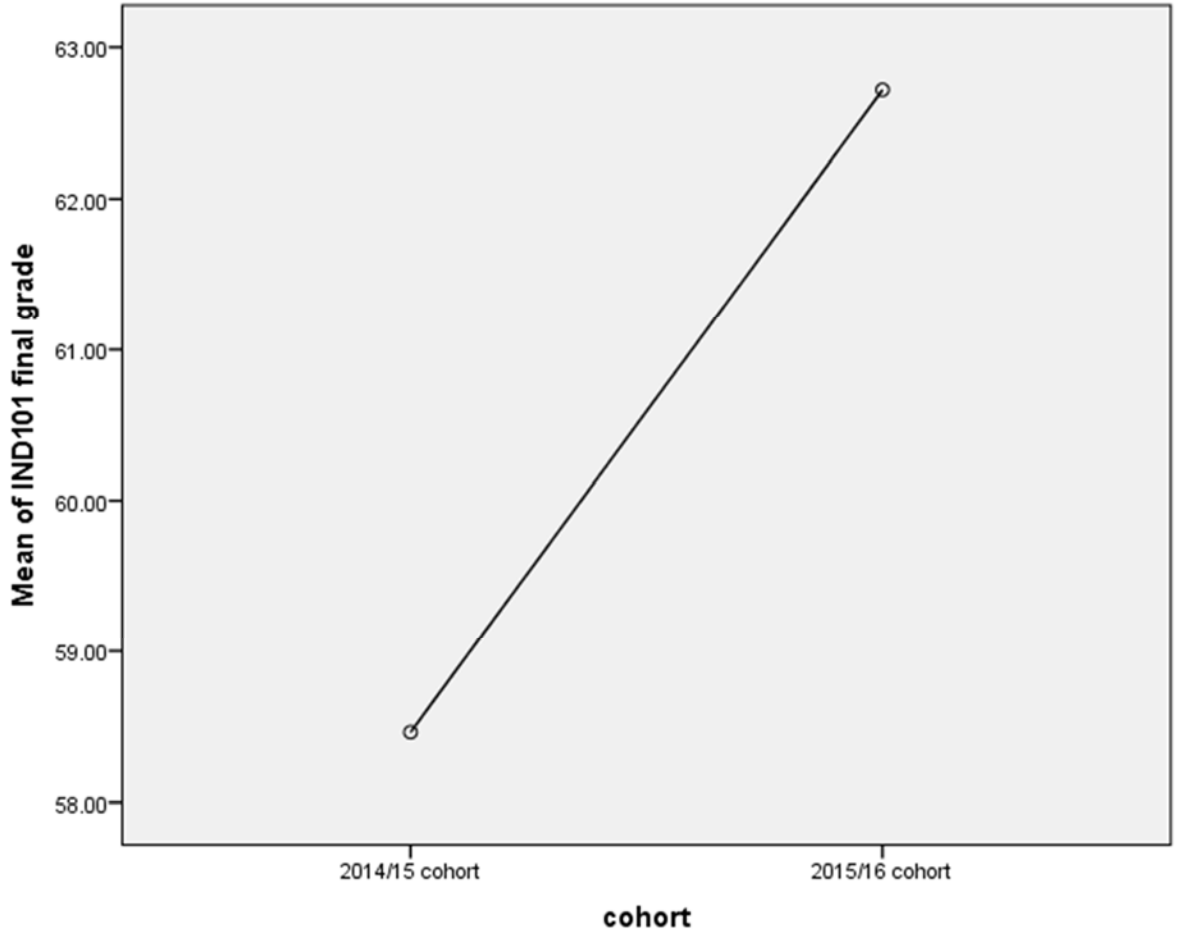


Results (ANOVA of student final grades)

Group Statistics

	cohort	N	Mean	Std. Deviation	Std. Error Mean
IND101 final grade	2014/15 cohort	40	58.4618	7.38163	1.16714
	2015/16 cohort	58	62.7186	4.73381	.62158

Means Plots



Results (Retrospective questionnaires)

