InterLACE Worksheet

(Interactive Learning and Collaboration Environment)

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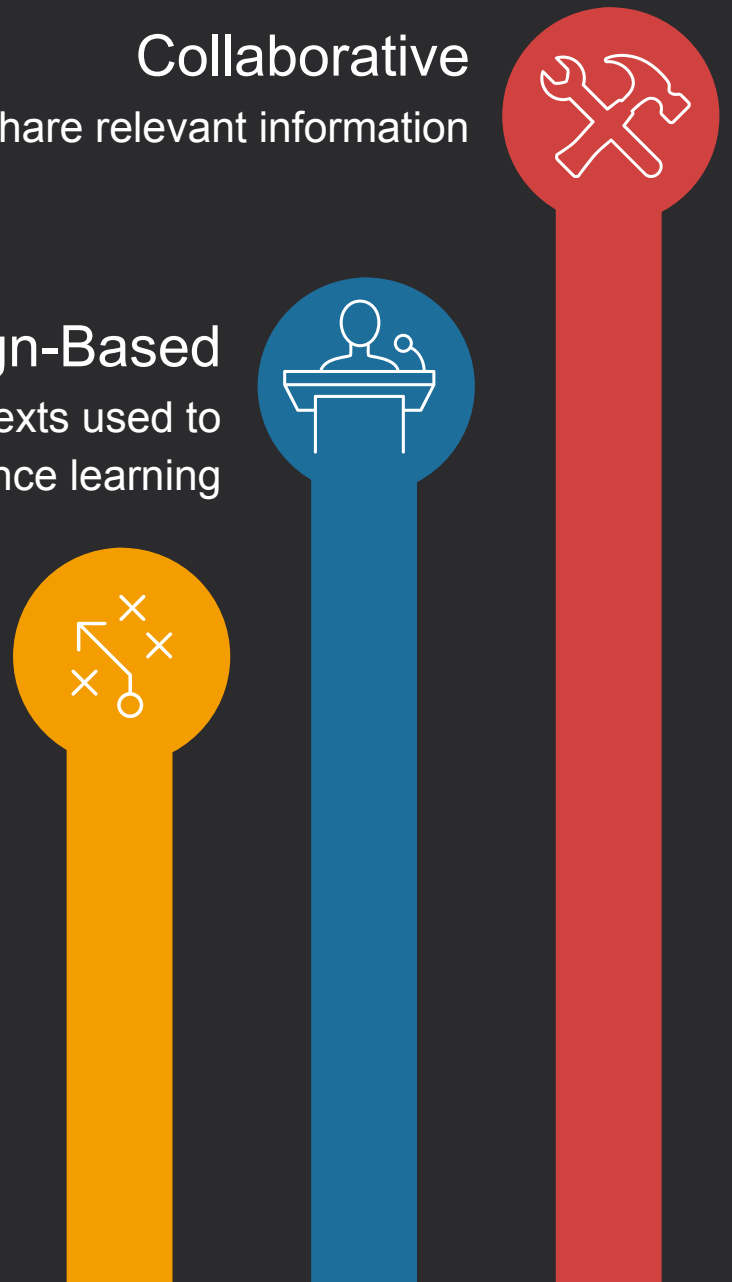
Correlation between collaborative, design-based, inquiry teaching and strong student conceptual gains

