World Engineers Summit 2021

SafeSim Design:

Answering the need for greater Design for Safety (DfS) competency in Singapore

Principal Investigator **A/Prof Yang Miang Goh**
Research Fellow **Dr. Juliana Tay**
Presented by **Miss Sufiana Safiena**

PROBLEMS WITH

Construction Industry

- Remained the **top contributor** to workplace fatalities in Singapore (MOM, 2021)
- **Cause of accidents:**
  - Unsafe acts and/or condition
  - Lack of design planning for safety*
- Can be eliminated or controlled effectively with **early intervention** (Goh & Chua, 2016)

- A lot of focus on contractors' duty
- Little focus on designers (i.e., architects, engineers)
  - Lack understanding of the implications of their unsafe design
- **Anticipate** and **"design out"** these potential hazards

Design for Safety (DfS)

Design for Safety (DfS) is the **process** where **stakeholders of a construction project**[1] come together at the **earliest opportunity** during **different stages of a project**[2] to **identify and eliminate or reduce foreseeable design risks** throughout the **life cycle**[3] of a structure through good design.

I. **Reducing risk at source**
II. **Collaborative and systematic risk assessment**
III. **Conducted throughout the project lifecycle**

[1] *E.g., developer, designers, contractors*
[2] *From planning and design phases onwards*
[3] *E.g. construction, use/operation, demolition*

Using digital game-based learning (DGBL) to teach designers about DfS:

how to identify the design risk, how to mitigate them through design controls/changes

Advantages of DGBL

- Positively impact learners' interest and understanding of the topic
- Provision to make mistakes in the virtual world
- Helping learners understand the process and how their actions affect the outcome

SafeSim Design

A digital game-based learning software for designers to learn about design risk and how to mitigate them

Dept. of the Built Environment, NUS IT

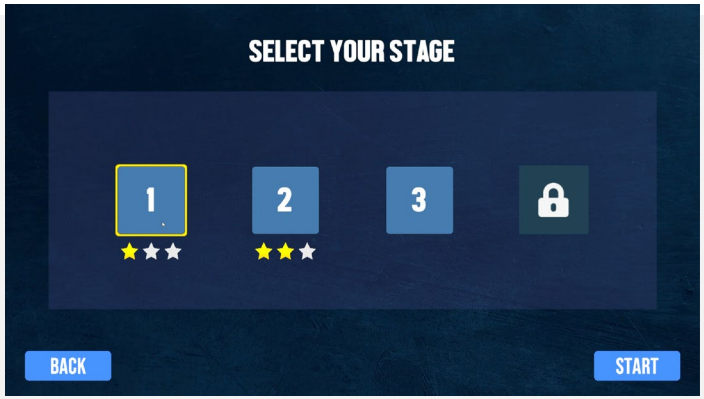
This study is funded by SkillsFuture Singapore under Workforce Development Applied Research Fund (WDARF) Grant.

The contributions of IES DfS Workgroup and other anonymous practitioners are greatly appreciated.

1. Utilise their roles as designers to apply the hierarchy of control in DfS process
2. Identify common design risks that can affect the safety and health of workers
3. Evaluate design risks based on severity and likelihood, risk levels and detailed safety review
4. Identify industry standards, guidelines, and norms when mitigating design risks
5. Critique different design alternatives to eliminate or reduce design risks
6. Formulate alternative design changes to manage design risks

Introduction to SafeSim Design

- Developed based on the authors' previous work, SafeSim Risk (SSR) **but** SSD extends beyond SSR
  - implications of unsafe design throughout the project lifecycle
  - educate designers on the difference between design risks and occupational hazards
  - how to conduct risk evaluation, and
  - how to design out issues through various design-related controls
- Content are based on the **IES-NUS DfS Library**