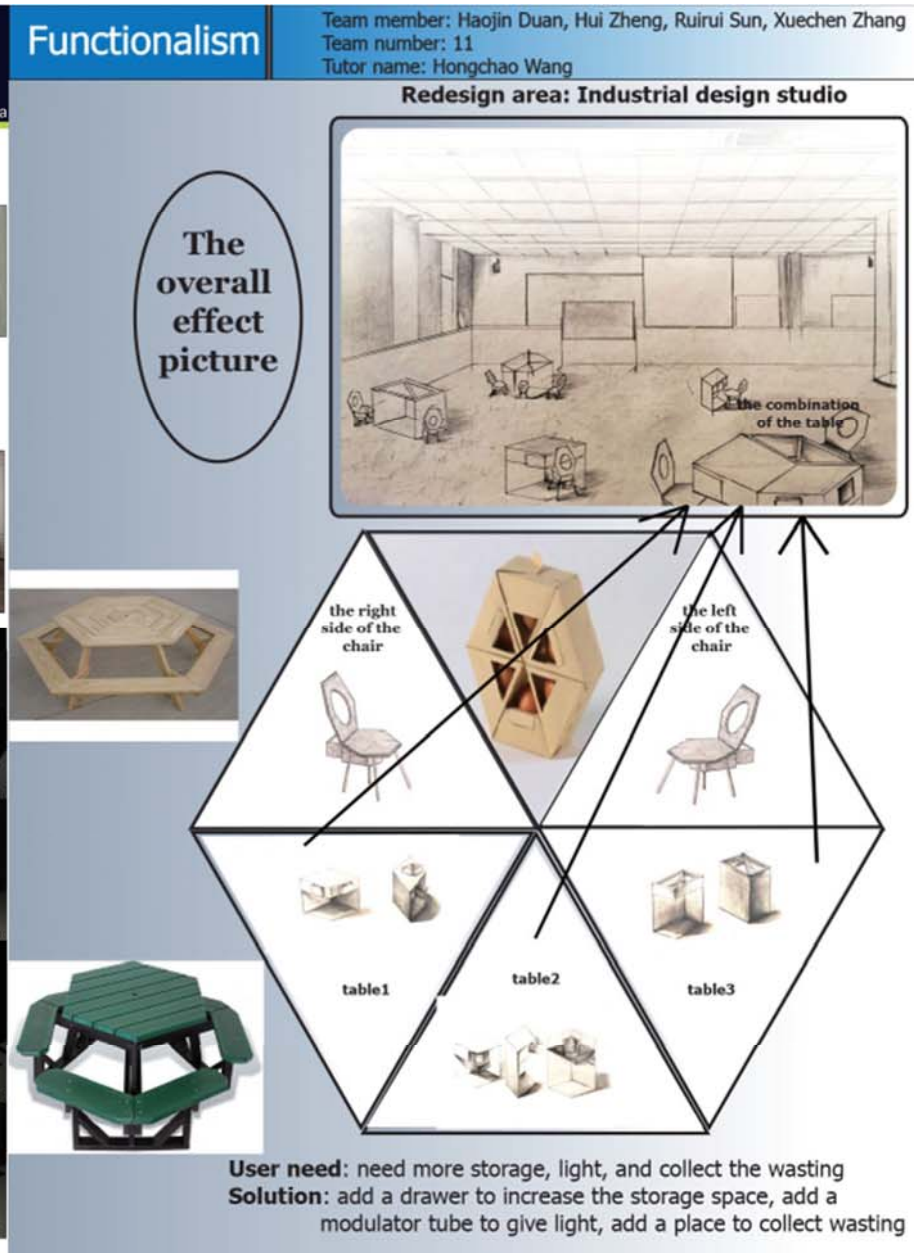
1) On a scale from 1 (lowest) to 5 (highest), how do you feel about your role in the team?
2) On the same scale, how do you feel about the team as a whole?
3) Why do you feel that way?
4) What one thing would make you happier in the next group project?

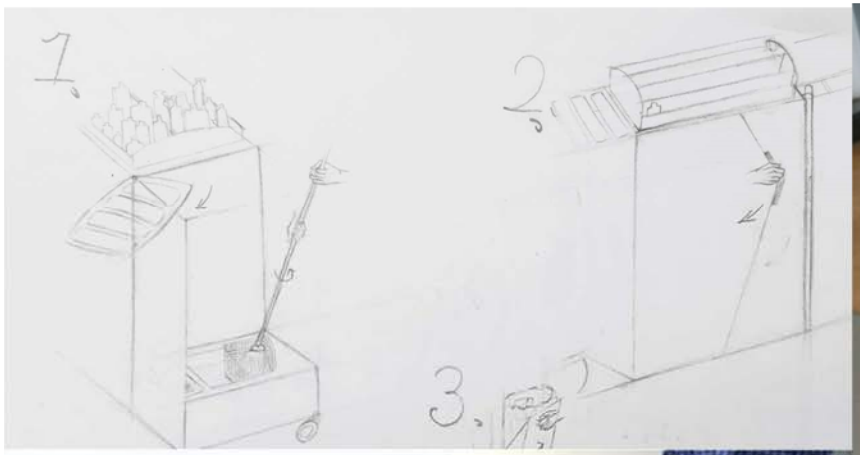
	(# of responses)	Q1 (Mean)	Q1 SD	Q2 (Mean)	Q2 SD
1st sprint retrospective	46	3.80	0.77	4.22	0.78
2nd sprint retrospective	48	4.02	0.53	4.25	0.64
3rd sprint retrospective	22	4	0.69	4	0.87
4th sprint retrospective	27	4.37	0.63	4.59	0.50

