Assessment for Learning - Diagnosing blockages in student understanding

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Abstract
This workshop will demonstrate how teachers can improve their assessment for learning. You will witness how educators can obtain exceptionally powerful insights into their assessment of written answers, multiple choice assessment and practical work. You will see how your teachers’ workload can be reduced and students’ outcomes improved. Educational leaders will see how their teachers can:

1. Self coach by identifying the strengths and weaknesses in their pedagogy.
2. Identify gaps in student learning not observable under conventional assessment.
3. Quantify question quality. Teachers will be able to identify the quality of their questions.
4. Correlate student progress over time. Teachers will be able to track a student's strand of learning across a range of assessments not observable under conventional assessment.
5. Understand the nature of student erroneous thinking.
6. Store student records in a readily retrievable form for the short and long term.

Introduction

While teaching, the author was frustrated by his inability to accurately determine what educational strategies were the most effective and to know how much students had really mastered. In cases where a student failed an assessment the author had little idea of the answer to the question; where next? The author’s experiences showed, there was no means of moving from hind sight, as in this instance, to insight and then foresight if we were to advance the education of those students who were struggling.

Knowing about Hattie’s effect sizes (Annex A) is one thing, but to be able to quantify ones’ own teaching effectiveness is another. Similarly, knowing some students are not progressing is all very well but it is often difficult to determine the reasons for poor achievement. Progress in these two vital aspects of educational understanding has not changed markedly over the last century. The struggle therefore is not the province of the student alone. Teachers struggle with identifying the best/most appropriate style of pedagogy that creates the most progress for their students.

Laptop computers are seen by some as a solution to educational productivity. However, a ten million dollar research project reported by Hu showed that there was no significant improvement in educational outcomes by students with laptops compared with those without laptops. This calls into question how the education dollar is best used.

A sad reality in Australia is that the socio economic status of students is a better indicator of student outcomes than our national educational assessments. This need not be the case. Both the Finns and Canadians have
broken this unfortunate connection. It is through effective assessment for learning that the connection with socio economic status and educational outcomes can be broken.

Our nation’s wealth is expected to grow as a consequence of improved educational outcomes across the board. OECD “…research indicates a country can achieve gains of up to 2.5 per cent in gross domestic product per capita from a 1 per cent increase in literacy performance.” (Gillard) Improvements in education can therefore be seen as nation building and wealth producing for all.

The reverse is also worth noting. Dr. Bridget Dalton, Vanderbilt University, states, “…Several states, project the number of prison beds they will need in the future on the basis of reading results achieved by third and fourth grade students.” (Stevenson)

Teacher Self Assessment

“It is critical that teachers learn about the success or otherwise of their interventions” Hattie p. 24.

With this in mind a teacher is now able, with AutoMarque, to mark thirty students’ paper based responses to multiple choice questions, in less than two minutes, using a photocopier or portable sheet fed scanner connected to a computer. The students’ responses are transferred to the computer which then processes the results. In doing this, teachers can quickly obtain an insight into the quality of their teaching effectiveness and clearly see gaps in student learning. Assessment of written work, using ‘digital rubrics’ in conjunction with AutoMarque, though more time consuming than multiple choice assessments provides insights into the teacher’s pedagogy and strengths and weakness in student understanding.

Researchers like Hattie, Glasson and Petty emphasis the importance of teachers’ feedback to enhance student learning. Hattie noted that Nuthall found that 80% of students feedback comes from their peers and 80% of that is incorrect. (Hattie p. 4). The author contends that teachers too have a need for feedback to enhance their effectiveness.

By using assessment for learning in a well planned consistent manner, producing powerful data, a teacher can easily identify deficiencies in his/her pedagogy and through self-coaching address the deficiencies which have lead to less than desirable student outcomes. More than this, teachers can save considerable time by only teaching what their students don’t know. According to Hattie, (Hattie p. 241) students already know forty percent of the material the teacher is planning to teach. Automarque is ideal for this.

Imagine, if you will, that you are alerted by AutoMarque, that the last unit you had taught was not understood by most of your students even though it was a method you had been using for many years. In discussions with colleagues about how they taught such material, you learn they use the same pedagogical methodology. Wouldn’t this be a handy wakeup call for your team to look afresh at how the unit could be better taught?

