



# “Skateboards, Roundabouts & Blood” - An Investigative Case Study of Human ABO Blood Types: Does

a CSI Context Improve Learning and Engagement? Dr. Margaret Sonnenfeld and Christine Petersen

(2022 TRU CELT SoTL Scholar Grant holders)

## Analysis

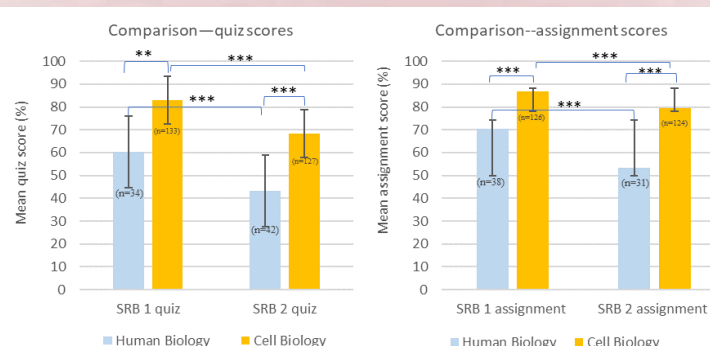
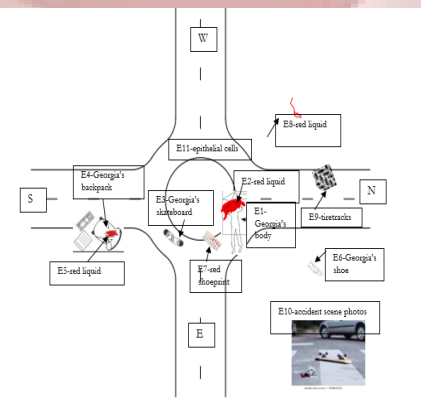
## Goals

- both case-based learning in lecture settings & traditional hands-on laboratory exercises are beneficial (1-5)
- combination of case-based **laboratory** investigation has not been sufficiently investigated (6).
- determine if integrating case studies with laboratory investigation improves **deep learning** of core concepts in undergraduate biology e.g., blood typing.

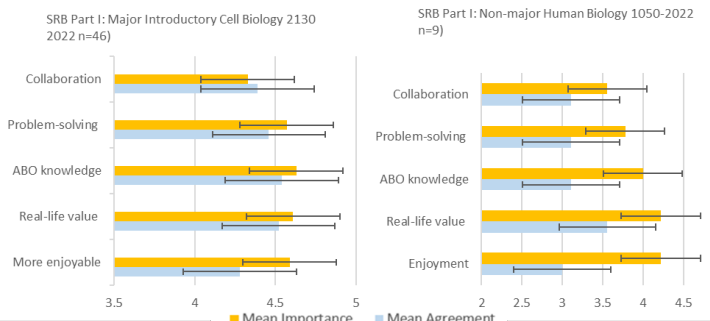
## Approach

- integrated a case study, “Skateboards, roundabouts and blood”, story line into traditional F2F labs for both majors (Cell Biology = BIOL 2130) & nonmajors (Human Biology = BIOL 1050) during several semesters (2019, 2020 & 2022) (7).
- Part 1: students developed their skills in blood analysis**
- Part II: students apply higher-order skills to give priority to evidence as they collaborate to solve the crime scene**
- used a web-based Likert survey & aligned student scores in direct assessments to qualitatively & quantitatively compare learning gains (TRU ethics approval given)