Student deliverables

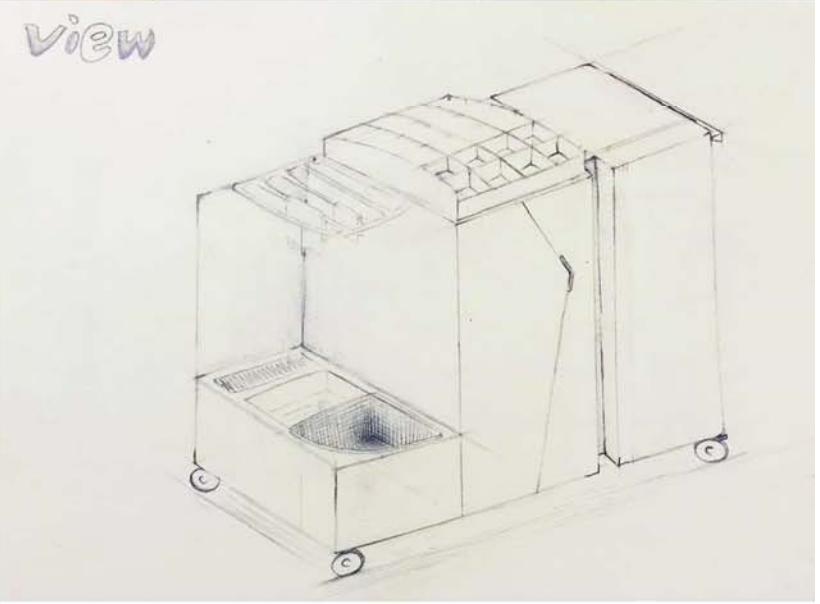
	Sprint #1	Sprint #2	Sprint #3	Sprint #4
Project theme	What industrial design is about? How to promote industrial design to Yr1 students?	Building a furniture series to address specific user needs	Conducting user research to identify a specific problem in a given context	Building full-size prototypes and conducting user evaluations
Duration / week	2	3	3	4
Deliverables	Any forms of effective communications or PPT presentation	Poster presentation and scaled models	PPT presentation	PPT presentation, full-size prototypes, user evaluation video