How does AutoMarque inform the teacher of his/her teaching effectiveness?
After scanning either multiple choice sheets, practical ‘digital rubric’ analysis sheets or written ‘digital rubric’ analysis sheets on your photocopier, you open AutoMarque on your computer. There are two forms of evidence available to indicate your teaching effectiveness:

- class results by strand of learning within the assessment, and
- results per question.

To obtain results by strand of learning, click on one of fifteen icons available. Figure 1 is a summarized version of the class’ success by strand of learning. In this case, the teacher needs to reconceptualise his/her teaching of the three strands of learning in which the class performed poorly.

To obtain results per question, click on . Figure 2 shows the students’ results per question and the strand of learning to which each question belongs. An indication of the overall reliability of the test is also shown.

Reliability of the test is calculated by AutoMarque using the Kuder Richardson formula 20 (KR20) test of reliability. KR20 is the most accurate of the practical Kuder Richardson formulas for estimates of reliability. It measures consistency of responses to all the items within the test. It is the mean of all possible split-half coefficients. (Athanasou et al, p. 315).

In the cases where more than one choice has to be made, per question, to obtain a correct answer, in a multiple-choice assessment test, reliability and
consistency is measured by AutoMarque using Cronbach’s coefficient alpha. (Athanasou et al, p. 179).

![Automarque Question Analysis](image)

**Figure 3**

Figure 3, identifies the questions that were least well performed by the class. This is achieved by clicking on this icon.

In effect, figures 1, 2 and 3 provide a teacher with insights into her/his teaching effectiveness enabling immediate redirection of the teaching effort, where necessary, to meet the class’ needs. Similarly, if it is evident that the students know and understand the topic then time is saved by not spending any more time on it.

When compared with the traditional practice of revising the whole test, teachers are now able to define the areas of weakness in learning in a class as a whole and concentrate their teaching resources to address the class’ specific needs. The author understands this aspect of AutoMarque’s output is a ‘world first’. These insights enable teachers to reflect on which teaching methods are effective/appropriate for their students and explore alternate strategies where necessary. As Hattie would define it, ‘reconceptualise the learning’. (Petty, p. 63) This aspect of AutoMarque is of immense assistance to teachers as it provides new insights into their professional practicum. It also assists teachers to confirm that they have taken students from surface to deep learning.

It is the author’s experience that there are many highly qualified teachers who are gifted in their particular subject area, but are unaware that they have poorly developed teaching skills. It is therefore apparent that AutoMarque would be a powerful aid to help such teachers and more importantly, their students.

**Students at the centre**

Prompt feedback to each student when assessed by multiple choice assessment is readily achieved by clicking on the print icon within AutoMarque producing a sheet per student as shown in Figure 4. This removes the need for hand marking multiple choice student work and yet provides detailed feedback. This is in line with Hattie’s findings that feedback is one of the most powerful things you can do for your students in their process of learning.
AutoMarque’s assessment of written work relies on the production of a ‘digital rubric’. An example of which is found at Annex B. In developing a ‘digital rubric’ the teacher needs to deeply reflect on what is to be taught, what assumptions of prior/foundation knowledge or understanding or skill that the student should have at the outset and what the student will be expected to demonstrate after teacher intervention. Initially, a list of the strands of learning that are fundamental to the topic is produced. Under each strand of learning a number of questions are written. Each question needs to be able to be answered with a yes or no. If, as in the case of question 3 in Annex B, the teacher cannot answer yes or no then the question needs to be broken down even further. Much will depend on the target audience and teacher expectations. Once the digital rubric is developed in AutoMarque a copy is printed and the required number of photocopies are made. The teacher marks yes or no to each digital rubric for each student and then scans the sheets. The marked sheets are then given to the students as their feedback. Powerful feedback indeed!

The scanned results will appear as if they were multiple choice questions. They provide the teacher with powerful insights, similar to those above, not previously obtainable. The feedback to the teacher enables him/her to improve his/her teaching effectiveness and to better understand individual student needs.

This form of assessment enables the ready use of ‘21st century skills’ (Critical thinking, analytical, reasoning and problem solving skills) and the analysis of student progress, aside from the pedagogical challenges that they present.

Similar assessment sheets could be used by teachers to assess individual students as they participate in team work, thus broadening the base of assessment and effective feedback in areas of practical work such as public speaking, theatrical and musical performance.

Assessment for learning as detailed above, has great potential to assist teachers improve the quality of their teaching but will not necessarily deliver insights into individual student needs.

