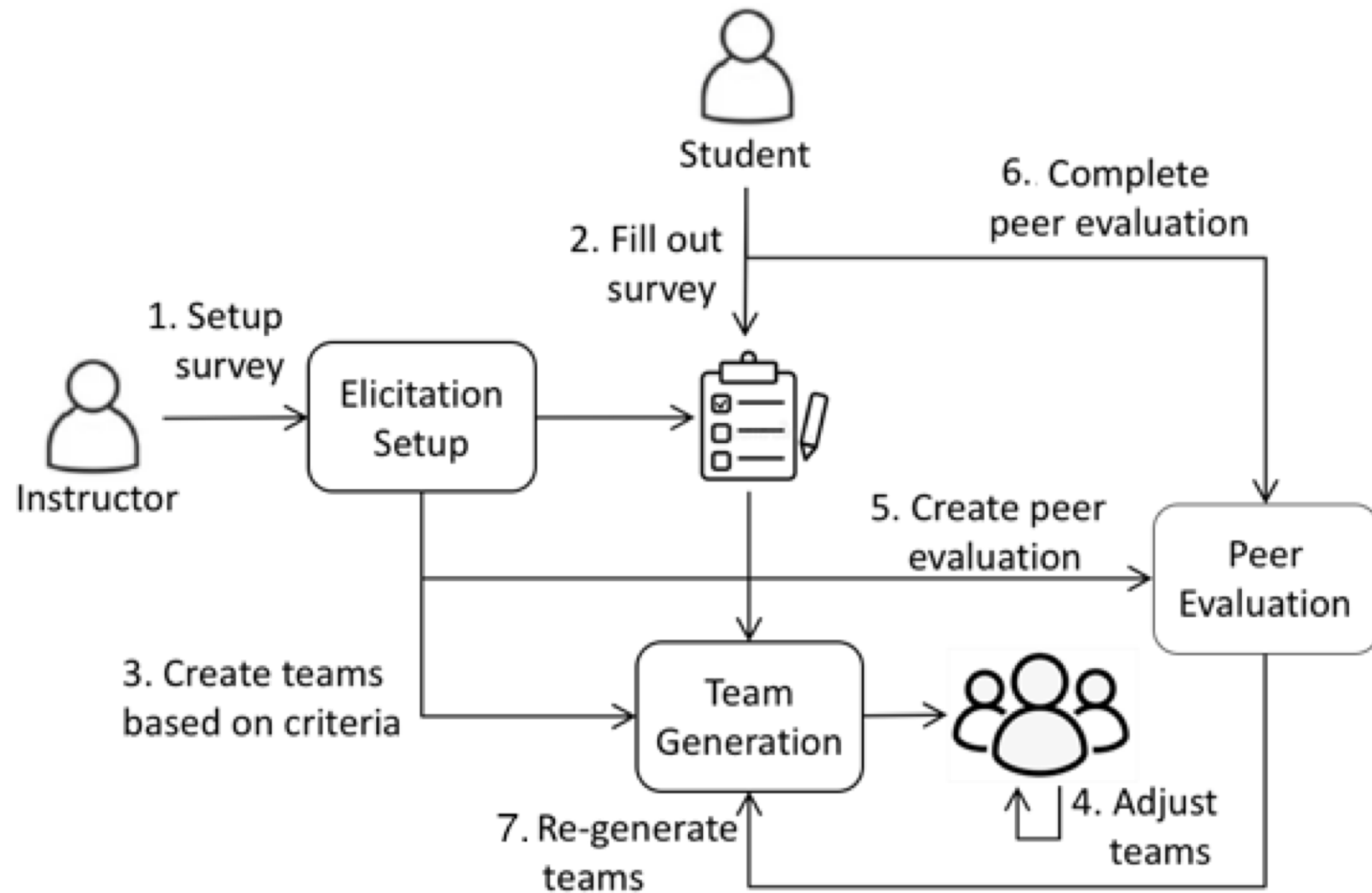


Design Guidelines for a Team Formation and Analytics Software

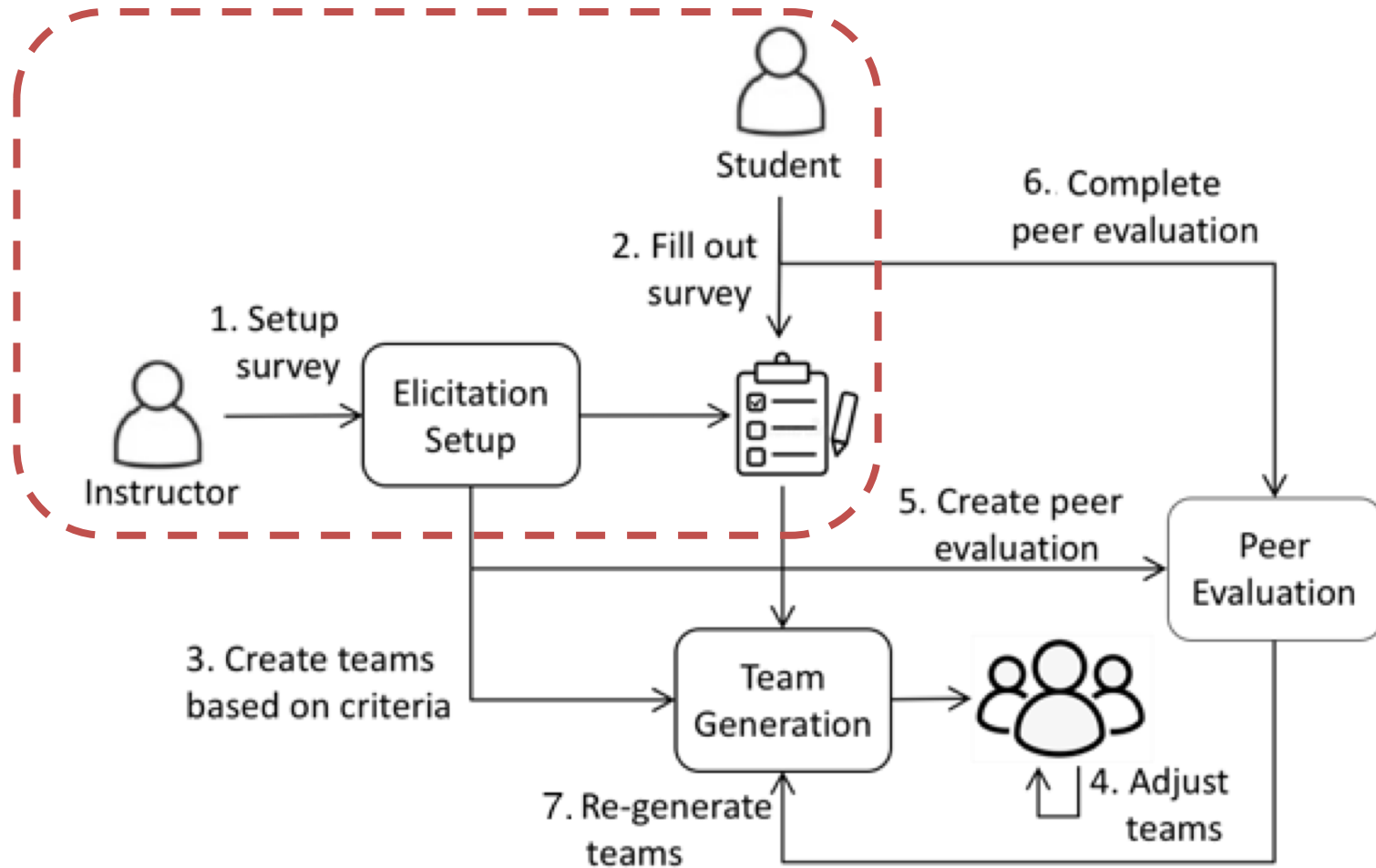
Bowen Hui, Opey Adeyemi, Mathew De Vin, Brianna Marshinew, Keyvan Khademi, Jeff Bulmer, Callum Takasaka



