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Characterizing an organism through a highly adaptable lab jigsaw activity

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Abstract

The jigsaw is a well-known cooperative learning technique and is quite amenable to all different types of learning contexts. Expert groups each work on different small tasks. Participants are then shuffled so that in the new jigsaw groups each member holds a unique piece of information. Discussions were had first, then each jigsaw group explained the larger complete task through an infographic. We ran this activity with dissecting microscopes and each group looked at a different aspect of a complicated mutant phenotype. Understanding how these different aspects connected became important in the jigsaw groups. Comparing other jigsaw group's creations and a whole class discussion greatly assisted students to fully solidify their ideas for their final products. This technique was used in a genetics lab in very different contexts. Students felt it improved their learning and that they all made important contributions to their group.

Keywords: cooperative learning, jigsaw, group work, infographic

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INTRODUCTION

The jigsaw is a cooperative learning activity that has been around since the 1970s (Arnason et al. 1978). It was first created to ease tensions and the competitive environment in a diverse elementary school classroom. Our students have become quite fluent in groupwork since the pandemic and while they may struggle with complex tasks or putting together a number of ideas, the jigsaw helps. A learning task is divided into a number of smaller tasks. Each group is assigned one smaller task where they become the experts in this area. After completing their smaller task, the groups are shuffled so that each new group contains a member from each of the original groups. Within these "jigsaw" groups students work to put together the information from each individual and complete the larger assignment. Each member holds a separate piece of the puzzle, meaning everyone's contribution is important to complete the assignment (Fig. 1).

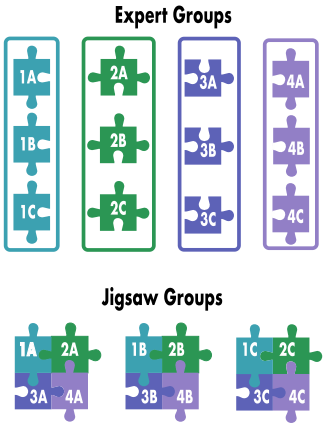

Figure 1. Design of the two-step jigsaw activity. Expert groups work on different tasks first and then new groups form with one member of each of the previous groups where they share their unique knowledge and work together to complete the larger assignment.

The jigsaw is easy to understand and implement, and as such, it has been used in diverse classroom situations (primary school through to university classrooms, lecture halls and labs) as well as every subject area one can imagine. A recent meta-analysis (Drouet et al. 2023) carefully considered 69 different studies to suggest how to gain the most benefits and these suggestions match well with our findings in a genetics lab class as well as the discussion had with attendees in this mini workshop.

METHODS

1. Place students in expert groups of 3-6 people all assigned the same small task. These tasks must each be unique and of comparable difficulty.

2. After 5-15 minutes (or longer) shuffle the groups so that now each new jigsaw group has 1 member each from all the previous groups. Each member has unique knowledge that they share. If the tasks interconnect, the discussions are crucial and become very lively. In the mini-workshop while characterizing mutant *Arabidopsis* flowers, the gynoecia and sepal people, for example, realized that the mutant sepals look like open partially-fused gynoecia. There were other connections between knowledge-holders as well.

3. The new groups put all this information together to complete an assignment integrating their knowledge. In the genetics lab and in this mini-workshop each jigsaw group made an infographic characterizing the differences between the wild type and mutant flowers.

4. Time is provided to let all the students circulate and see the completed assignments made by other groups. A class discussion is important. ABLE mini-workshop participants did this, but wanted even more time for discussion. Expert feedback from the instructor helps in case any individual group member struggled. Then the jigsaw groups can revise and resubmit.

NOTES FOR THE INSTRUCTOR

How to be an expert

Drouet et al. (2023) suggested some students in their expert groups could benefit from being able to rehearse together how they will explain their unique information when they switch groups. Within these expert groups they could also roleplay: “How will you explain it if they ask you about X?”

Everyone’s knowledge is valuable even if it gets edited down

Knowledge holders can become very invested in having everything they learned be in the final product. If, however, they feel heard and they see everyone’s information is being trimmed down and fit together, fears about

their contribution not being equal disappear.

Sharing and feedback

We have found that students appreciate feedback on their rough draft, not just from the instructor but from their classmates as they circulate and see each other's work. A class discussion, with probing questions from the instructor helps before they make their final draft. Student questions about things that came up within their group can lead everyone's final product to be even better.

Fear of drawing

Repeated drawing exercises such as those created by Couch et al. (2022) can reduce anxiety about drawing, if that is part of the task. Alternatively, BioRender (2023) is a free online software that allows students to work cooperatively on the same infographic at the same time. It is designed especially for biology with thousands of images of organisms and things that would likely be part of a biology lab or field site. Images can also be easily imported.

CITED REFERENCES

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About the Author

Jennifer has been an Instructor at the University of British Columbia since 2001, where she teaches large second-year lectures in genetics and third-year labs in genetics and molecular biology.

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