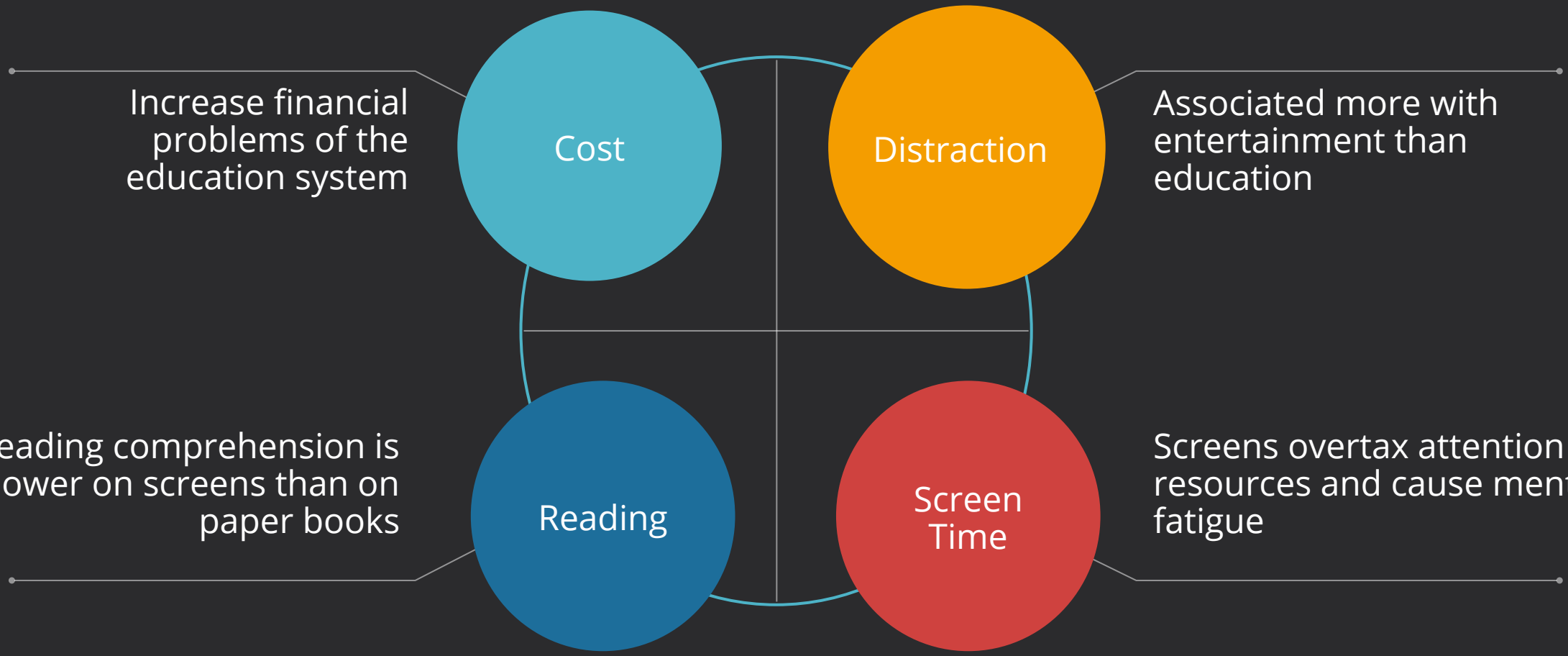


Why are existing methods of enhancing classroom collaboration lacking?

Misconception: Lack of resources to integrate this type of learning

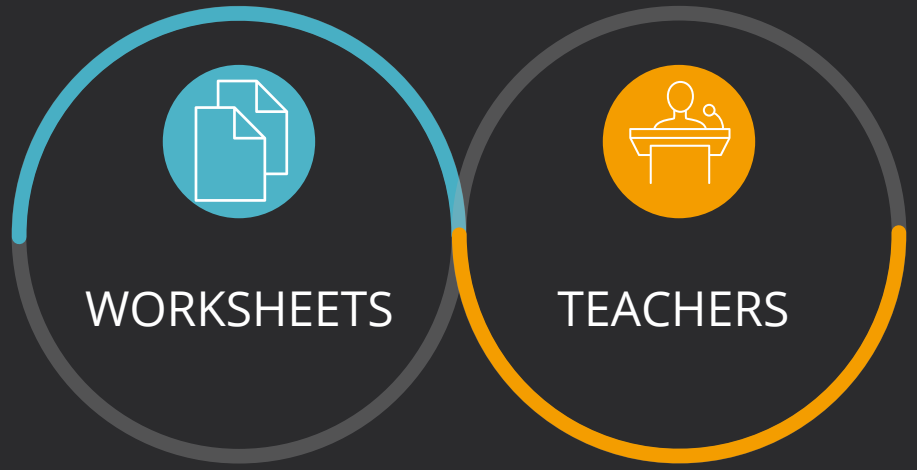
Problem:
Resources not effectively used to augment learning/teaching

Why don’t iPads solve this issue?