Under conventional assessment students are usually allocated results as either a letter, raw score or a percentage. The following table (Figure 5) illustrates student results of a numeracy assessment in both raw score and
percentage. The author contends that these results are of little use to teachers alone. However, within AutoMarque they are a source of deep analysis which is easily obtained by clicking on one icon at a time.

Individual student results, by strand of learning, compared with their peer group are obtained on the click of a mouse on [Figure 5]. This provides a powerful insight into an individual student's needs (Figure 6). Conventionally the student's teacher would not have know that the student could not do any of the 'chance and data' questions even though he obtained 62% in the test. It can be seen therefore that this feedback provides powerful insight into a gap in learning that would otherwise have been invisible.

How many other students needs like this are going un-noticed?

![Figure 5](image)

![Figure 6](image)
AutoMarque’s student strand analysis result sheet is of great assistance when advising the teacher’s supervisor that intervention is required. As AutoMarque stores test results, a history of student achievement is readily retrievable and student progress easily and clearly demonstrated.

A teacher’s understanding of a student’s learning needs are further improved when the same test is conducted a second time, after intervention. (Figure 7) For teachers who wish to create a feeling of progress amongst their students this facility is particularly powerful, especially when it is used in a pre-test/post test situation. This form of result is also a powerful tool for counselling students who are struggling as it is not a comparison with their peers.

If you would like to see how a student has succeeded in one strand of learning over a series of assessments it is only a matter of clicking on to obtain an image like that in figure 8. So long as the strand has the same name it can analyse a student’s success over a wide range of subjects.

If a teacher wants to obtain an overview of which students have similar learning difficulties AutoMarque’s ‘needs analysis’ shows this, (Figure 9). It ranks students from the least successful to the most successful in a particular strand. AutoMarque also enables the ranking of a series of classes within an institution, based on a single strand of learning. This enables a more tactical approach to identifying groups of students who have similar learning needs so that effective targeted remediation can be implemented. Many schools use this approach to determine the prior learning of new students, particularly those beginning high school or secondary college.
One of the requirements for conducting assessments or surveys of special needs students is to keep multiple choice response boxes next to the question.

AutoMarque solves this problem by enabling the assembly of questions next to the response boxes. An example of this appears in figure 10. AutoMarque enables a test or survey to be up to 10 pages per student.

The need
The above is all very well but is it needed one may ask?
The Victorian Parliament’s Education and Training Committee endorsed Seven Principles of Highly Effective Professional Learning.

They are:

“1. Focused on student outcomes (not just individual teacher needs) 
2. Focused on and embedded in teacher practice (not disconnected from the school) 
3. Informed by best available research on effective teaching and learning (not just limited to what they currently know) 
4. Collaborative, involving reflection and feedback (not just individual inquiry) 
5. Evidence based and data driven (not anecdotal) to guide improvement and measure impact 
6. Ongoing, supported and fully integrated into the culture and operations of the system – schools, networks, regions and the centre (not episodic and fragmented) 
7. An individual and collective responsibility at all levels of the system
AutoMarque enable teachers to meet these requirements in a very powerful way and in a much more effective fashion than previously possible.

Identification of quality questions

There are considerable free resources on the ‘net’, usually in pdf format, available for teachers to acquire. The quality of these questions can then be assessed by AutoMarque. AutoMarque requires a minimum of 100 students to have completed an identical test before the question quality analysis can take place.

![Automarque Question Analysis](image)

In figure 11, we see how five classes, 130 students, have completed an identical test and that an analysis of each question is displayed as well as an indication of the test’s overall reliability.

AutoMarque expresses the difficulty of a question as a percentage of the students who answered incorrectly. For discrimination, the software uses a Point Biserial Coefficient of Correlation between the correctness of the response to the given question and the students’ result in the test as a whole. (Athanasou and Lamprianou, p. 309)

The confidence intervals displayed are indicated by the length of each line, per question, for difficulty and discrimination. The line’s length is inversely proportional to the square root of the sample size.

Teachers can use this facility to verify the quality of test questions. This will help teachers ensure that they are using quality assessments and better guarantee quality students’ outcomes.

Most photocopiers scan a sheet per second, so school wide moderation assessments can also be easily conducted. After selecting an appropriate test, the teacher co-ordinator only needs to photocopy off the number of response sheets required.

Once the test has been completed, the results sheets are fed through the photocopier to obtain student results as well as an idea of teacher effectiveness. The major advantage of moderation testing or assessment of
learning is the real time results and AutoMarque’s ability to disclose what would, under other circumstances, be unknown.