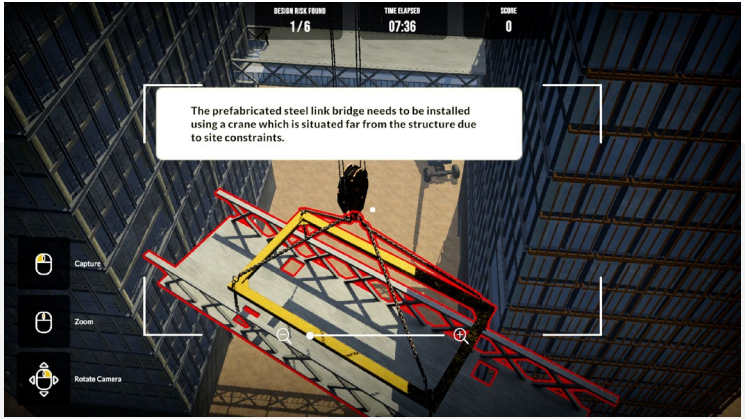
- **Four** stages of varying difficulty
  1. ***different design limitations***
  2. ***address different learning outcomes***
- **Two** phases at each stage
  - *Exploration Phase*
  - *Corrective Phase*

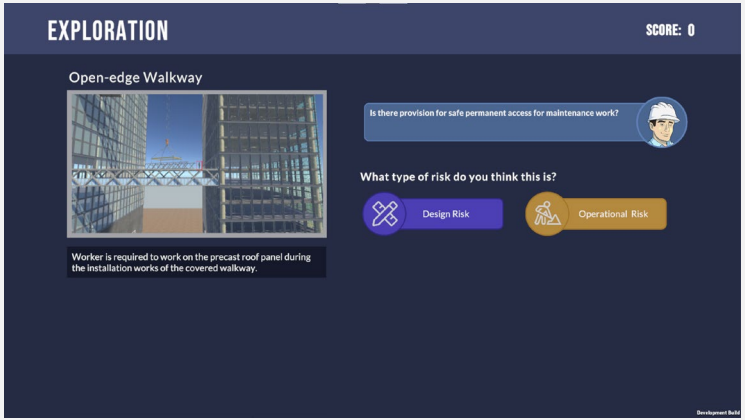
01. Guidance Tool

- Introduced to Mr Chief Designer (Mr CD)
- Non-playable character to guide players throughout the game
- Provide context
- Help with the introduction of the game controls and user interface

02. Exploration Phase

- **Capturing design risks**
  - Using the camera tool
  - Classify identified hazard as design risk or operational risk

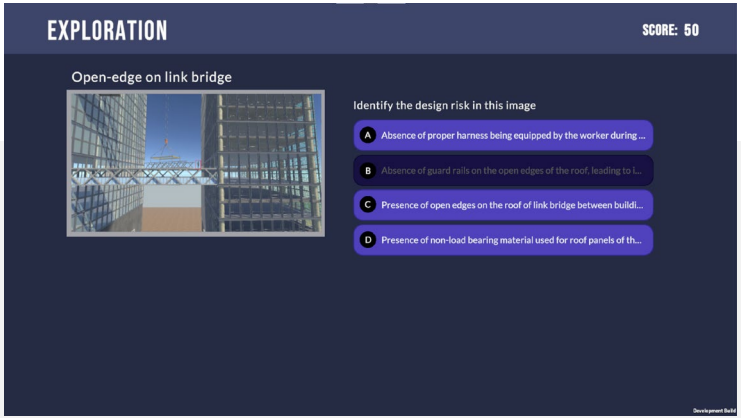


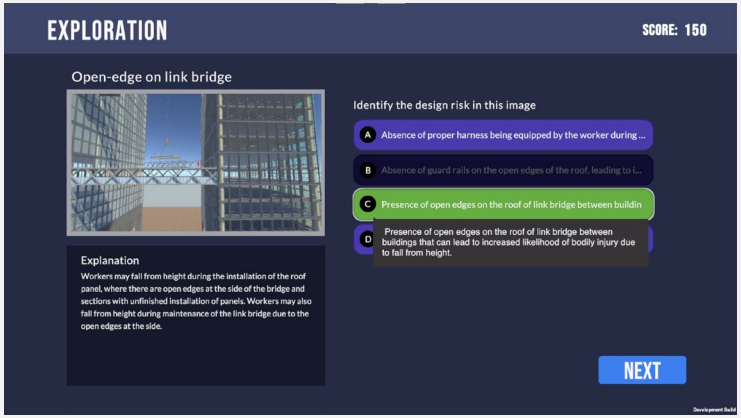


- **Utilise their roles as designers to apply the hierarchy of control in DfS process**
- **Identify common design risks that can affect the safety and health of workers**

