The use of QuestionMark to deliver flexible "decision-driven" learning

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Decision making processes and learning

- Decisions form a central part of conceptual learning and drive processes that stem from learned material.

- These span disciplines and inform on student understanding and appropriate application of knowledge.

- In life sciences, such decisions are central to executing experimental procedures accurately and appropriately.

- With this in mind, the current project aimed to build a simulation of a key experimental protocol driven by a student "decision engine".

The Western blot: a decision-driven experimental protocol

- The Western blot is one of the most commonly used experimental procedures in the life sciences.

- It studies protein in experimental samples, and is a fundamentally important technique.

- Actual practical classes are infeasible due to costs and time constraints.

- As a complex procedure, the Western blotting protocol involves many stages, and these can be mapped as decisions points.

- Each decision has a bearing on the final experimental result, and by presenting students with control of these decisions their learning can be applied, reinforced and assessed.

- Downstream of each decision there are unique consequences depending upon the precise decision made; these can be linked to each decision and presented as informative feedback.
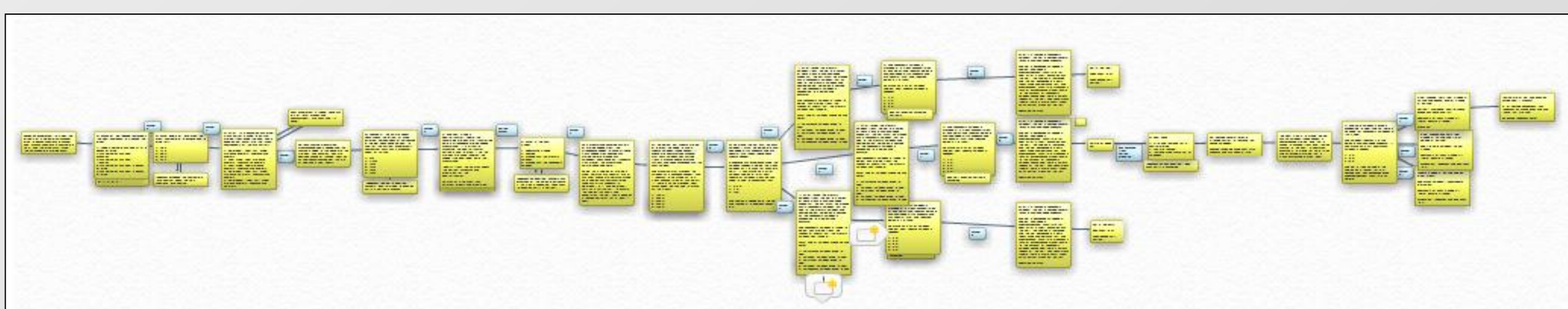

Figure 1: The Western blotting procedure mapped as a series of decisions with consequences. The consequences of each decision create a series of loops and branches that realistically demonstrate how these steps will affect the outcome of the procedure (bubbl.us).

Bringing the process to life with QuestionMark

- The decision points mapped in Figure 1 were transformed into "drag and drop" questions within QuestionMark.

