Using Vignettes to Categorize Behaviors Students Associate with Dispositions

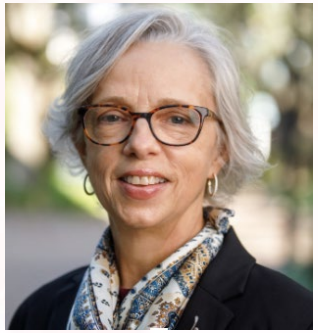
Mihaela Sabin

University of New Hampshire

dispositions-project.org

Authors and Researchers

Mihaela Sabin
University of New Hampshire
New Hampshire, USA



Renée McCauley
College of Charleston
South Carolina, USA

Bonnie MacKellar
St. John's University
New York, USA

Amruth N. Kumar
Ramapo College of New Jersey
New Jersey, USA

Acknowledgments: This work was partly supported by the National Science Foundation under awards 22161121, 2216031, 2215970, an 2215166. The authors would like to thank Dr. Marisa Exter for fruitful discussion about the ***DEAP project***.

Motivation and Goal

Foster ***professional dispositions*** in computing and engineering education

- Professional dispositions - personal qualities that:
  - Facilitate consistent exercise of ***behaviors*** that are **valued in the workplace**
  - Examples: being *persistent*, *self-directed*
- Build on prior work
  - Kiesler et al., "*Students' Perceptions of Behaviors associated with Professional Dispositions in Computing Education*," ITiCSE 2024
  - McCauley et al., "*WIP: Using Vignettes to Elicit Students' Understanding of Dispositions in Computing Education*," FIE 2023
- Identify behaviors students experience when they apply four dispositions:
  - *Collaborative, meticulous, persistent,* and *self-directed*
- These behaviors can help educators promote and assess dispositions

Prior Work

- Reflection Exercises
  - Definition of a disposition
  - Open-ended reflection prompt on:
    - How students applied the disposition in their assignment/project work
- Collected reflection exercise data
  - From four institutions
  - On eight dispositions, including the four dispositions in this study:
    - Persistent, self-directed (fall (U.S.) 2021 and spring (U.S.) 2022)
    - Collaborative (fall 2021, meticulous (spring 2022)
- Thematic analysis
  - Preliminary behavioral categories of the dispositions

This Study

- Vignette exercises
  - **Scenario**: Depicts real-life story of the application of a disposition
  - **Disposition definition**
  - **Scenario prompt**: Students identify the disposition
  - Reflection prompt:
    - "*Describe an example of you being [disposition name] when completing this assignment. Otherwise, describe the circumstances that prevented you from being [disposition name].*
- Collected vignette response data: spring and fall (U.S.) 2023
  - 77 undergraduate students, from four institutions differing by:
    - Type, educational focus, and student population
  - Four different courses
    - CS1, Data Structures Fundamentals, Concepts of Programming Languages, and Database Management Systems
  - Four dispositions
    - *Collaborative (2 courses), meticulous (2), persistent (4), self-directed (2)*

Research Question

- Which behavioral categories obtained from student responses to ***reflection exercises*** were confirmed using ***vignette exerci***ses?
  - Which behavioral categories <u>were not confirmed</u>?
  - Which behavioral categories <u>were refined</u>?

Data Analysis

- Thematic qualitative analysis of open-ended vignette responses
  - Deductive-inductive content analysis approach (Mayring 2014)
  - Overall, a student response had one meaning (139 coding units)
- Two-step process
  - Independent coding of each disposition by two researchers
  - Iterative process involving all four researchers to reach consensus
- Trustworthiness and credibility: three forms of triangulation
  - Data, method, and investigator triangulation

Results: *Persistent* Disposition

Definition: Stick with a task until it is completed even when the task seems difficult and even when you have doubts about your ability to complete the task.
Vignette Scenario: Edison's invention of the light bulb

Category	Category Definition
Overcoming setbacks	Going through a lot of trial and error to solve a problem; Trying (many) alternative ways of doing things to complete work no matter what; Working out the solution step-by-step despite difficulties.
Achieving set goal or success	Working determinedly to achieve solution; Trying continuously to figure out and fix mistakes.
Participating regularly over the course of the project	Spending constant effort without giving up.
Investing considerable time	Committing a lot of time (or extra time) to complete the work by the deadline; Scheduling necessary time on a regular basis.
Aiming at high quality	Applying effort with the goal of a high quality outcome.

Results: *Persistent* Disposition

Category	Excerpt of student response
Overcoming setbacks	*"I often found myself stuck but kept trying."* *"I manually put in breakpoints so that I could follow the path and find out exactly where it went wrong, trying out different example until I finally found the issue."*
Achieving set goal or success	*"I had to try many different things and edited several different files before arriving at the right solution."* *"... Checking the dozens of attributes multiple times to see if anything has been missed or is unnecessary."*
Participating regularly over the course of the project	*"kept reading through the book at some examples and looking at how I could better understand everything."*
Investing considerable time	*"I spent a great deal of time on this project and kept at it till it was complete."*
Aiming at high quality	*"I made sure to make a commit whenever I had completed an aspect of the project ... [It] pays off because in the future, when I work on large projects with multiple people, being comfortable making frequent commits will dramatically help then."*

Results Summary

- Confirmed the applicability of 17 of the 24 behavioral categories from prior work
  - Not applicable example: *General communication and exchange (Collaborative)*
- Found one new behavioral category for *meticulous*
  - Name: Applying a detailed step-by-step process
  - Definition: Proceeding carefully and methodically by following a detailed process"
  - Example: *"I then broke the process down into its smallest parts, followed by creating a list on paper of all the relationships I needed to create. Then, using a system of steps for each relationship, I was able to finally get a better understanding of the material after hours of work and research."*
- Renamed six behavioral categories for *collaborative* (2) and *persistent* (4)
  - *Persistent: Investing effort despite frustration* □ *Overcoming setbacks*
- Refined most of the behavioral category definitions