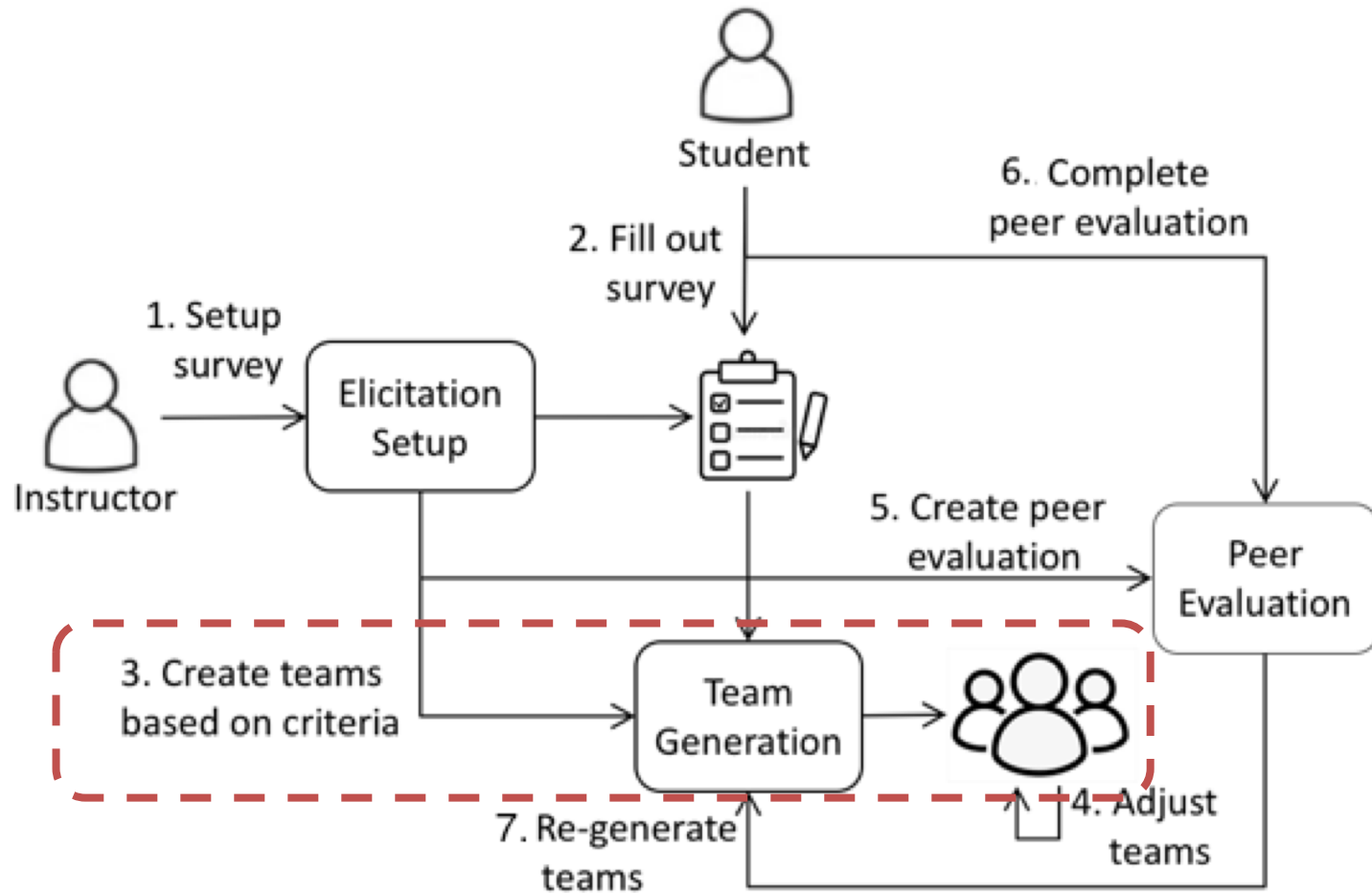
General Team Formation Process



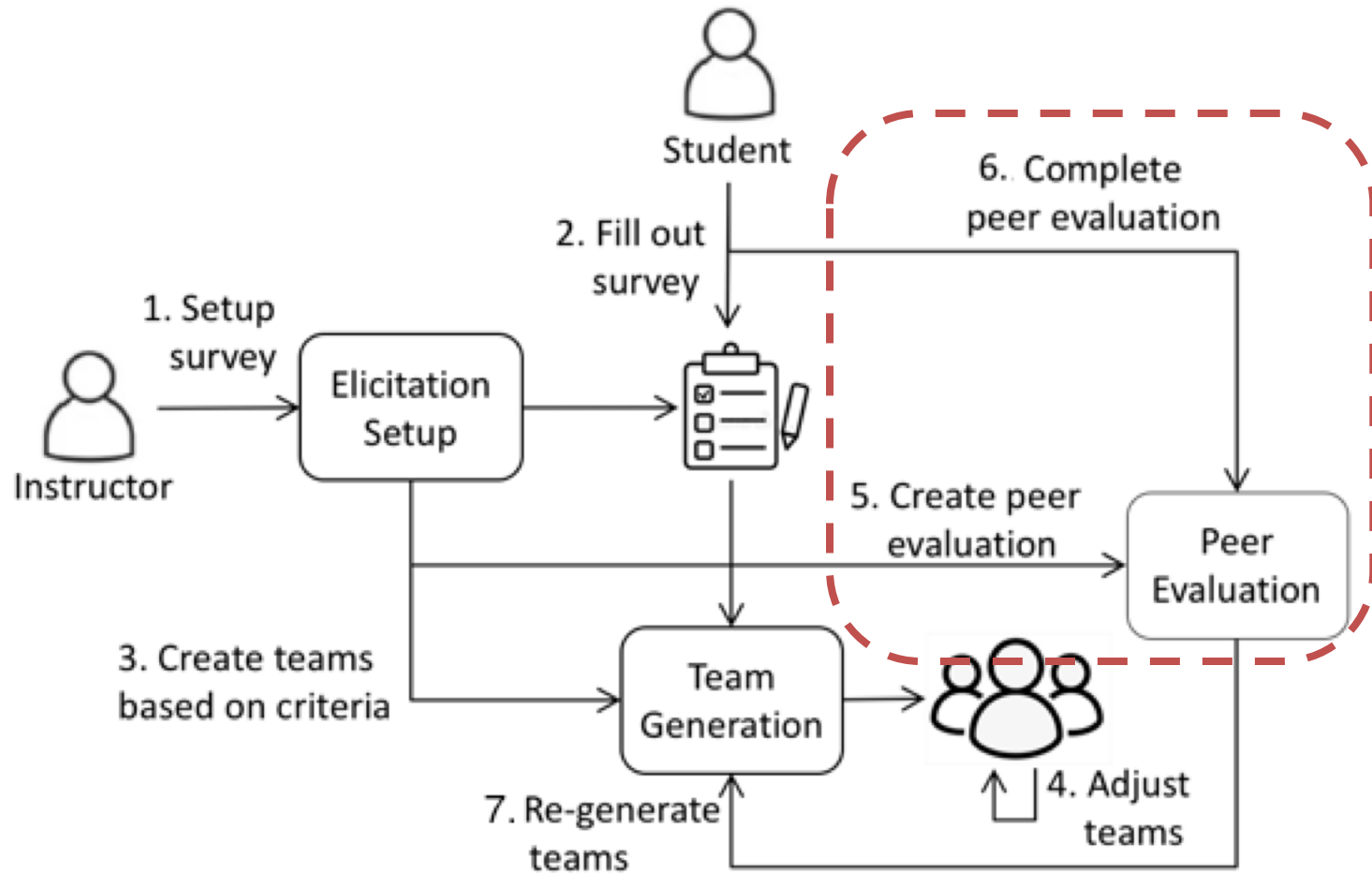
General Team Formation Process



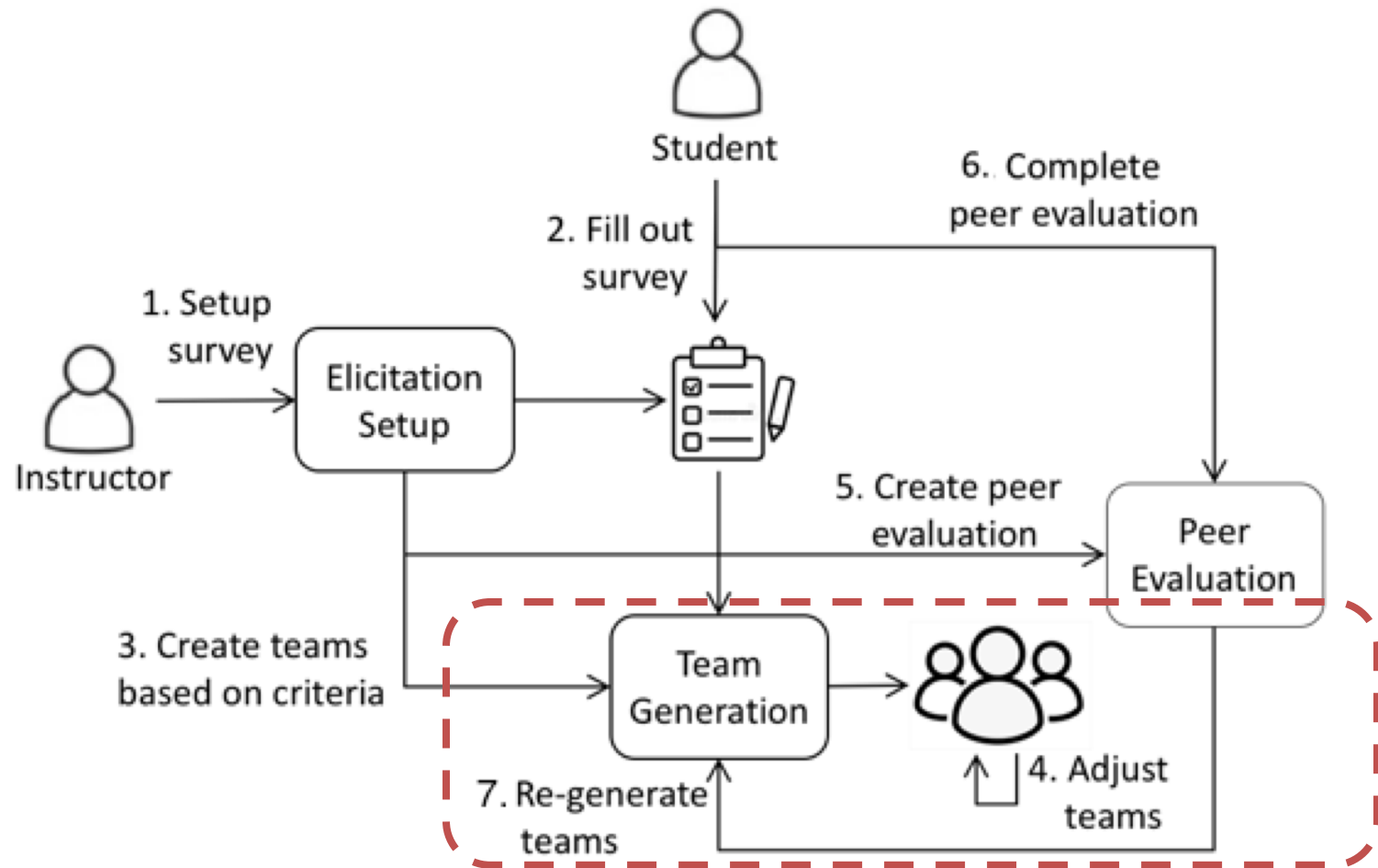
General Team Formation Process



General Team Formation Process




General Team Formation Process

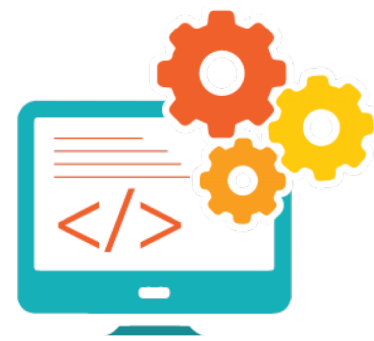



Existing Systems



- GRumbler [Sparrow 2011]
- Team-Match (team-match.com 2012)
- CATME [Layton et al. 2010; Ohland et al. 2012]
- Teamable Analytics  [Hui et al. 2022]