TWO PILLARS OF THE WORKSHEET PROBLEM

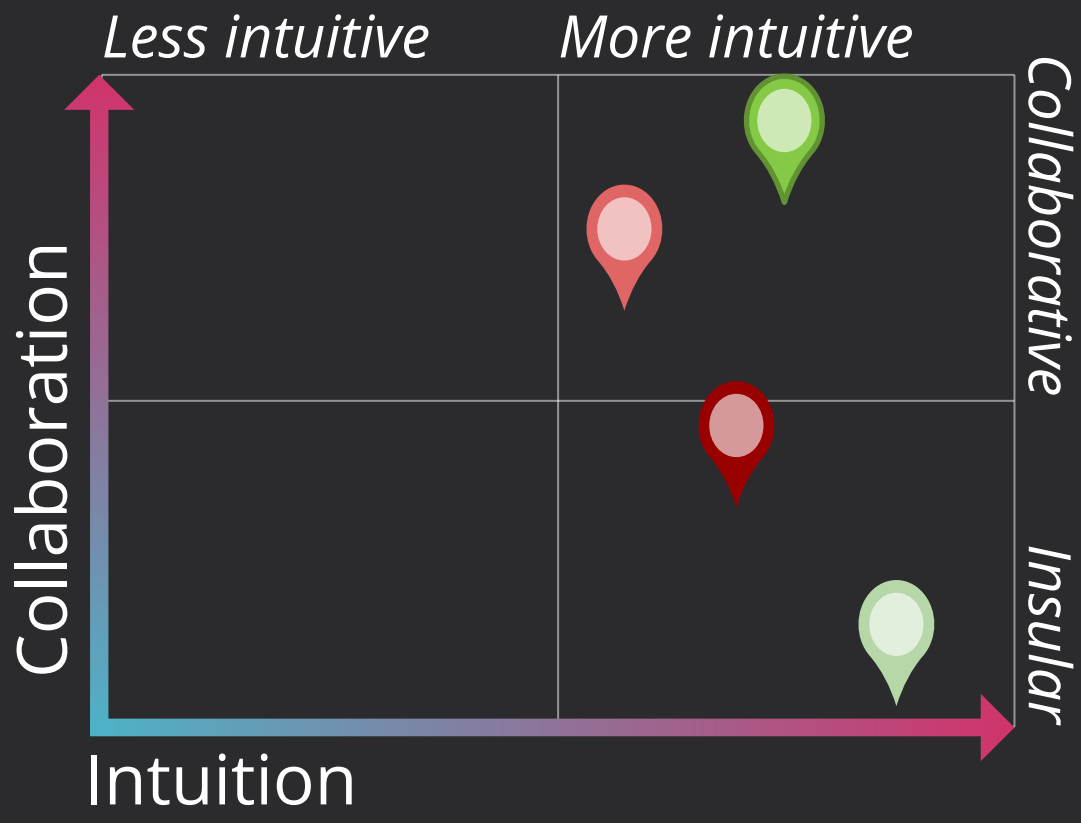
Worksheets are great! They are tactile, require no training, and promote freedom of expression. However:



01 Worksheets do not promote collaboration between students

02 Teachers do not have a definitive method for analyzing worksheet responses and classroom trends

Are others working on this?