Discussion

- Implications for using vignettes
  - Lengthier and more specific student responses
  - Potentially reduced socially desirable bias
- Initial comparison of behavioral categories in this study against dispositions valued in the workplace, DEAP project, https://deapcomp.org
  - 21 of the 24 behavioral categories mapped to 14 DEAP dispositions
- Implications for fostering dispositions
  - Behavioral categories frame
    - Classroom practices, assessment rubrics
  - Instructors model dispositions
  - Authentic and relevant workplace-related experiences
    - Internships, industry-supervised projects
    - Speakers from industry, including alums
- Disposition development challenges

Limitations

- Vignette dataset (139 coding units) is considerably smaller than the reflection dataset (1207)
- Same four institutions and courses involved in prior work and this study
- Vignette exercises were evaluated differently in the two studies
  - Credit towards the assignment grade
  - Counted towards class participation
- Validity of the vignette scenarios has not been formally established

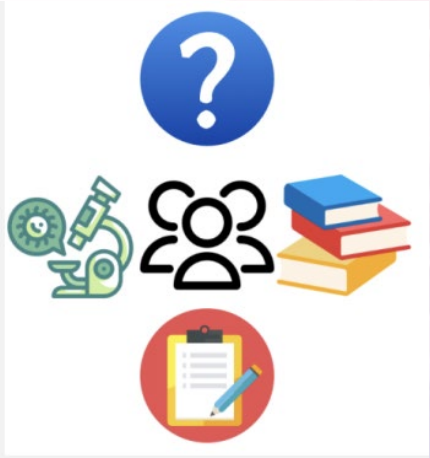
Conclusion and Future Work

- Vignettes seem to be a viable alternative to reflection-only exercises
  - Raise student awareness of dispositions
  - Facilitate student intention to apply knowledge and skills and by
    - Engaging in behaviors that are valued in the workplace
- New insights from comparing behavioral categories in this study wit
  - Prior work
  - DEAP dispositions
- Future work
  - Continue this study using vignette data from additional 4 semesters
  - Examine evidence-based teaching practices that target dispositions

Project Information

- Learn more about the project and access to project materials
  - https://bit.ly/dispositions-study

- Visit the project website
  - https://dispositions-project.org/



Operational Definition of Professional Disposition

Awareness and ***intention*** to apply knowledge and skills by engaging in **behaviors** that are **valued in the workplace**

Key aspects of the definition:

- **Observable behaviors**: indicative of the disposition
- **Awareness** of when an opportunity exists to engage in a behavior and the **intention** to carry out the behavior
- Context of **professional workplace expectations** of desirable dispositions

Linux Operating Systems Mini-Vignette

In 1991, while a computer science student in Finland, Linus Torvalds started working on a new free operating system, as a personal project. On August 25, 1991, he posted a message on Usenet, which was an early Internet newsgroup site similar to Reddit, announcing his project. He posted "I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)".

So that people could access his project files, he uploaded them to a FTP server (an early Internet protocol for sharing files). One of the volunteer administrators of the server named the project "Linux", and the name stuck. He released the project under the GNU General Public License (GPL) which allows four freedoms: the freedom to run, copy, study/improve and distribute the work. The use of GPL, as well as the fact it was free and ran on affordable personal computers, are the reasons why Linux became one of the most popular operating systems of all time.

As Linux became popular among PC hobbyists, users started writing and contributing their own code : bug fixes, utilities, and extensions. Over time, the Linux development community snowballed, with many programmers from all over the world working on the system. By 2005, the original system of passing changes around as patches and archived files became impossible to manage, so Torvalds and other community members worked together to develop Git, a version control system that can manage huge numbers of globally dispersed developers so they can work together. Today, Linux is an enormous open source project that is maintained and extended by over 600,000 programmers from around the world. Likewise, Git has become a very popular version control tool, helping developers work together. GitHub alone had 40 million registered developers in 2018.

Results: *Collaboration* Disposition

Definition: Work with other people as a team, exchange, share and discuss ideas, feedback, and actions to accomplish a task.
Vignette Scenario: Development of the Linux operation system

Category	Category Definition
Problem-related communication	Discussing hypothetical solutions or sharing ideas before implementing them. Sharing thoughts about the benefits and challenges of hypothetical solutions. Listening to others' solutions.
Interactive problem-solving	Working together, usually in real-time, to solve a problem, whereas all team members participate interactively and contribute equally to the progression toward the final integrative solution.
Independent problem-solving	Dividing the assigned work into parts and after everyone completes their tasks independently, the parts are put together and discussed.
Asking for help	Occasion-related seeking of help. Discussing specific questions in the face of a specific challenge.

Results: *Collaborative* Disposition

Category	Excerpt of student response
Problem-related communication	*"During this project, my group mate and I spent a lot of time discussing ideas and going back and forth with one another regarding issues in our ER model for example."*
Interactive problem-solving	*"An example of me being collaborative during this assignment would be me coming together with my partner and brainstorming our ideas.* *At time there may have been a difference in ideas, but we came together to from one product. "*
Independent problem-solving	*"We worked together to communicate on which parts needed to be fixed. We also equally distributed the work among each other while asking for help in between."*
Asking for help	*"I got help from a tutor in order to complete homework 3, my difficulties with linked list and nod, prevents me from being of any help."*