Existing Systems



- GRumbler (Group Rumbler)
 - Spreadsheet with student data
 - Designed to diversify characteristics, except gender
 - Allows for enemies exclusion but not friends inclusion
 - Supports weighting of characteristics
 - Can generate multiple teamsets, but no peer evals
- Team-Match
- CATME
- Teamable Analytics 


Existing Systems



- GRumbler
- Team-Match
 - Web app based on personality and cognitive styles
 - Students get personality report via psychometric test
 - Designed to diversify cognitive styles
 - Includes team progress reports
 - No peer evaluation
- CATME
- Teamable Analytics 


Existing Systems



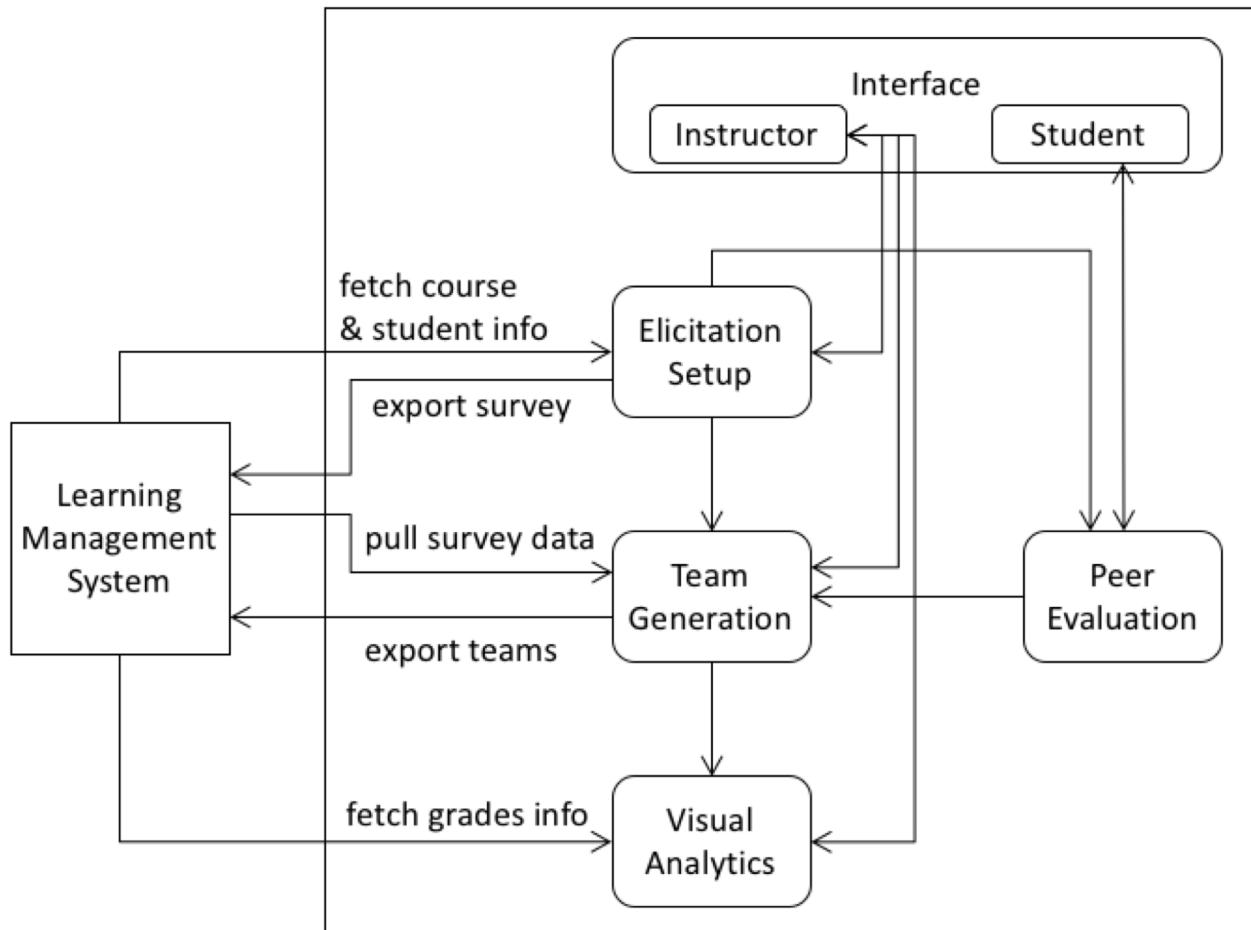
- GRumbler
- Team-Match
- CATME
 - Web app built in 2002
 - Elicitation process within web app, has default questions
 - Has self/peer evals but cannot be used to generate teams
 - Instructor specify team formation criteria, but teams cannot be modified after generation
 - Visual analytics to explain overall compliance of criteria
- Teamable Analytics 