02. Exploration Phase

- **Answering MCQ**
  - Immediate feedback through scoring system
- **Explanations and Rationale**
  - To reinforce the concept of DfS

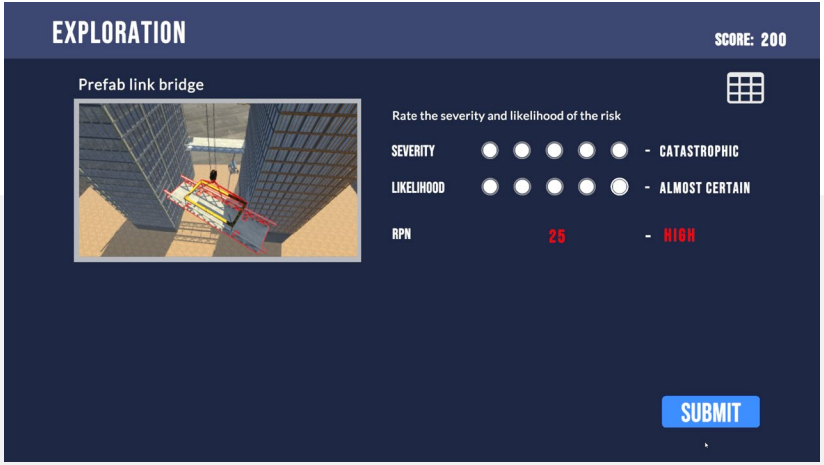


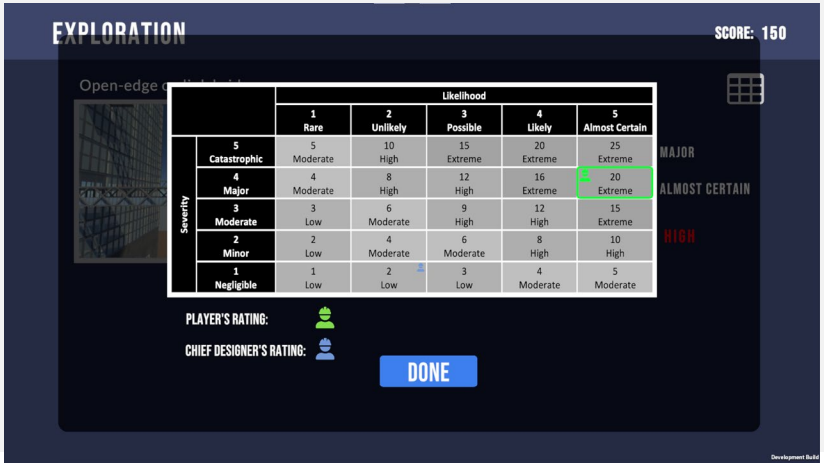


- **Identify common design risks that can affect the safety and health of workers**

02. Exploration Phase

- **Rate** identified risk based on **severity and likelihood**
  - Based on RM Code of Practice

