A Jigsaw Lesson for First-Order Logic Translations Using Identity

Russell Marcus
Hamilton College

American Association of Philosophy Teachers
Biennial Meeting

August 1, 2010
This workshop, relevant to courses in formal symbolic logic, discusses and models a jigsaw lesson for teaching translation into first-order logic using the identity particle.

Jigsaw lessons are cooperative-learning exercises which require interdependence among group members.

Workshop attendees will participate in a jigsaw lesson the content of which focuses on original translations from English to first-order logic (using ‘only’, ‘except’, ‘at least’, ‘at most’, and superlatives).

Take-home:
- teaching techniques: the jigsaw and a method for assigning groups
- new exercises for your logic classes/exams
The Jigsaw

- Developed in the 1970s for elementary schools
  - Elliot Aronson (psychology) in Austin, Texas
  - Poor performance and low self-esteem of African-American children in the wake of school desegregation

- Widely adapted
  - Initially used long-term in classes: the jigsaw classroom
  - May be used for individual lessons
  - Ideal for small, content-delivery tasks

- Benefits
  - Active engagement for all students
  - Independence and responsibility
  - Social benefits

- Requirements
  - instructor preparation
  - student trust (that the moving parts will resolve appropriately)
  - predictable attendance
  - three to five distinct topics, roughly equal in difficulty
Two distinct groups

- base group
- work group

Three stages

- Students start in base groups (five minutes).
- Each student moves to a distinct work group to master a task (ten minutes).
- Students return to their base groups to teach the other base group members what they have learned (25 minutes).

At the end of the lesson, each student in each base group has had the opportunity to learn each of the parts of the complete project.

Figure 1: The three steps of the jigsaw lesson. Each member of each base group attends a work group with a different topic, and then returns to his/her original base group.

Marcus, Logic Jigsaw, Slide 4
Five tasks, so five-membered base groups
1. Sentences using ‘only’
2. Sentences using ‘except’
3. Superlatives
4. ‘At most’ sentences
5. ‘At least’ sentences

In each base group, each person chooses a different topic.

Each work group focuses on one topic.

The size of the work groups depends on the size of the class, not the number of topics.

All groups are best kept small (three-five).
Distributed to work groups

Five sample English sentences and corresponding regimentations in first-order logic

Three additional English sentences with no corresponding regimentations

In the work groups, students learn from the samples and regiment the additional sentences.

Each student learns his/her small task well enough to teach it to the other members of the base group later.

Return to base groups, teaching each other
  - take enough worksheets
I like random group assignments.

Counting-off for base groups

In small classes, work groups can assemble themselves by topic.

> 17: two work groups/ some topics
> 24: two work groups/ all topics

I have a neat trick for assigning groups.
Let’s Do It

- Base groups (5 minutes)
- Work groups (10 minutes)
- Base groups (25 minutes)
A Jigsaw Lesson for First-Order Logic Translations Using Identity

Russell Marcus
Hamilton College

American Association of Philosophy Teachers
Biennial Meeting

August 1, 2010
A: Is that your grade on the top of that paper?
B: Yeah.
A: Is that out of 100?
B: Uh-huh. My professor gives us some really tough quizzes. That’s the fourth one.
A: What are your other grades?
B: Put it this way: the product of my first three quizzes is 2450, while their sum is twice the grade you just saw.
A: Hmm... That doesn’t quite answer the question.
B: You’re right. I forgot to mention that the product of my two lowest grades is less than my highest grade.
A: Ah, that clears it up.

What were B’s four grades?