Existing Systems

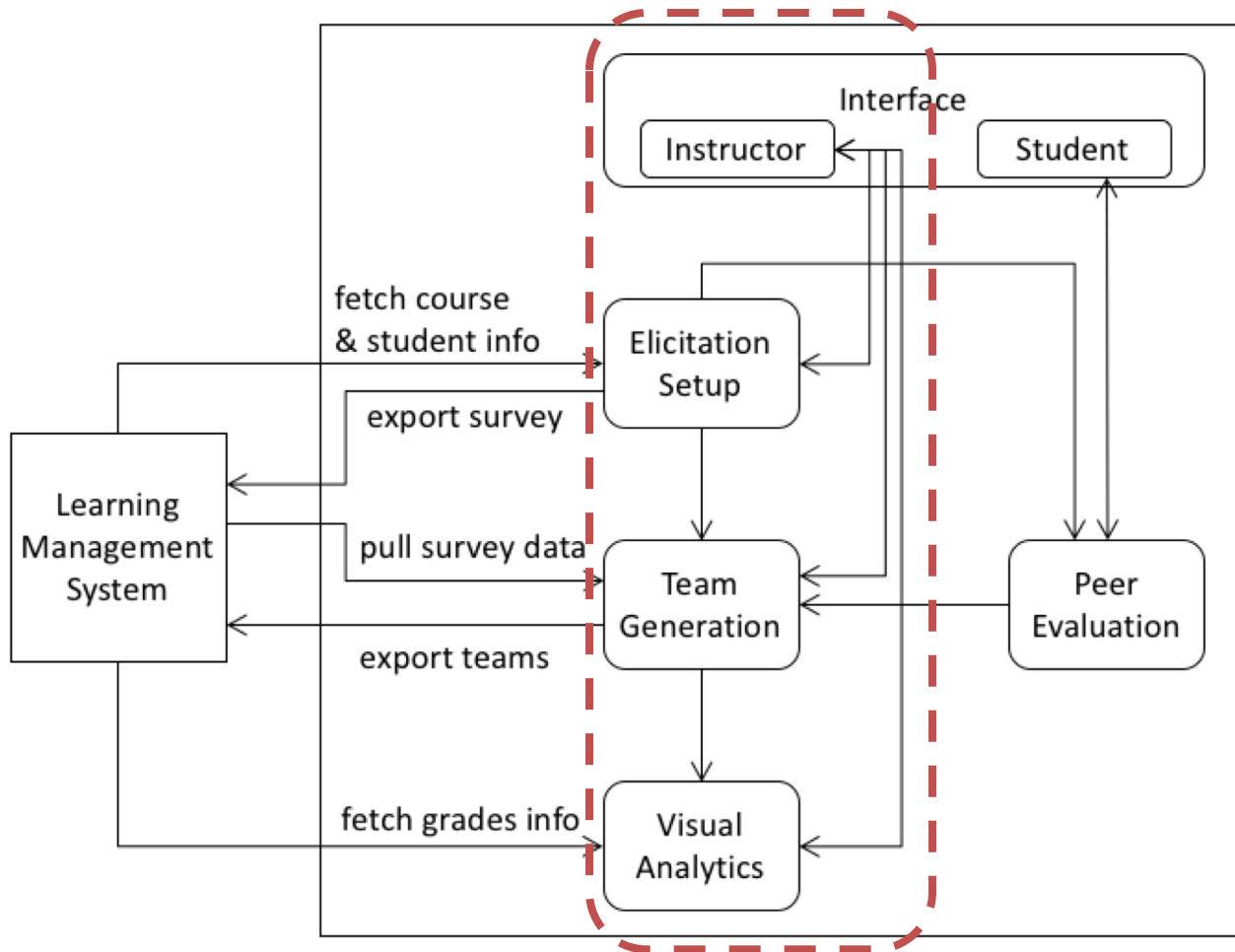


- GRumbler/Team-Match/CATME
 - No integrated with LMS (more initial setup and data transfer from peer evals)
 - Focus on diversifying (not clustering) students
 - No project support
 - Generated teams cannot be modified
 - Focus is on team formation, not team analytics
- Teamable Analytics 