- This provides:
  - *visual impact*
  - *interactivity*
  - *enhanced experience of protocol/apparatus*
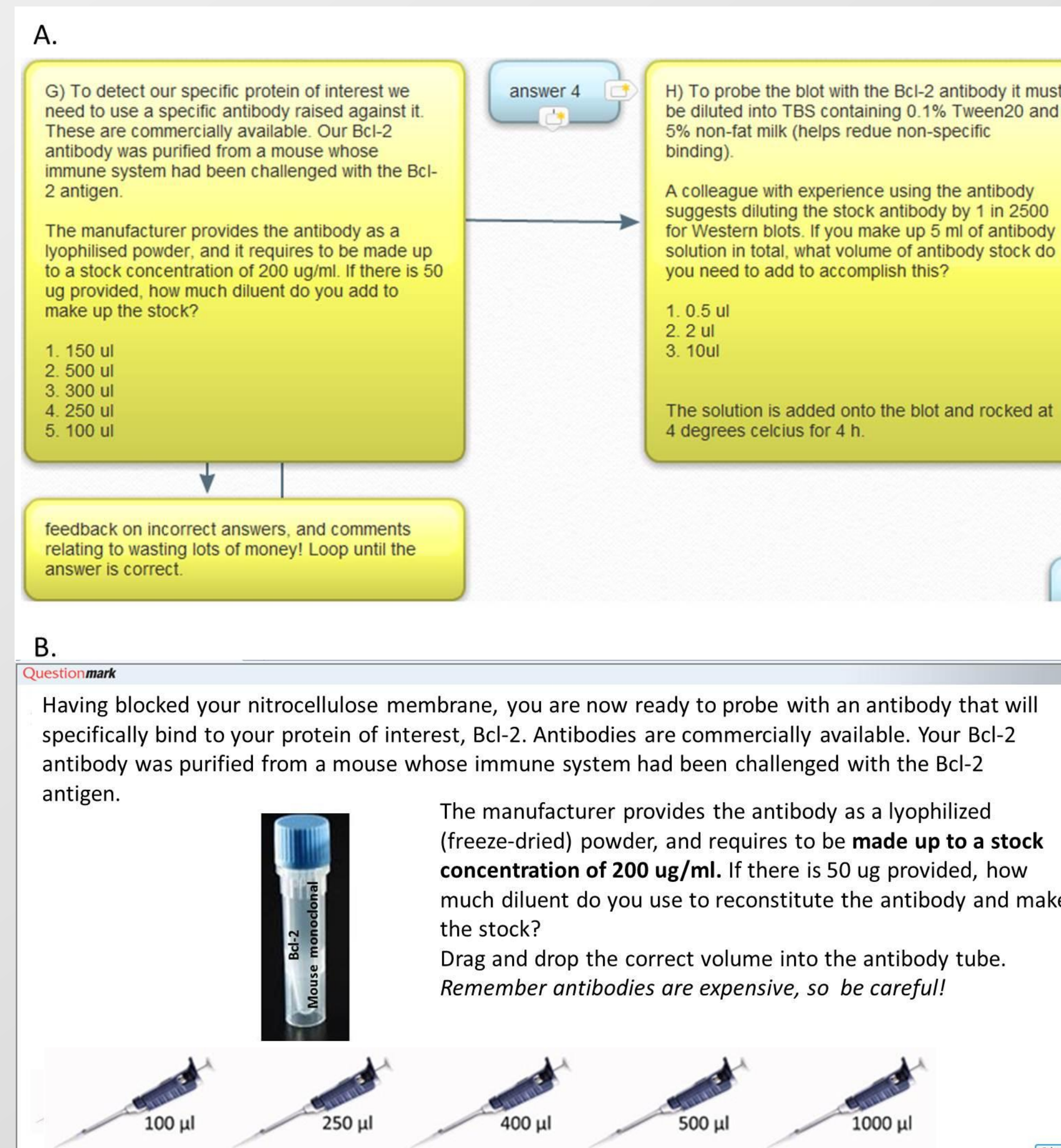
- *"Brings process to life"*

Figure 2: Transformation of decision points into "drag and drop" questions within QuestionMark. A. An original decision point within the flowchart (Figure 1). B. The decision point transformed into an interactive question.

- Following transformation, questions were intricately aligned with consequences and feedback.

- Incorrect answers link to consequences and then feedback aimed at reinforcing correct concepts. The student is then redirected to the initial question again.

- Correct answers link to reinforcing feedback and then progress through the protocol.

