We adhered to the behavioral research ethics protocol for our university in this study and the participation in the study was voluntary. Quantitative and qualitative data on student attitudes were collected based on the research design shown in Figure 1.

**Biological Altitdue Survey (BAS)**
- Designed to capture students’ attitudes towards biology.
- Included 63 statements in the pre and 70 statements in the post survey that were developed in consultation with Di. All students were in the first year of the course. The survey was open for 10 days each time.
- Student’s data was reviewed. A p-value 0.05 or less was considered to be statistically significant.
- Data were also subdivided into three groups based on marks in the final exam.

**Midterm Feedback Survey (MFS)**
- Administered in the middle of term to evaluate the effectiveness of teaching strategies and resources in the course and to identify elements that need modification and that succeeded in supporting student learning.
- 67% of students responded.

**Focus Group Interviews (FGI)**
- Three semi-structured, one-hour sessions were conducted by a graduate student. The interviews were audio recorded and the transcripts were analyzed.
- Interviews were guided by a set of questions on student opinions on teaching strategies and resources, e.g., activities, teacher, teaching strategies, etc.
- Sessions were audio-recorded and transcribed. The transcripts were then qualitatively analyzed through emerging themes. Any disagreements were discussed and resolved for inter-rater reliability.
- The frequency of comments was classified as frequently emphasized, several mentions, or mentioned once.

**RESULTS**

1. **BELIEFS**

   **Biological science as a science**
   - Evidence: A study of 100 students found 83% to agree that biological science is a science.
   - Interpretation: A significant shift towards agreement from 43% to 60% among all students (p<0.05).

2. **MOTIVATION**

   **Intrinsically curious, need to know**
   - Evidence: 72% of students agreed that biological science is a science, and 85% of students agreed that the need to learn is frequently emphasized.
   - Interpretation: A significant shift towards agreement from 35% to 64% among all students (p<0.05).

3. **LEARNING STRATEGIES**

   **Relate or apply to real-life situations, problem-solving**
   - Evidence: A study of 100 students found 78% to agree that biological science is a science, and 81% of students agreed that the need to learn is frequently emphasized.
   - Interpretation: A significant shift towards agreement from 43% to 60% among all students (p<0.05). Similar trend noted in both aggregate and sub-groups.

CONCLUSION

- There is a need to relate curriculum to the natural world to provide students with a context for biological concepts. The links need to be explicit and be incorporated into a broad picture of societal and global issues.
- Curricular hooks need to be incorporated into instruction to capture student attention. The relevance of the curriculum needs to be explicit to enhance interest and motivation for learning.
- The purpose of using instructional strategies needs to be explicit to students. The intentionality of instruction enhances student awareness of expectations and their responsibilities in adopting appropriate learning strategies.
- Instructional support is needed for students that are not confident in their own abilities or are less sophisticated in their approaches to learning biology.
- There is a need to build students’ confidence in biological problem solving by introducing more practical activities.
- Course assignments and assessments can be designed and scheduled to motivate students to read and use the material on a regular basis.
- Students need to be reassured that assessment in the course will evaluate concepts, critical thinking skills, and problem solving rather than memorization of facts.
- Evidence can be further analyzed to identify instructional strategies that effectively engage students and those that require modification to further enhance engagement.

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