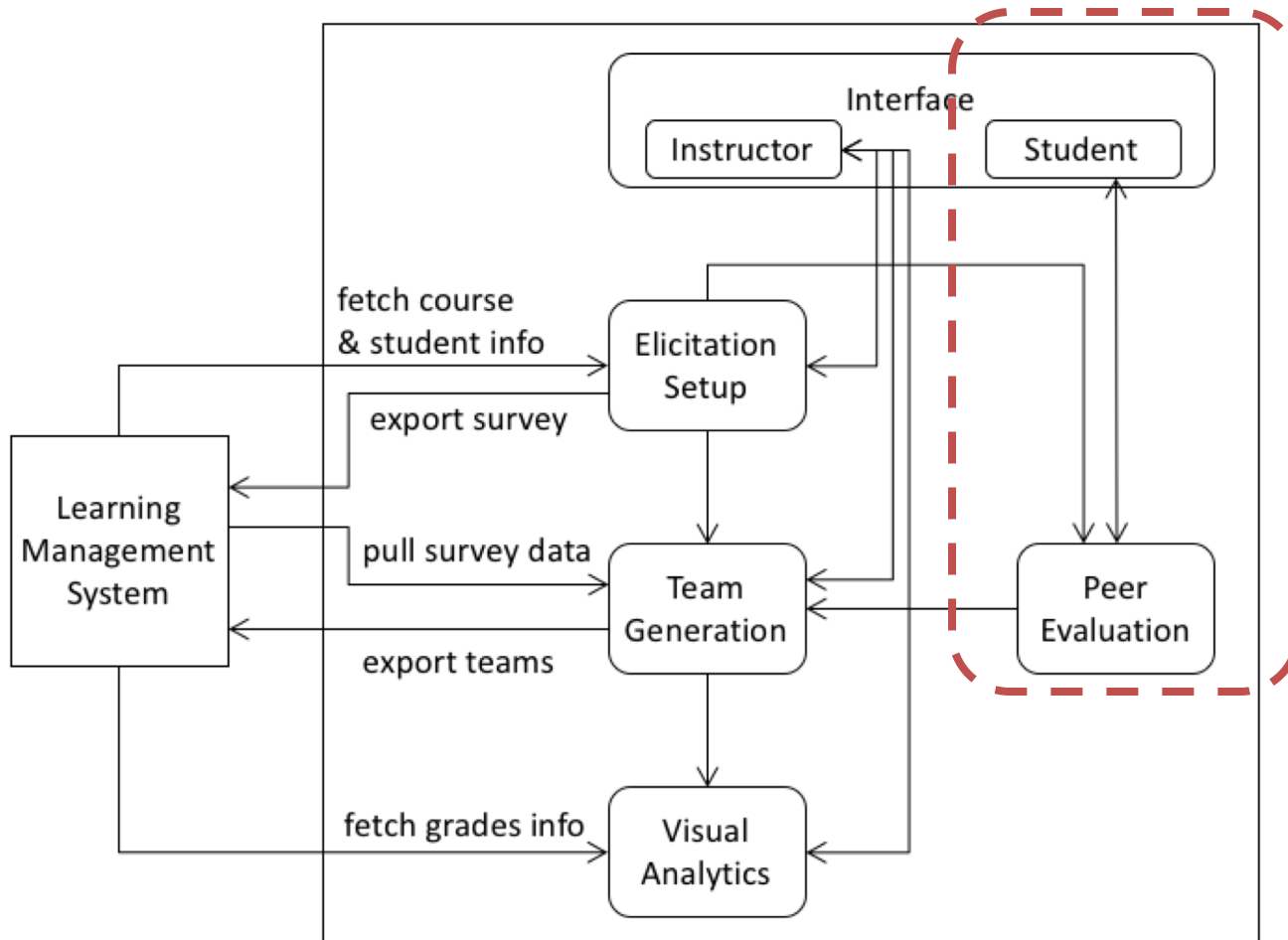
Teamable Analytics System Architecture



Teamable Analytics System Architecture



Teamable Analytics System Architecture



Overview of Teamable Analytics

The screenshot displays the 'Team Formation' interface. At the top, a dark navigation bar contains 'Team Formation' and 'How Does It Work?' on the left, and 'Admin Stats' and 'Logout' on the right. Below this is a horizontal process flow with seven numbered steps: 1. Sections (highlighted in blue), 2. Students, 3. Attributes, 4. Projects, 5. Surveys, 6. Teams, and 7. Peer Evaluations. The main content area shows the breadcrumb 'Courses / Test Course' and a large instruction box for 'Step 1: Import Sections'. This box contains the following text: 'The first step is to import data from your course into the Team Formation tool. You can do this by clicking 'Import Course Data'. You can view a list of your students in the 'Students' tab. If you want to form teams by sections and those sections do not appear with your students, then that means that your course was not set up with the required section format on Canvas. In this case, you may manually create sections for your students by clicking 'Create New Section'. At the bottom of the box is a 'Go to Sections' link. Below the instruction box is a 'Team Formation Steps:' section with a list of steps and links: 'Step 1 - Import Sections' (Go to Sections), 'Step 1.1 - Create or Edit Sections' (Create a Section), 'Step 2 - View Students' (Go to Students), and 'Step 3 - What are Attributes?' (Go to Attributes).

Team Formation How Does It Work? Admin Stats Logout

1 2 3 4 5 6 7

Sections Students Attributes Projects Surveys Teams Peer Evaluations

Courses / Test Course

Step 1: Import Sections ⓘ

The first step is to import data from your course into the Team Formation tool. You can do this by clicking 'Import Course Data'.

You can view a list of your students in the 'Students' tab. If you want to form teams by sections and those sections do not appear with your students, then that means that your course was not set up with the required section format on Canvas. In this case, you may manually create sections for your students by clicking 'Create New Section'.