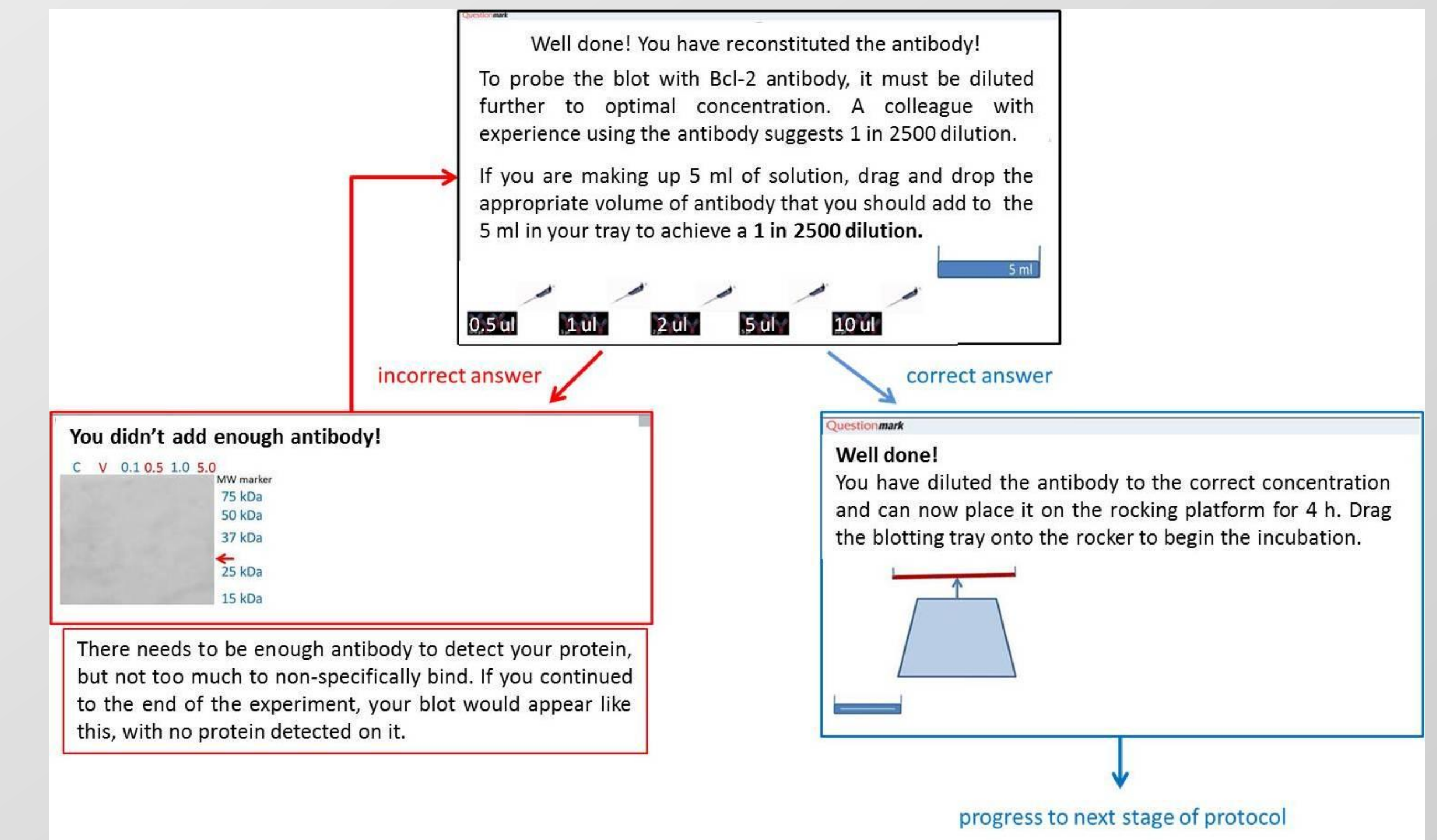- Such circuitry provides progressive, reflective, experiential learning of the process.