Weighted results

AutoMarque provides weighted and non weighted results. The weighted results are derived by either of two methods.

The simplest method is when teachers use standardised tests with known difficulty ratings for each question; eg. ACER PAT assessments as per the Wright Map supplied. In this case the levels of difficulty are entered into the software before marking the test.

The other method is designed for tests where the level of difficulty is unknown. For this to work, at least 100 students need to have completed the same test. The weightings are obtained by firstly having AutoMarque complete Question Analysis (Figure 11) and then click on the top left corner of the screen. AutoMarque calculates the weighting of each question based on the level of difficulty of each question.

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Names</th>
<th>Score</th>
<th>W%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zealand</td>
<td>Aberdeen</td>
<td>8</td>
<td>14.0</td>
</tr>
<tr>
<td>Yolanda</td>
<td>Bamaby</td>
<td>26</td>
<td>46.5</td>
</tr>
<tr>
<td>Xee</td>
<td>Christine</td>
<td>29</td>
<td>52.1</td>
</tr>
<tr>
<td>Williams</td>
<td>Douglas</td>
<td>8</td>
<td>10.6</td>
</tr>
</tbody>
</table>

Class Average 23.0 35.5%

Some of the results per student are shown (Figure 12) with weighted results shown as ‘W%’. This column of results will change to unweighted when double clicked on its title. There were 30 students in this class, AutoMarque automatically averaging the results.

Identifying student erroneous thinking

With conventional assessment, establishing the reasons behind incorrect answers has frequently been difficult. AutoMarque provides two techniques to assist teachers to understand more about student misunderstanding or wrong thinking. They are:

- Generation of a spreadsheet for detailed perusal, and
- Segment analysis of student responses.

A spread sheet is generated by clicking on the top left corner of the screen. AutoMarque, part of which is seen in figure13. The spreadsheet enables the teacher to identify the distracters chosen by students for each question.
For example, in question five only 12 per cent of the students selected the correct answer, ‘A’ while 81 per cent chose ‘B’. Looking at the nature of distracter ‘B’, the teacher can see why the students misunderstood and which students did not understand this specific aspect of the subject and help them accordingly.

Figure 13

The use of segment analysis of student responses is even more powerful in analysing student thinking. This is obtained by clicking on \( \text{ } \) to obtain a graph describing the student’s thinking figure 14.

![Figure 14](image)

Figure 14 shows the results of a 16 question test on basic fraction manipulation.

The student,

- Correctly answered seven questions
- Added without using a common denominator for four questions
- Subtracted without using a common denominator for four questions
• Multiplied instead of dividing for one question

From the above, we can now see the student needs assistance in the use of a common denominator for both adding and subtracting and needs to improve her reliability when dividing fractions.

Under conventional practice, the teacher would have had to spend time observing the student’s method of calculation. To do this with every student in a class group is an inefficient use of teacher time compared with AutoMarque’s rapid clear identification of each student’s needs. AutoMarque enables the teacher to quickly identify which students have the same learning need and to quickly address them.

This same process of data collection can be used for surveys of students to monitor student well being (minimise bullying), student sports carnival choices, optional subject choices and parental surveys. School psychologists find AutoMarque’s ability to reduce the time spent on data entry and correlation a great advantage.

AutoMarque’s ease of data collection reduces teacher and teacher leaders’ workloads and yet provides insights not previously obtainable without considerable time consumption. Hence the expression, “Let your photocopier do your work”

Conclusion

This has been a brief summary of some of the features of AutoMarque and its benefits for teachers and above all, their students. It is clear from the above that we have a resource that provides teachers with self coaching/advice on their teaching effectiveness.

AutoMarque is a great time saver enabling teachers to do their assessments of student work quickly and reliably; providing exceptionally powerful feedback. It provides data for the profession to describe quality outcomes and has potential to shorten courses of study, thus raising the profession’s productivity.

AutoMarque moves teachers and their leaders beyond the use of hind sight, as it provides teachers with powerful real-time insight enabling exceptional foresight of teachers and students needs.

Above all, it is a wonderful tool for assessment for learning which will enable teachers and students to better embrace the challenges of the 21st century.

Annexes

Annex A – John Hattie’s Table of Effect Sizes from Petty, G, Evidence Based Teaching, Nelson Thornes, 2006

Annex B – A Digital Rubric for Assessment of Written Work
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