[Go to Sections](#)

Team Formation Steps:

- Step 1 - Import Sections [Go to Sections](#)
- Step 1.1 - Create or Edit Sections [Create a Section](#)
- Step 2 - View Students [Go to Students](#)
- Step 3 - What are Attributes? [Go to Attributes](#)

Overview of Teamable Analytics

What are Attributes? ⓘ

List of Attributes

Show 10 entries Search:

[+ Create New Attribute](#)

Name	Type	Number of Questions	Actions
Academic History	Multiple Choice	1	View Edit Delete
Big 5 Personality Test - Conscientiousness	Complex Multipart	9	View Edit Delete

Showing 1 to 3 of 3 entries [Previous](#) [1](#) [Next](#)

List of Available Attributes to Import

Show entries Search:

Name	Type	Number of Questions	Actions
Academic History	Multiple Choice	1	View Import
Big 5 Personality Test - Agreeableness	Complex Multipart	9	View Import
Big 5 Personality Test - Conscientiousness	Complex Multipart	9	View Import
Big 5 Personality Test - Extraversion	Complex Multipart	8	View Import
Big 5 Personality Test - Neuroticism	Complex Multipart	8	View Import

Overview of Teamable Analytics

Team Formation [How Does It Work?](#) [Admin Stats](#) [Logout](#)








1 Sections 2 Students 3 Attributes 4 Projects 5 Surveys 6 **Teams** 7 Peer Evaluations

[Courses](#) / [COSC Team Analytics](#) / Teams

Generate Teams ⓘ


List of Team Sets [+ Generate Teams](#)

Show entries Search:

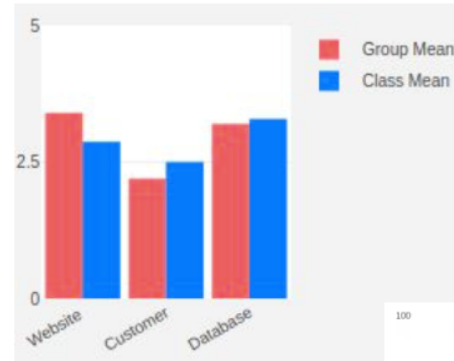
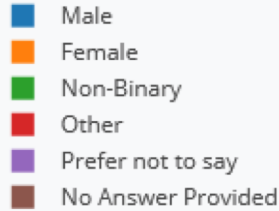
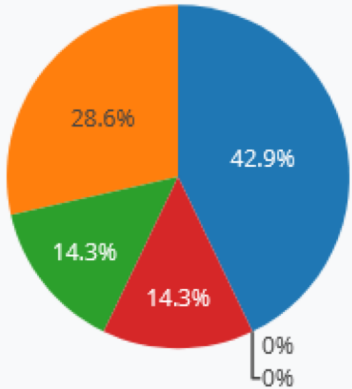
Team Set	Number of Teams	Added to Canvas	Actions
Term 1 Assignment Groups	5	✓	 
Term 2 Teams	3	✗	    

Showing 1 to 2 of 2 entries [Previous](#) [1](#) [Next](#)

Developed by Jeff Bulmer, Opey Adeyemi, Mathew de Vin, Keyvan Khademi, Bri Marshnew, Dr. Bowen Hui, Callum Takasaka, Kanishka Verma

 THE UNIVERSITY OF BRITISH COLUMBIA

Visual Analytics Component



Operating Systems

Windows: 0
Linux: 3
MacOS: 4
Other: 0

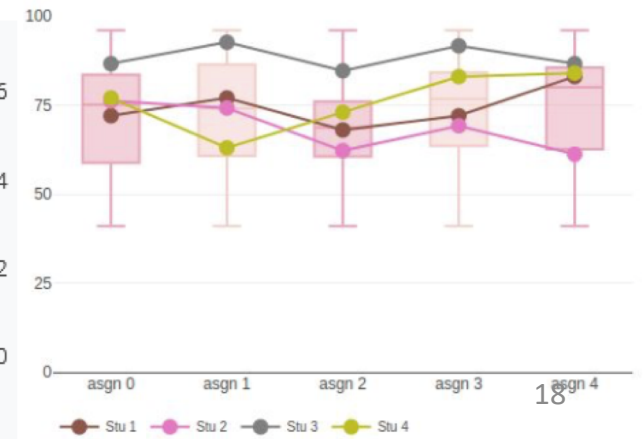
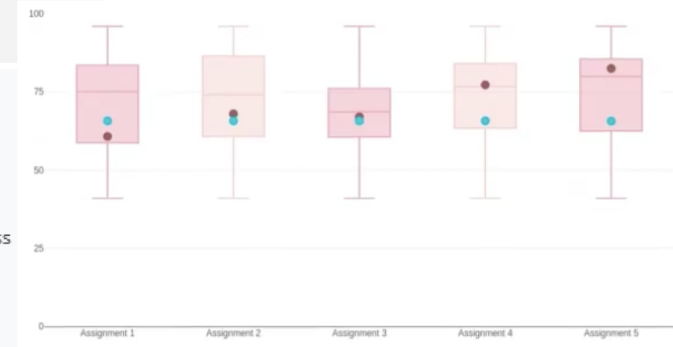
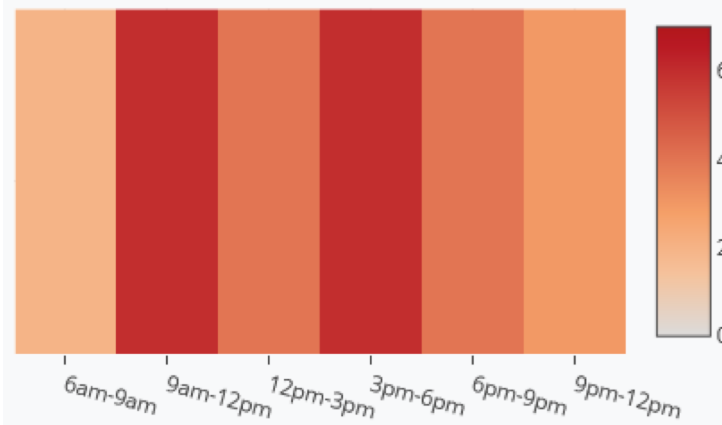
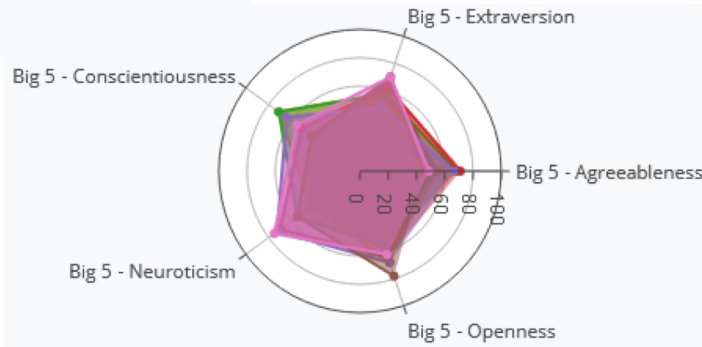
Mobile Game - iOS

7 Students

Capstone Project Preference
Satisfaction Level: 86%

[View Members](#)

Name	Capstone Project Preference
CTLB	Mobile Game - iOS: ✓ Community Garden Planner: ✗
CTLC	Youth Sports Tournament Creator: ✗ Mobile Game - iOS: ✓
CTLD	Youth Sports Tournament Creator: ✗ Community Garden Planner: ✗



Peer Evaluation Component

Courses / COSC Team Analytics / Peer Evaluations

Preview Peer Evaluations

List of Peer Evaluations [Back to Instructor View](#)

Hello, **UBCO CTLA**. You can complete a peer evaluation or view the results if they are released by your instructor.