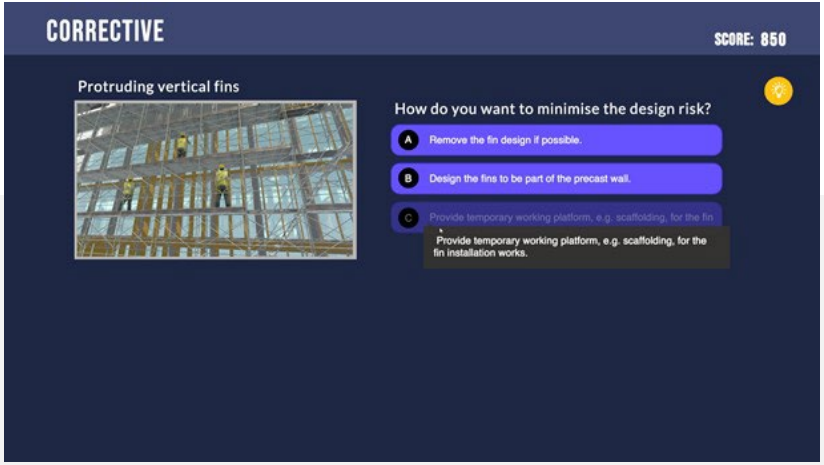


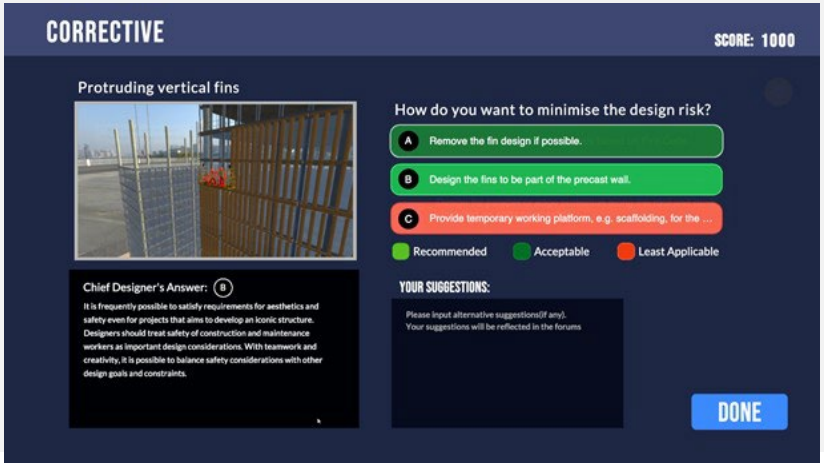


- **Evaluate design risks based on severity and likelihood, risk levels and detailed safety review**

03. Corrective Phase

- Choose **most suitable** measure
  - No right or wrong answer
- Option to provide **alternative solutions**
- Answers will be posted to the forum for further discussions

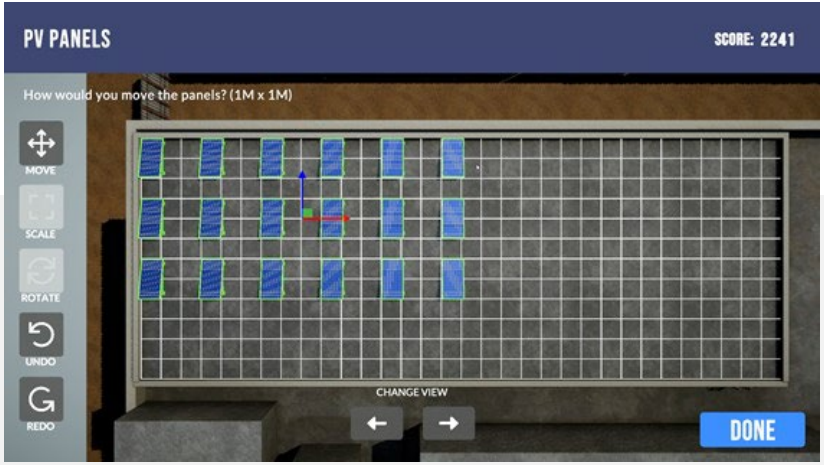


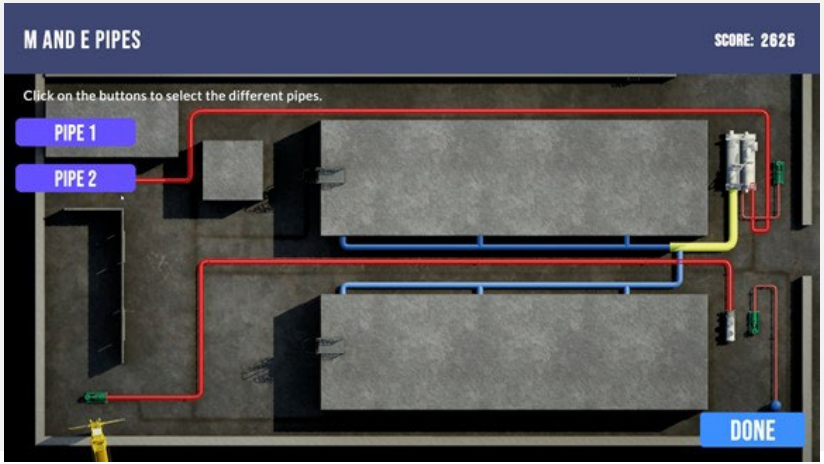


- **Utilise their roles as designers to apply the hierarchy of control in DfS process**
- **Identify industry standards, guidelines, and norms when mitigating design risks**
- **Formulate alternative design changes to manage design risks**