LiveScribe - Smartpen with embedded computer and audio recorder

Sketchboard - Team sketching on online whiteboard

GradeCam - Grade students on multiple choice questions

InterLACE Worksheet

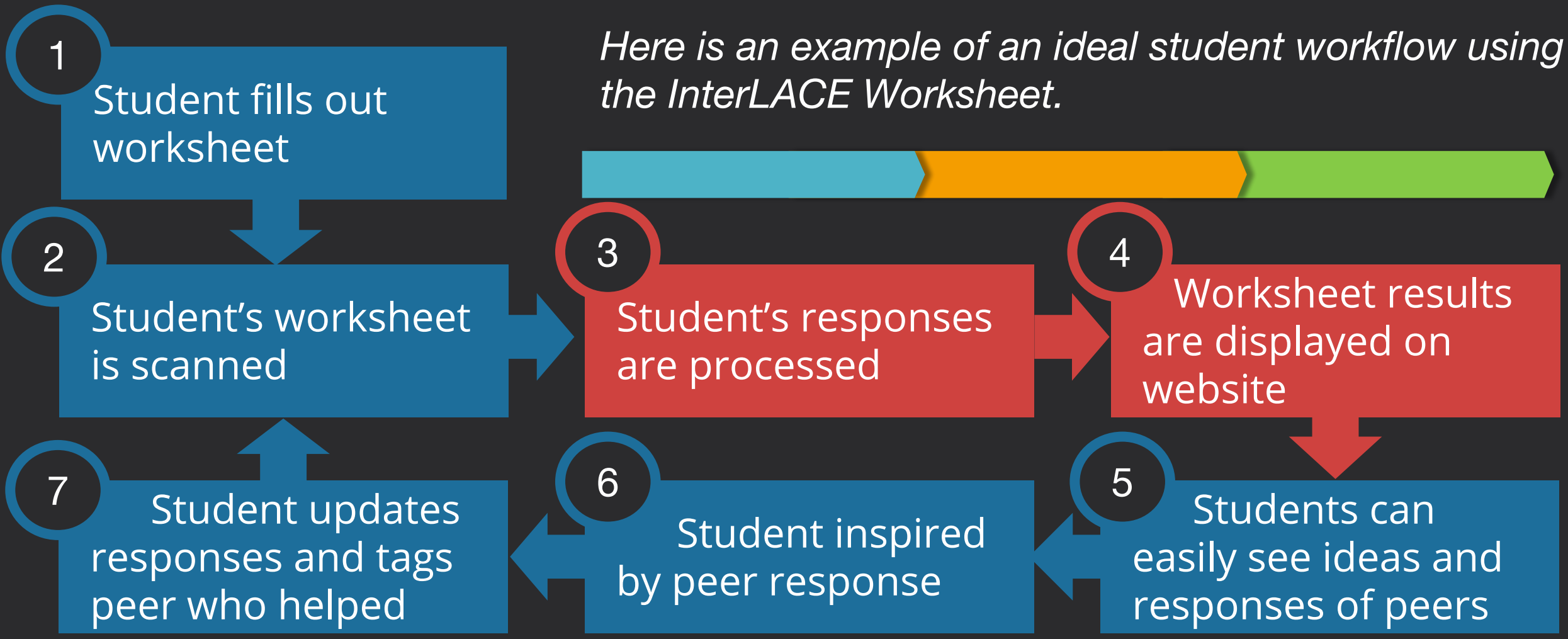
More expensive

Less expensive

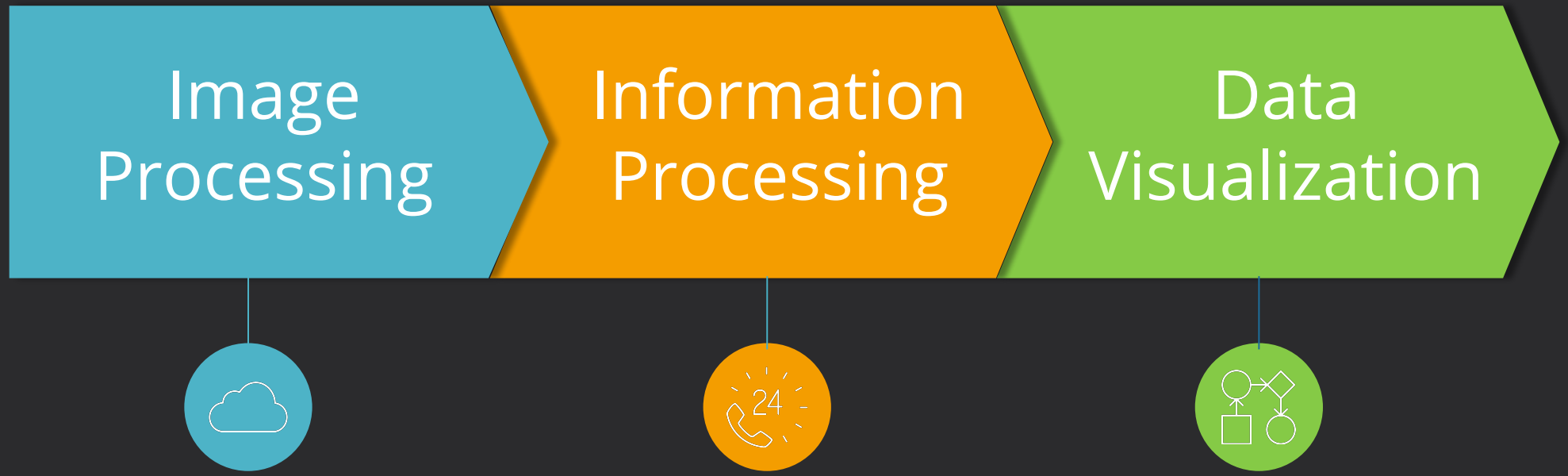
The InterLACE Worksheet is a low cost solution which promotes collaboration, while minimally disrupting the classroom workflow (more intuitive)