Show 10 entries Search:

Peer Evaluation	Completion	Closing Date	Actions
Milestone 1 Evaluation	0 / 5	Oct. 9, 2021, noon	View Next

Showing 1 to 1 of 1 entries [Previous](#) [Next](#)

Courses / COSC Team Analytics / Peer Evaluations / Milestone 1 Evaluation

Peer Evaluation - Milestone 1 Evaluation [Back to Instructor View](#)

Hello, **UBCO CTLA**. Please select who to evaluate from the list of team members below.

Show 10 entries Search:

Name	Progress	Actions
UBCO CTF	0%	Start Evaluation
UBCO CTLL	0%	Start Evaluation
UBCO CTLN	0%	Start Evaluation
UBCO CTLQ	0%	Start Evaluation
UBCO CTLS	0%	Start Evaluation

Showing 1 to 5 of 5 entries [Previous](#) [Next](#)

Courses / COSC Team Analytics / Peer Evaluations / Milestone 1 Evaluation

Peer Evaluation - Milestone 1 Evaluation [Back to Instructor View](#)

Hello, **UBCO CTLA**. Please select who to evaluate from the list of team members below.

Show 10 entries Search:

Name	Progress	Actions
UBCO CTF	100%	Edit Response
UBCO CTLL	67%	Continue Evaluation
UBCO CTLN	0%	Start Evaluation
UBCO CTLQ	0%	Start Evaluation
UBCO CTLS	0%	Start Evaluation

Showing 1 to 5 of 5 entries [Previous](#) [Next](#)

Experience Report

- Initial studies [Bulmer 2021]
 - 4 CS upper-level class (09/2019-04/2021)
 - Between 41 and 161 students
 - Criteria based on student characteristics, some had projects
 - Generally positive student satisfaction and activity cover

Experience Report

- Initial studies [Bulmer 2021]
- Classroom pilots (Ongoing)
 - 4 interdisciplinary pilots (09/2021-12/2021)
 - Between 15 and 170 students
 - Diversify student skills, diversify majors, cluster student goals, one class used peer evaluations
 - 93% neutral/positive student feedback, Visual Analytics difficult to use in large classes, need for “social” algorithm

Experience Report

- Initial studies [Bulmer 2021]
- Classroom pilots (Ongoing)
 - 4 interdisciplinary pilots (09/2021-12/2021)
 - Between 15 and 170 students
 - Diversify student skills, diversify majors, cluster student goals, one class used peer evaluations
 - 93% neutral/positive student feedback, Visual Analytics difficult to use in large classes, need for “social” algorithm
 - 5 interdisciplinary pilots (01/2022-04/2022)
 - Between 59 and 539 students

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- Interoperability
- Transparency
- Social Relevance
- Flexibility
- Usability
- Extensibility

Design Guidelines



- Privacy and data security
 - Accessibility
 - Customizability
 - Composability
 - Scalability
 - Efficiency
 - Interoperability
 - Transparency
 - Social Relevance
 - Flexibility
 - Usability
 - Extensibility
- } Common to all

Design Guidelines



- Privacy and data security
 - Accessibility
 - **Customizability**
 - Composability
 - Scalability
 - Efficiency
 - Interoperability
 - Transparency
 - Social Relevance
 - Flexibility
 - Usability
 - Extensibility
- } Instructor in control

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- **Composability**
- Scalability
- Efficiency
- Interoperability
- Transparency
- Social Relevance
- Flexibility
- Usability
- Extensibility



Handle multiple competing constraints

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- **Scalability**
- Efficiency
- Interoperability
- Transparency
- Social Relevance
- Flexibility
- Usability
- Extensibility

} Support large classes

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- **Efficiency**
- Interoperability
- Transparency
- Social Relevance
- Flexibility
- Usability
- Extensibility

} Minimal user wait time

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- **Interoperability**
- Transparency
- Social Relevance
- Flexibility
- Usability
- Extensibility

} LTI integration with LMS

Design Guidelines



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- Accessibility
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- **Transparency**
- Social Relevance
- Flexibility
- Usability
- Extensibility



Visual analytics improves user trust

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- Interoperability
- Transparency
- **Social Relevance**
- Flexibility
- Usability
- Extensibility



Avoid social isolation and *tokenism*

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- Interoperability
- Transparency
- Social Relevance
- **Flexibility**
- Usability
- Extensibility

} Allow for incremental adjustments

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- Interoperability
- Transparency
- Social Relevance
- Flexibility
- **Usability**
- Extensibility

} *All aspects must be user-friendly*

Design Guidelines



- Privacy and data security
- Accessibility
- Customizability
- Composability
- Scalability
- Efficiency
- Interoperability
- Transparency
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- Usability
- Extensibility

} Extends to new use cases

Thank You!



- Key take-aways
 - Different contexts call for different team formation criteria (not always about diversity)
 - Integration with LMS minimizes data risks and user effort
 - Visual analytics play crucial role in end-to-end support
 - Diagnose unbalanced teams
 - Increase user trust
 - Monitor ongoing team performance
- Next steps
 - Seeking collaborators
 - Visual analytics research
 - Setup and pilot at other institutions
 - Contact: Dr. Bowen Hui bowen.hui@ubc.ca