Figure 3: Design and alignment of consequences, feedback and progress.
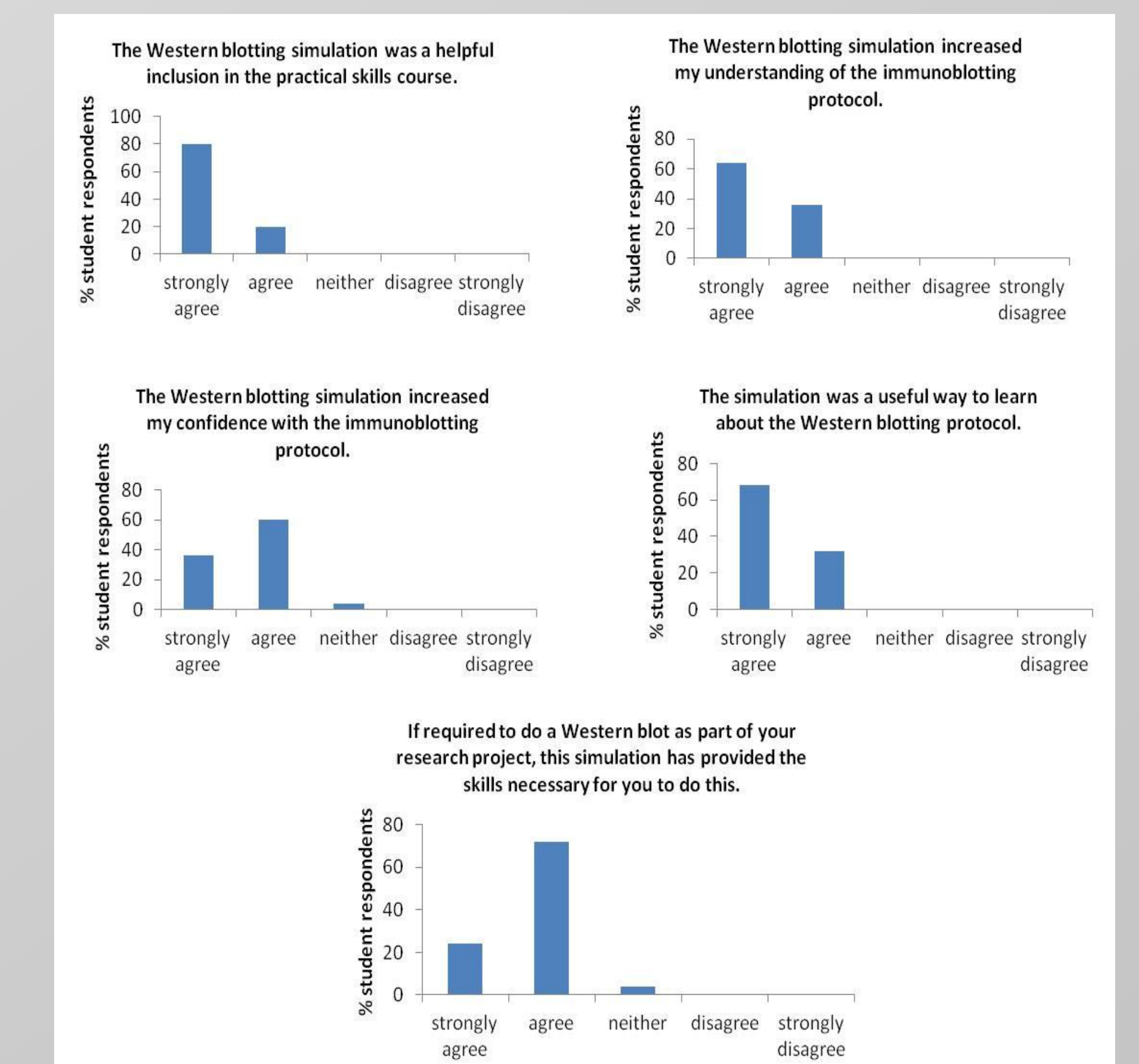
Student feedback

Figure 4: Student feedback from 2013 BT5901 laboratory skills MSc cohort (25 students).

Outcome

- The simulation was very well received by students and increased confidence with the protocol.

- Provides experience of the decision driven process in a safe environment and enhances understanding.

- Broadly applicable to any discipline with decision driven processes e.g. Law, Engineering, Business