

## **Estimator Bug – Error with SEM - Reported on 5/21/2010**

### **Introduction**

Estimator users may or may not know that “debugging,” correcting errors or “bugs” in the computer code is part of all software development and maintenance. The following describes how a recent bug was discovered in Estimator and what was done to correct it. The example, underscores the importance of users being vigilant and reporting suspicious consultation results.

### **How the Bug was Discovered**

An Estimator user from central Utah entered the following scores for a nine year old student:

\* Aptitude Test: Woodcock-Johnson III Tests of Cognitive Abilities, General Intellectual Ability – Std Standard Score = 118

\* Achievement Test: Key Math - Revised - New Norms, Operations Standard Score = 95.

The consultation report returned a confidence that there was a severe discrepancy of 75. The user thought this seemed low given the difference in the aptitude and achievement scores. She also noticed the standard error of measurement (SEM) for the achievement test was reported to be 0. This is an obvious error because SEMs are always greater than 0.

Concerned about the possibility of an error the user called the Estimator help line, 435-752-6305 or 435-757-7372, and reported her concern.

### **The Bug - What Happened**

1. A single line of code used the variable “apt\_age” instead of “ach\_age”. The “apt\_age” variable contains the age in months at time of aptitude testing. The “ach\_age” variable contains the age in months at time of achievement testing.
2. This program bug only resulted in an error if the age at the time of aptitude testing was not within an approved age range for the achievement scale used. So there had to be a difference in ages at the time of aptitude and achievement testing and the difference had to be enough to put the age of aptitude testing below or above the range of ages acceptable for the achievement test used.
3. The line of code where the bug occurred was researching the mean and standard deviation of the achievement test, which Estimator needs in order to calculate if there is a severe discrepancy. This error did not affect the program’s ability to identify the reliabilities or correlations.

4. The results of the error were that the achievement test mean and standard deviation obtained were zero. The calculations using these numbers to be affected. In all but two cases, the confidence generated was lower than it should have been.

5. There were 58 cases of this bug out of the 26,265 consultations since March 2009. The first case occurred in a consultation run on 1/13/2010, after over 9500 successful consultations had been run.

### **How the Bug was Corrected**

After fixing the code in the Estimator program, individual reports were developed for each Estimator user that had run one or more affected consultations. The reports were attached to the following email message:

Dear Estimator User,

We recently identified a rarely-occurring bug in the Estimator program where the program was miscalculating the student's age at the time of achievement testing. The miscalculation consequently affected the confidence level calculated that represented whether the student exhibited a severe discrepancy. Out of almost 25,000 Estimator consultations, 58 consultations were in error and 25 students were affected.

We have determined that you have run one or more of these consultations. Since we do not store student names for consultations, the attached information will allow you to determine your students whose consultations were affected. To confirm from your own records the consultations that had an error, check the Standard Error of Measurement (SEM) on the Summary of Discrepancy Information report. The SEM appears in parentheses next to the achievement test score on the report. If the consultation had an error, the report will say "(SEM = 0.000)".

For each consultation included in the attached report, we have indicated the confidence reported in your consultation along with the correct confidence. In some instances, the confidence generated in the erroneous report indicated the child did not have a severe discrepancy, when in fact, the correct confidence indicated that there is a severe discrepancy. With this information, you may want to revisit your qualification decisions.

We apologize for the error and any inconvenience it may cause you or your students. The error has been corrected, so if you re-run the consultation(s) the program will now generate accurate reports. If you have any questions please feel free to contact Dick Baer at 435 757-7372.

Again, our sincere apologies for any inconvenience you may be caused.

Dick Baer

### How Bugs are Prevented or Discovered and Corrected

As with many software programs, Estimator program bugs are generally prevented or discovered and corrected in two ways:

1. Beta testing – Prior to releasing the web based Estimator for general use, multiple test cases representing the many branches of the program were run and compared to the stand-alone disc based Estimator results.
2. Periodic check routines – Periodically, the logs of the data used in consultations (the ages, tests and scores) are run in the stand-alone Estimator formula and the two sets of data (intermediate values and final confidence) are compared to check for differences. The last set was run in December 2009 – almost 9000 consultations with virtually no differences.

The logged student ages, test names, and scores were used to find and fix the bug within hours of it being reported. Additional logged data also made it possible to find the 58 erroneous cases and to identify the users who entered the case data. Since, for confidentiality purposes, specific names of students and schools are not kept, we could not provide these users with anything more student-specific on the cases than the date of the consultation and student's date of birth.

### How the Bug was Missed

In corresponding with users who had run the affected consultations, it was discovered that a user from northern Utah had run a consultation with an aptitude score of 94 and an achievement score in the 60s. The consultation report returned a 33 percent confidence that there was a severe discrepancy. A confidence that was highly unlikely given the magnitude of the difference between the two scores. However, as the user later stated:

I saw the 33% likelihood and laughed given an IQ of 94 and a PLS score in the 60s. I knew something was awry, but just threw away the printouts. It's the only time it happened to me.

This underscores the importance of Estimator users reporting suspicious results immediately. Had the user reported the findings, the bug might have been detected and corrected sooner and fewer consultations affected.

### Conclusions

1. Utah users have more than two decades of experience with Estimator.

2. It has been beta tested and periodic check routines are run to see it is working properly. As software programs go it is highly stable and reliable.

3. Even so, no one can guarantee that any software program is completely free of bugs.

4. Recently, a bug was found because a user noticed a questionable result and asked for clarification.

5. The Utah State Office of Education/Special Education (USOE/SpEd) provides support for Estimator and Estimator users. Any user can call (435-757-7372 or 435-752-6305) or email (rd\_baer@msn.com) the Estimator developers, Effective Instructional Materials and Systems (EIMS), for help.

6. USOE/SpEd and EIMS solicit all users as allies in making Estimator the best it can be. If you question a result, please report it.