Effects of Frequent Group Quizzing on Student Learning in Large-Enrollment Classrooms.

Mark Hens
Department of Biology
University of North Carolina Greensboro

UNC Charlotte Summer Institute
May 18, 2009
Charlotte, NC
Learning Biology from RATs in Groups

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Goal: To give you a simple way increase engagement and to gauge how you and your students are doing.
Learning Biology from RATs in Groups

the rationale. . . .

Get students to come to class prepared
Get students engaged in what’s going on in the classroom
More formative assessment
Introduce *desirable difficulties* and *the testing effect*
Get away from constant lecturing
Learning Biology from RATs in Groups

About biology at UNCG . . . .

~ 800 biology majors

two-semester intro course for biology majors (and many others)

~1,800 students last year

24 students (Honors sections) → more than 200 students
Learning Biology from RATs in Groups

about Hens . . .

at UNCG for 12 years
teaching intro biology for 12 years
training

getting to this point (Pet peeves)

1. Student preparation
2. Talking in class
3. Listening to myself (even in small classes)
getting to this point

Fall 2006

February 2007 → Lilly South Conference

‘active learning’
‘cooperative learning’
‘group learning’

etc...

Team-based Learning
precedent for success . . .

• Freeman et al., 2007

Prescribed Active Learning Increases Performance in Introductory Biology

• Armstrong et al., 2007

Cooperative learning in Industrial-Sized Biology Classes
Team-based learning

Multi-step process over a 3-4 week block of time covering one main topic in a course.

1. Preparation
2. Application
3. Assessment

“TBL is an instructional strategy... not just a teaching technique or activity that can be plugged in more or less wherever.” (from Michaelsen et al., 2002)

but that’s what I do....
Team-based learning

Preparation phase \(\rightarrow\) reading and testing/quizzing

“Readiness Assurance Process” (RAP)

or

“Reading Assessment Test” (RAT)

1. Individual test
2. Team test
3. Appeals
4. Corrective instruction
Good RATs are active and collaborative.

Good RATs engage everyone in learning.

Good RATs determine whether everyone understands the reading.

1. Individual test
2. Team test
3. Appeals
4. Corrective instruction
Team-based learning *slightly modified*

Current practice:

- Quiz with five *good* multiple choice questions taken individually. Turn in answer sheets.

- Same quiz taken by a group of four. Choose the correct answer. **Explain the incorrect answers.** Turn in quiz sheets, IFATs, or ‘click’ in the correct answer.

- Review the quiz as a class.

1. Individual test
2. Team test
3. Appeals
4. Corrective instruction
Team-based learning *slightly modified*

**What’s to be gained?**

- Students are better prepared.
- Students know where they stand.
- Students learn by being tested (‘desirable difficulties’).
- Students are engaged.
- Students practice a form of critical thinking.
- Immediate feedback
- ‘*Synergistic learning*’

**Does it work?**

1. Individual test
2. Team test
3. Appeals
4. Corrective instruction
RATs in an ideal world

Goal: team score is higher than the best individual score among team members.

**Figure 11.2**
Readiness Assessment Test Scores

<table>
<thead>
<tr>
<th>Team #</th>
<th>Low</th>
<th>Average</th>
<th>High</th>
<th>Team Score</th>
<th>Team Gain over BEST Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>142</td>
<td>169</td>
<td>188</td>
<td>204</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>126</td>
<td>154</td>
<td>168</td>
<td>201</td>
<td>33</td>
</tr>
<tr>
<td>3</td>
<td>135</td>
<td>164</td>
<td>183</td>
<td>210</td>
<td>27</td>
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<tr>
<td>4</td>
<td>149</td>
<td>165</td>
<td>184</td>
<td>197</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>149</td>
<td>173</td>
<td>192</td>
<td>213</td>
<td>21</td>
</tr>
<tr>
<td>6</td>
<td>107</td>
<td>166</td>
<td>187</td>
<td>207</td>
<td>20</td>
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<tr>
<td>7</td>
<td>135</td>
<td>162</td>
<td>181</td>
<td>213</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>140</td>
<td>163</td>
<td>186</td>
<td>203</td>
<td>17</td>
</tr>
<tr>
<td>Average</td>
<td>135.4</td>
<td>164.5</td>
<td>183.6</td>
<td>206.0</td>
<td>22.4</td>
</tr>
</tbody>
</table>

(Cumulative scores after 4 RATs)

12% higher than the BEST team member
<table>
<thead>
<tr>
<th>Course (enrollment)</th>
<th>Number of tests</th>
<th>Individual scores</th>
<th>Group scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio 355 (SP 07)</td>
<td>5</td>
<td>467</td>
<td>119</td>
</tr>
<tr>
<td>~95 students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio 111 (SU 07)</td>
<td>5</td>
<td>317</td>
<td>82</td>
</tr>
<tr>
<td>~65 students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio 111 (SP 08)</td>
<td>7</td>
<td>567</td>
<td>136</td>
</tr>
<tr>
<td>~100 students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio 453 (FA 08)</td>
<td>5</td>
<td>112</td>
<td>25</td>
</tr>
<tr>
<td>23 students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bio 355 (SP 09)</td>
<td>3</td>
<td>345</td>
<td>83</td>
</tr>
<tr>
<td>~120 students</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>25</td>
<td>1,808</td>
<td>445</td>
</tr>
<tr>
<td>~313 students</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two questions:

- Did students generally do better when they took the test in a group?
- Did the group outperform its highest scoring member? (i.e., was synergistic learning taking place?)
Take the quiz again . . . .

**FIRST**- As a group, decide on the correct answer for all five questions, then . . . . .

**SECOND**- FOR QUESTIONS 2 AND 5 ONLY, discuss as a group why the other choices are incorrect.

Write your explanations, numbered appropriately, on a separate sheet of paper.

Be sure that the names of all group members are printed on the quiz paper and on the explanation paper.

**NO BOOKS OR NOTES ALLOWED, JUST BRAINS.**
Immediate feedback is important.
Two questions:

1. Did students generally do better when they took the test in a group?
Two questions:

2. Did the group outperform its highest scoring member? (i.e., was synergistic learning taking place?)

Bio 355 SP 2007

Bio 111 SU 2007

Bio 111 SP 2008

Bio 453 FA 2008

Bio 355 SP 2009
Two questions:

2. Did the group outperform its highest scoring member? (i.e., was synergistic learning taking place?)
1. Which is the best answer to the following question?
   Energy flows through living systems in the form of ____.
   A. organic molecules
   B. electrons
   C. NADH
   D. ATP

individual

‘group’
So does it work? \(\rightarrow\) on a larger scale

Decrease in D/F/W s?

Improved midterm exam scores?

Improved course grades?
What I like about this . . . .

Motivation to read
Interaction with a purpose (motivation → grade)
Targeted discussion
Students look forward to taking quizzes
*Formative assessment*
*Immediate feedback for everyone*

What I don’t like about this . . . .

Time and effort, concern about content, etc...
Thanks . . . .

Dan O. Smith
Michael Carter