Student works

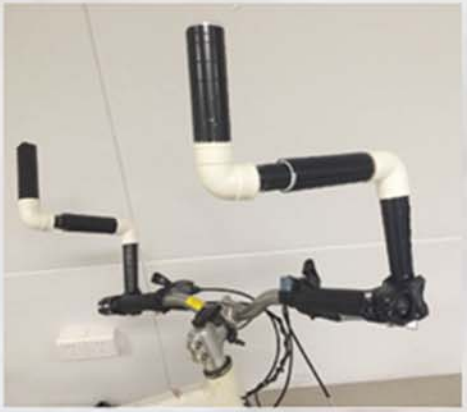


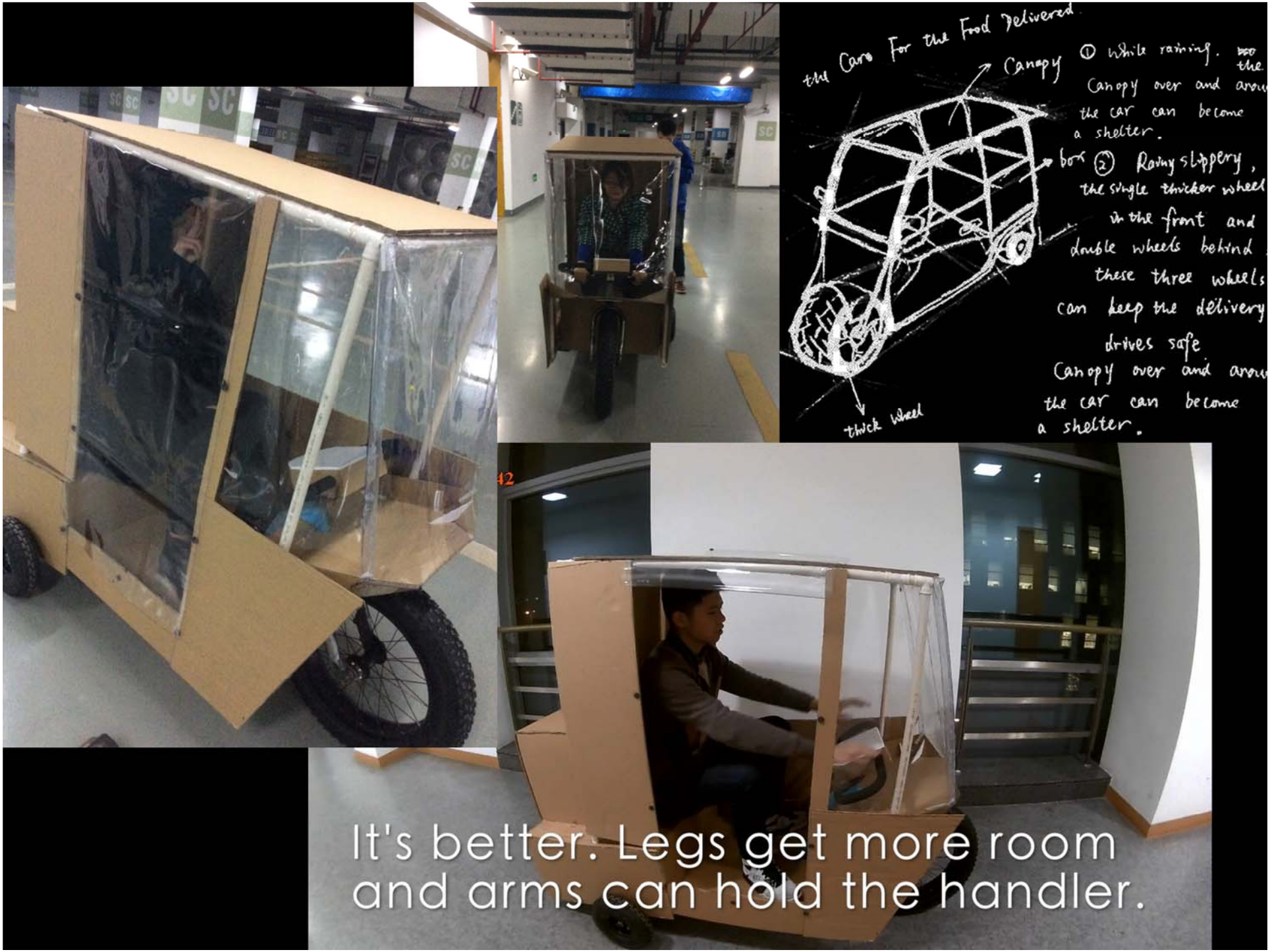


1.First design



2.Optimized design




the Cars For the Food Delivered
Canopy
① While raining, the Canopy over and arou the car can become a shelter.
② Rainy slippery, the single thicker wheel in the front and double wheels behind these three wheels can keep the delivery drives safe
Canopy over and arou the car can become a shelter.
thick wheel
It's better. Legs get more room and arms can hold the handler.

Results (Summary)

Qualitative

- Time-based tutor diary, each entry is entered shortly after a tutorial has been conducted. (easily for students to fall back to the same old habits of being idle and disengaged - don't know what to do!)

Quantitative

- Module feedback questionnaires (MFQ) (time spent outside class remains the same, responses to the tutor show +ve differences)
- Student final grade comparison (ANOVA shows a significant effect with a medium effect size, $\eta^2 = .112$)
- Student attendance (No student misses more than 1 tutorial in each sprint for my groups)

Mixed methods

- Responses from the retrospective questionnaires after each sprint (become more concrete and show students' willingness to improve)
- Student deliverables (quantity of output shows 2x-3x improvement)

Conclusions

- Average students' productivity has increased by 200%-300% compared with the last year cohort.
- Student work's quality increased moderately.
- No more non-attendance issue.
- Strong individual motivation and team engagement were noticed
- Most issues (e.g. student work quality and quantity) were addressed by the end of the first sprint (early Week 3)

Discussion

- How can student productivity be improved significantly in a teamwork environment?
- Did SCRUM work? / Why did SCRUM work?
- A transparent system involving tutors and students to monitor a team progress with clear objectives
- Under SCRUM, individual responsibilities become transparent and there is no place to hide
- Students present at every tutorial and receive timely feedback
- Students have opportunities to reflect on concrete incidents
- Students can follow a step-by-step approach to modify their behaviours and improve their performances incrementally

Implications

- Based on the results, we demonstrated that the teaching and learning quality related to teamwork can be improved on a large scale with minimal resources using an appropriate framework.
- SCRUM is more than just techniques and is a system of leading team communications and interactions.
- The environmental / contextual factors seem to triumph personal traits / dispositions
- What about assessing groupwork reliably?
- Applying a boundary rule (Yes/No) for assessing individual contributions instead of gradation
- Getting/setting the right priority and balance between student learning and assessments


Thank you
Q&A
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