03. Corrective Phase

- **Bonus rounds (> Stage 2)**
  - Earn more points
  - Moving the elements, Manipulation, etc.
- **PV panels**
  - Move the PV panels within the specific grid based on the fire code
- **M&E Pipes**
  - Choosing the best layout to prevent tripping hazard during maintenance





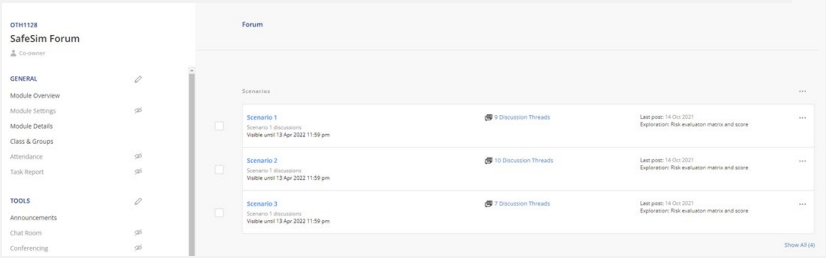
- **Identify industry standards, guidelines, and norms when mitigating design risks**
- **Formulate alternative design changes to manage design risks**

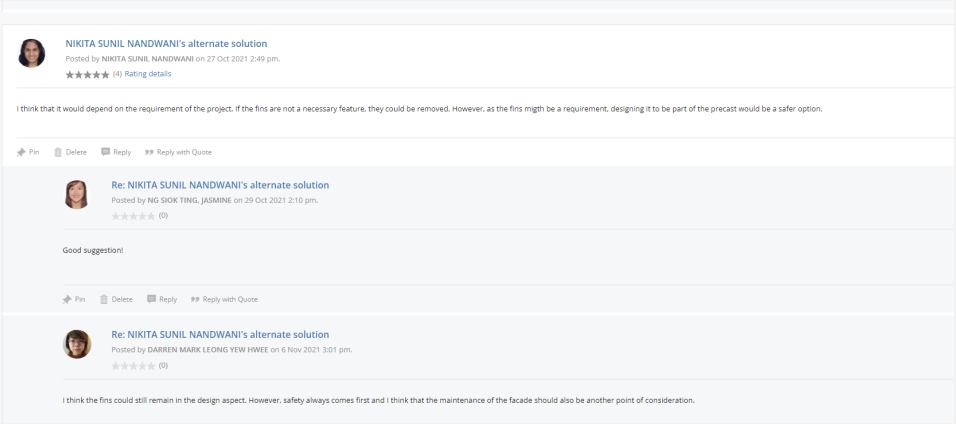
04. Summary Page

- **Breakdown of scores**
- **Leaderboard**
  - Check ranking against peers
  - Motivate players to do better
- **Ability to redo**
  - Allowing players to do self-directed learning
- **Post questions/answer in the forum**
  - Able to critique alternative solutions

05. Forum Page (External)

- Allow players to view other players' alternative solutions
- Able to reply and rate post





- **Critique different design alternatives to eliminate or reduce design risks**
- **Formulate alternative design changes to manage design risks**

Thank You

Any questions?

A/P Goh Yang Miang
bdgbox27@nus.edu.sg
Safety and Resilience Research Unit,
Department of Building, NUS

This study is funded by SkillsFuture Singapore under Workforce Development Applied Research Fund (WDARF) Grant.

Invitation to join in this study

NUS Safety and Resilience Research Unit (SaRRU) invites you to join us in testing SafeSim Design. We need your help to evaluate the gameplay and the authenticity of the game. Your participation will help us understand the effectiveness of the game and identify areas for improvement.

If you are interested, please contact us at

bdgbox27@nus.edu.sg

(Attn: Ms Sufiana Safiena)