This report examines teachers' educational background and students' overall performance on the Third International Mathematics and Science Study-Repeat (TIMSS-R). Data analyses show that there are 17 Delaware classrooms performing above the average U.S. student score of 502. The majority of teachers in the top 10 higher performing classrooms had undergraduate degrees in mathematics. The overall trend indicates that the higher performing classrooms have teachers with a graduate degree. Teachers' years of experience are not correlated with higher or lower student performance. (KHR)
TEACHER PREPARATION: HOW IS IT LINKED TO STUDENT ACHIEVEMENT?

Julie Cwikla, Ph.D.
Mathematics Education
University of Southern Mississippi

June 2002

Funding Agency:
Delaware Foundation for Science & Math Education

Copyright 2002 J. Cwikla
INTRODUCTION

The first set of research studies (www.rdc.udel.edu) focused on the Delaware Science Coalition's performance on the Third International Mathematics & Science Study - Repeat (TIMSS-R) indicated there are performance differences across students with various ethnic backgrounds on both the TIMSS-R and the Delaware Student Testing Program (Cwikla, 2001). The recently released TIMSS-R data allow students to be linked to their teacher. This report will examine teachers' educational background and their students' overall classroom performance.

TIMSS-R PERFORMANCE SCORES

The TIMSS-R performance scores were computed using "plausible values" or multiple imputation methods. Each student was administered only a fraction of the mathematics items. Time would not allow each student to complete every item. A plausible value is an estimate of how each student might have performed if they had been administered the entire test. Five plausible values were computed for each student, based on responses to the item set administered and responses by students' with similar characteristics and other items. Therefore reporting an individual student's plausible score(s) is not statistically reliable. However, examining classroom performance and groups of students provide performance trends.

A separate study examined the highest and lowest TIMSS-R performers in Delaware and their teachers' characteristics (Cwikla, 2002). This study grouped students by their mathematics classroom and teacher to investigate overall classroom performance and teacher preparation. Mathematics classroom average performance scores were used to separate classrooms into high and low performers. As with previous TIMSS-R studies I have conducted there is no one golden key and in this case, no "perfect" teacher. However, there are trends and similar characteristics across teachers of the higher performing classrooms. And likewise, there are similarities across teachers of the lowest performing classrooms. Keep in mind these scores are based on plausible values and this report links average classroom scores and does not address individual students who might be outliers within their classroom.

OVERALL DELAWARE CLASSROOM PERFORMANCE

When average classroom performance is examined there are 17 Delaware mathematics classrooms performing above the U.S. national average mathematics score of 502 and 30 classrooms performing below the national average. The figure below shows the distribution of all participating Delaware classrooms and the U.S. national average (See Figure 1).
Forty-seven Delaware mathematics classrooms were selected to provide a stratified sample of students in the coalition to participate in the TIMSS-R study. In a separate study (Cwikla, 2002) the top 40 individual student performers were linked to 13 teachers, 12 of whom provided educational background information. In this study, the top 10 performing mathematics classrooms were linked to their teachers' characteristics and educational background (See Table 1).

**Table 1: Top Performing Delaware Classrooms' Teachers' Background**

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Classroom Performance</th>
<th>Bachelors</th>
<th>Masters</th>
<th>Years Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>613</td>
<td>Mathematics</td>
<td>Mathematics</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>607</td>
<td>Mathematics</td>
<td>Mathematics Education</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>592</td>
<td>Mathematics &amp;</td>
<td>Mathematics Education</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>588</td>
<td>Mathematics</td>
<td>Mathematics Education</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>582</td>
<td>Other</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>559</td>
<td>Mathematics &amp;</td>
<td>None</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 1: Mathematics performance by classroom.**
The majority of the teachers of the top performing classrooms hold a masters degree in mathematics or mathematics education. In addition all but one teacher holds an undergraduate degree in mathematics or mathematics education.

LOWEST PERFORMING CLASSROOMS & THEIR TEACHERS

The teachers' characteristics of the 10 lowest performing classrooms are displayed in Table 2 below. Four low performing classes were eliminated because they had less than twelve students. It is hypothesized that these classes might have been remedial classes or for students with special needs. The majority of the teachers of the low performing classes do not hold masters degrees.

Table 2: Lowest Performing Delaware Classrooms' Teachers' Background

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Average Classroom Performance</th>
<th>Bachelors</th>
<th>Masters</th>
<th>Years Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>371</td>
<td>Mathematics</td>
<td>None</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>387</td>
<td>Education</td>
<td>Mathematics Education</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>396</td>
<td>Mathematics &amp; Education</td>
<td>None</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>411</td>
<td>Mathematics</td>
<td>Mathematics</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>423</td>
<td>Other</td>
<td>None</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>423</td>
<td>Mathematics</td>
<td>Mathematics Education</td>
<td>15</td>
</tr>
</tbody>
</table>
It should be noted that all of these data are teacher reported and teachers' backgrounds cannot be verified. Moreover, the survey was designed so that teachers could check more than one major degree, and it is not clear in the case when mathematics and education were checked, if that indicates a double major, a minor, or teacher certification. This issue was complicated by the order of the choices on the survey: mathematics, education, and mathematics education. Teachers might have checked choices without first reading the whole list and then not changed their response. These data should be interpreted with these issues in mind.

CONCLUSIONS
A summary of these data analyses follow.

- There are 17 Delaware classrooms performing above the average U.S. student score of 502.
- The majority of teachers of the top 10 higher performing classrooms have undergraduate degrees in mathematics.
- The overall trend indicates that the higher performing classrooms have teachers with a graduate degree.
- Teachers' years of experience are not correlated with higher or lower student performance.

REFERENCES

Contact the author with comments/questions: Julie_Cwikla@yahoo.com
**Teacher Preparation: How Is It Linked to Student Achievement**

**Author(s):** JULIE CWIKLA

**Corporate Source:** DELAWARE FOUNDATION FOR SCIENCE AND MATHEMATICS EDUCATION

**Publication Date:** JUNE 2002

---

**II. REPRODUCTION RELEASE:**

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, Resources in Education (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

- **Level 1**
  - PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY
  - TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
  - Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.

- **Level 2A**
  - PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY
  - TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
  - Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only.

- **Level 2B**
  - PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
  - TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
  - Check here for Level 2B release, permitting reproduction and dissemination in microfiche only.

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

---

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

**Printed Name/Position/Title:** JULIE CWIKLA/ASS'T. PROF.

**Organization/Address:** UNIV. SOUTHERN MISSISSIPPI

**Telephone:** 228-542-6397 **FAX:** 228-542-6397

**Date:** 5/25/02

**E-Mail Address:** julie.cwikla@usm.edu

---

(over)
### III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

<table>
<thead>
<tr>
<th>Publisher/Distributor:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Price:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

### V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

**ERIC CLEARINGHOUSE ON ASSESSMENT AND EVALUATION**  
**UNIVERSITY OF MARYLAND**  
**1129 SHRIVER LAB**  
**COLLEGE PARK, MD 20742-5701**  
**ATTN: ACQUISITIONS**

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

**ERIC Processing and Reference Facility**  
4483-A Forbes Boulevard  
Lanham, Maryland 20706  

| Telephone: 301-552-4200  
| Toll Free: 800-799-3742  
| FAX: 301-552-4700  
| e-mail: ericfac@lnet.ed.gov  
| WWW: http://ericfac.piccard.csc.com  

EFF-088 (Rev. 2/2000)