InterLACE Worksheet Student Flow

Here is an example of an ideal student workflow using the InterLACE Worksheet.



InterLACE Worksheet Components



Input: Set of raw images

Output: Data extracted from images

Input: Data from images

Output: Data analysis tools

Input: Tools for data analysis

Output: Visualization of analysis

Image Processing

Image Processing Problem

The challenging part about handwritten characters, especially that of children is that the data is:

- *Highly variant (over time and between different users)*
- *Poorly spaced and oriented*
- *May contain connected lines*
- *Often misspelled*

OCR (Optical Character Recognition) or “Text in the WIld”

Custom solution or API

Image Processing

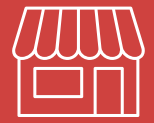
Image Processing Solution

Text Localization

- Preprocessing:
  - Static and adaptive thresholding
  - Gaussian blur
- Numbers: Image contours
- Words: Sliding window
- Throw out regions of interest that are perceived to be noise (too small)

Text Recognition

- Numbers: SVM of HOG
- Words: CNN trained with MatLab models from reference paper
- Microsoft Cognitive Services API

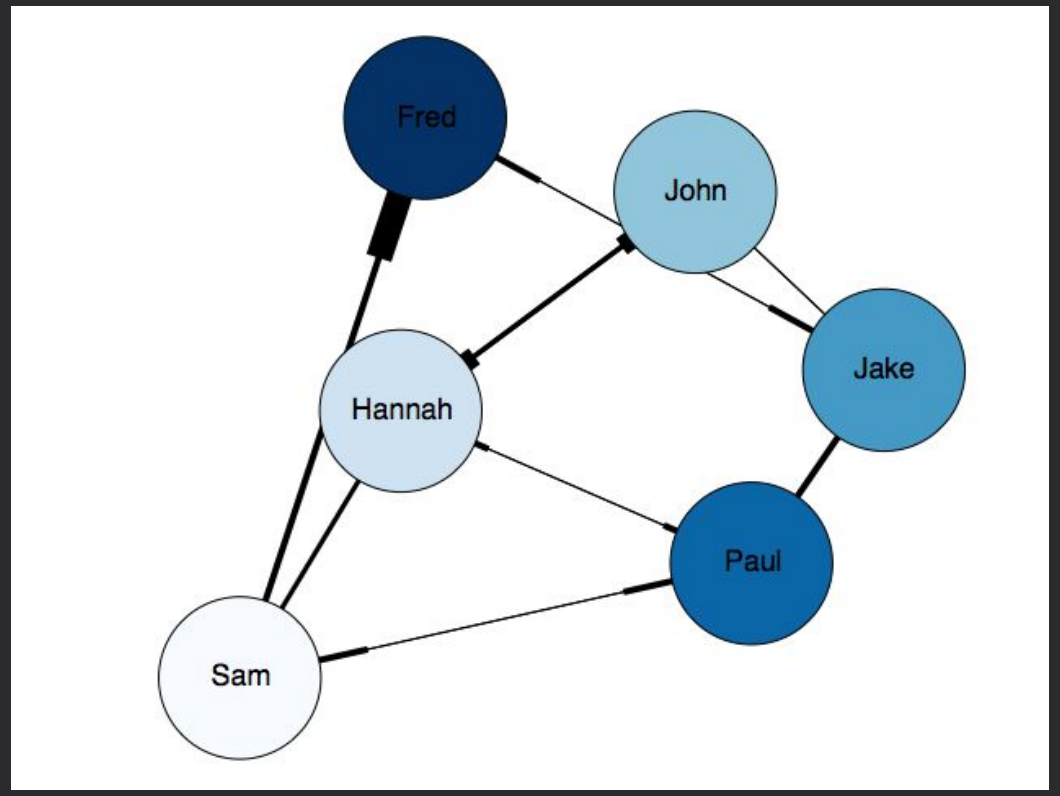


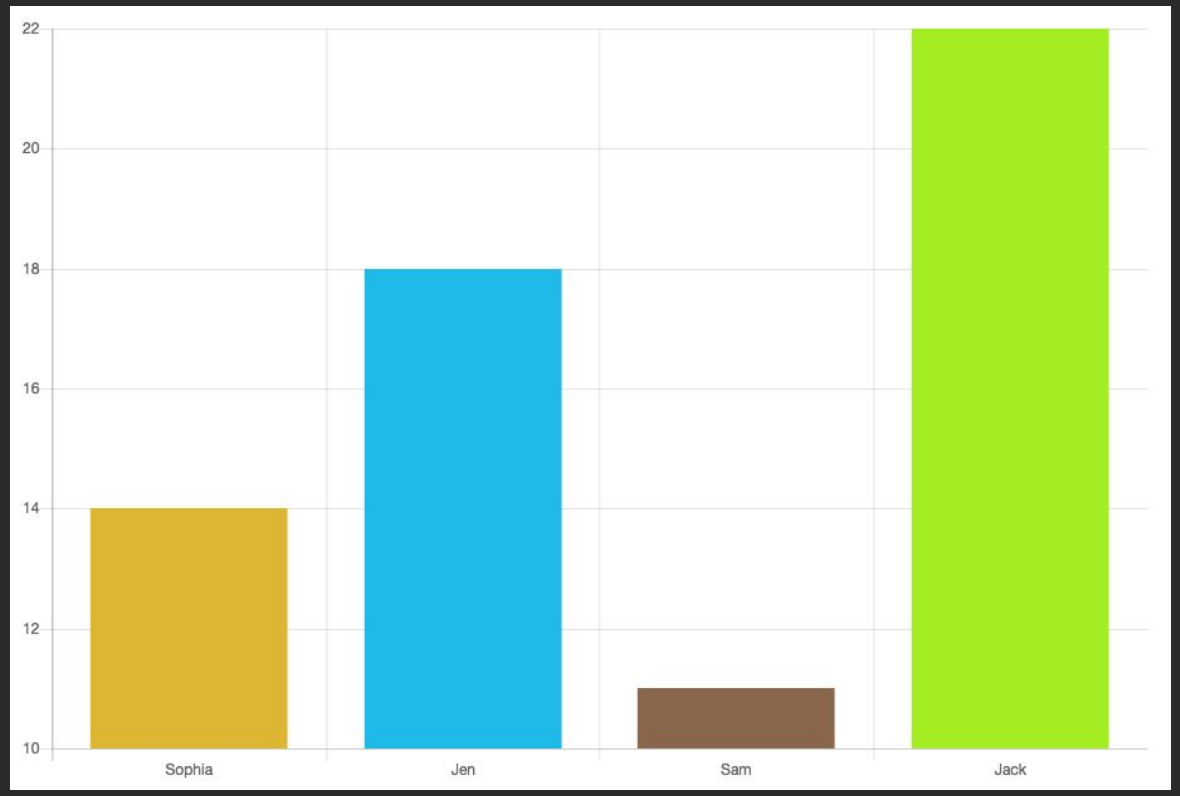
Refined Text Recognition

- For the best guess of a word w, given a dictionary D containing words d, output the most similar d in D to w
- Given a list of words and a dictionary, map each word to the best guess in the dictionary, ensuring that each word has a unique output

Information Processing

Data Analysis





Benefits

InterLACE Worksheet
Intuitive
Iterative
Collaborative
Low Cost
Flexible
X
Scanning worksheet is only change made to students workflow
X
Teachers do not have to change their teaching methods or worksheet questions
X
Students are encouraged to complete an assignment multiple times
X
Promotes active questioning of self and peer ideas
X
Students are encouraged to work within groups to solve problems
X
Groups of students can easily view other groups ideas
X
Scanners for each classroom are low cost
X
No training required for interacting with UI
X
Teachers may continue to expand the worksheets
X
Student “profiles” will grow overtime (days, months, years)