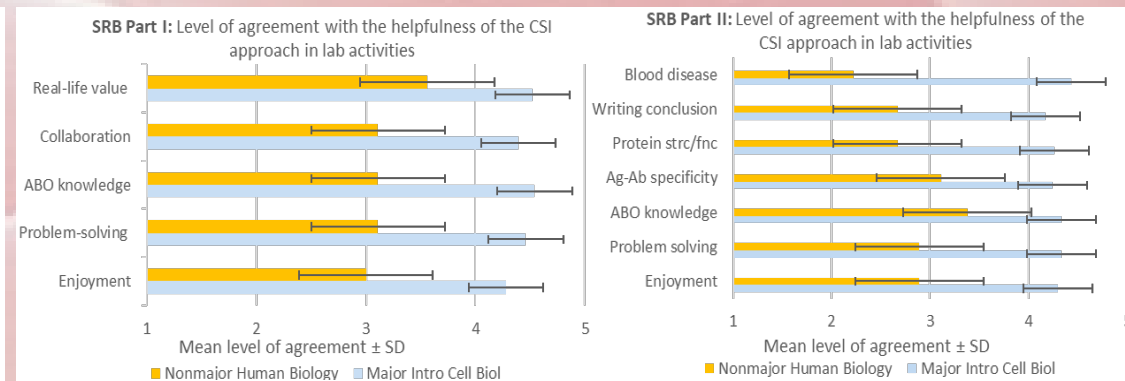
## Crime Scene Evidence



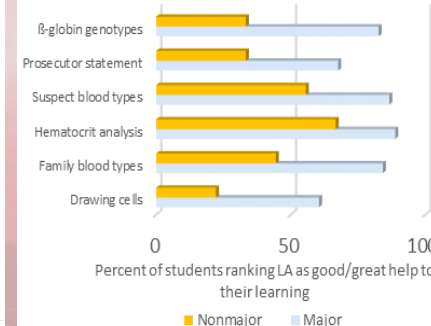
**Figure 1.** Comparison of outcomes in case-based laboratory assessments in majors (BIOL 2130 Cell Biology;20/22) and nonmajors (BIOL 1050 Human Biology;22) courses. Error bars indicate SD. \* indicate significant difference between means determined by t-Tests (P(T<t) two-tail; Two-Sample Assuming Unequal Variances). \* p < 0.05; \*\* p < 0.01, \*\*\* p < 0.001



**Figure 3.** Student perceived learning gains vs. relative importance. Students selected their level of agreement with statements about the helpfulness of the CSI approach in SRB Part I (1–5 = SD, D, N, A, SA) and ranked the importance of these attributes to their learning (1–5 = not at all important to very important). Error bars: SD.



**Figure 2.** Student perceived learning gains are significantly higher in majors (n=46) vs. nonmajors biology (n=9) in both SRB I and II. Levels of agreement 1–5= strongly disagree; disagree, neither; agree, strongly agree, respectively. Error bars indicate SD.



**Figure 4.** Student rating of learning activity effectiveness in SRB I and II in major Introductory Cell Biology 2130 (n=75) and non-major Human Biology 1050 (n=9).

## Summary—

- Mean assessment scores significantly higher in majors’ labs (Figure 1).
- Mean assessment scores significantly lower in SRB II than SRB I assessments in both majors’ and nonmajors’ labs (Figure 1).
- Increased student perceptions of learning gains from CSI approach in majors’ Introductory Cell Biology (Figure 2).
- CSI approach perceived most helpful & important in learning real-life value of ABO blood types by both majors & nonmajors (Figures 2 & 3; Table 1).
- SRB II perceived more helpful in understanding ABO blood types (Figure 2) & important to both (Figure 3).
- CSI approach more enjoyable to majors (Figure 2).
- In both courses, hematocrit analysis of crime scene blood and relation to disease most helpful followed by determining suspects’ blood types; drawing cells least helpful (Figure 4).
- Sickle cell analysis of β-globin genotypes more helpful to majors’ students (Figure 4).

**Conclusion—**Evidence is provided that case-based laboratory learning activities (CSI manner) enhance student engagement and provide real-life relevance. The inquiry-based learning in SRB II promoted deep learning of biological concepts and students working actively in groups to solve problems & create products. Revision required for nonmajors’ students.

## References

- Bonney, K. M., (2015).
- Davis, C. and Wilcock, E., (2003).
- Meyer et al., (2018).
- Barkley, E. F. (2010).
- McFee et al., (2018).
- Nicolaidou et al., 2018.
- Sonnenfeld (2019).

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