



# The elements of effective professional development

Centre for Education Statistics and Evaluation



## The elements of effective professional development

Status as a practitioner in any profession is synonymous with ongoing professional development. A professional's education and training are continuous. New knowledge and techniques based on further research in the field mandates this process. As professionals, teachers recognise the need for professional development. The questions that arise however are:

- In teaching what are the elements of effective professional development?
- How do we ascertain the most effective forms of professional development?
- How do we measure the effectiveness of that professional development?
- How does it translate into better classroom practice?
- How does professional development improve, and how do we measure, educational outcomes for students?

High-quality teaching is the greatest in-school influence on student engagement and outcomes<sup>1</sup>. Teachers and researchers value quality professional development as one way to improve teaching practice with a subsequent improvement in student outcomes<sup>2</sup>. A report compiled by the United States' Institute of Education Studies in 2007 examined the overall impact of professional development across a number of evaluation studies and found an average and consistent effect size of 0.54, indicating that providing professional development to teachers does have a positive effect on student outcomes<sup>3</sup>. Students who did not have a teacher receiving professional development would have increased their achievement by 21 percentile points if their teacher had received professional development<sup>4</sup>.

Professional development affects student outcomes through three steps:

1. professional development enhances teacher knowledge and skills;
2. better knowledge and skills improve classroom teaching; and
3. improved classroom teaching raises student outcomes<sup>5</sup>.

The impact of professional development however, decreases at each step. Hattie's synthesis of 800 meta-analyses notes that professional development is likely to change teacher knowledge with an effect size of 0.90. However, it is less likely to change their behaviour (0.60) and even less likely to have an influence on student learning (0.37)<sup>6</sup>.

This paper acknowledges the difficulties in attributing changes in student performance to professional development, as well as the difficulties in judging effectiveness through the use of student performance measures over the short term.

However where excellent teaching practice showing evidence of positive impacts on student outcomes can be identified, it should be analysed and shared. This paper provides a short introduction to the available evidence evaluating the impact professional development on student outcomes.

This paper adopts an OECD definition of *professional development*:

'activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher'<sup>7</sup>.

### Effect Sizes

Where possible, this report will analyse the impact of particular elements of professional development by referring to effect sizes. Effect sizes are often used to measure the difference in performance of two groups. In an education context, this often means the performance difference between students whose teachers received professional development and those whose teachers did not. American statistician, Jacob Cohen, suggests using the following as a guide:

\* A 'small' effect size is 0.2

\* A 'medium' effect size is 0.5

\* A 'large' effect size is 0.8

In his research on educational interventions, New Zealand professor of education John Hattie, suggests that programs with effect sizes of 0.40 or higher are worth considering for implementation.

Ref: J Cohen 1988, *Statistical power analysis for the behavioural sciences*, Hillsdale, NJ, Erlbaum; J Hattie 2009, *Visible learning*, Oxon, Routledge.

1 See for instance, M Barber and M Mourshed 2007, *How the world's best-performing school systems come out on top*, McKinsey and Company: 12; OECD 2009, *Evaluating and rewarding the quality of teachers: International practices*: 13; B Jensen 2010, *Investing in our teachers, investing in our economy*, Grattan Institute: 10; J Hattie 2009, *Visible learning*, Oxon, Routledge.

2 M Barber and M Mourshed 2007 (n 1 above): 26-27. OECD 2009, *Creating effective teaching and learning environments: First results from TALIS*: 74; Table 3.8. The 2009 Teaching and Learning International Survey (TALIS) reported that teachers identified the most effective forms of development as 'individual and collaborative research', 'informal dialogue to improve teaching', and 'qualification programs', all with close to 90% of teachers reporting a moderate or large impact. However the report notes that compared to other countries, Australia, (alongside Austria and Brazil), views the impact of most kinds of development less positively.

3 K Yoon et al 2007, 'Reviewing the evidence on how teacher professional development affects student achievement', *Issues & Answers Report REL 2007-No. 033*: 14. Note that all the studies examined professional development for elementary school teachers.

4 Yoon 2007 (n 3 above): 14.

5 Yoon 2007 (n 3 above): 4.

6 Hattie 2009 (n 1 above): 120.

7 OECD 2009 (n 2 above): 49.

This paper adopts Knapp's definition of *professional learning*:

'changes in the thinking, knowledge, skills, and approaches to instruction that form practicing teachers' or administrators' repertoires'<sup>8</sup>.

### **More empirical evidence is needed to identify what works in teacher professional development which leads to improved student outcomes.**

Many studies that investigate the effects of professional development programs focus on teacher behaviour and satisfaction as opposed to student outcomes<sup>9</sup>. This is only part of the picture. For example, a meta-analysis published in 2007 examined 146 studies that calculated the impact of professional development in maths but included only 14 studies that documented outcomes for students<sup>10</sup>.

These studies only provide an incomplete picture because there is little association between teacher perceptions of professional development and improved student outcomes<sup>11</sup>. Some studies record significant positive impacts on teacher outcomes as a result of professional development, but do not also find significantly higher outcomes for students<sup>12</sup>.

Even where student outcomes have been explicitly measured, it can be difficult to isolate the impact of professional development on any changes in these outcomes. Student outcomes are inevitably affected by other education factors such as school leadership, the curriculum, school culture, school structure and resources and much more<sup>13</sup>.

### **The empirical evidence base needs to be more robust.**

There are a lot of data available about students, and some evidence that suggests what modes of teaching and school practices can improve student outcomes. However, robust studies focussing on how teacher professional development programs impact student outcomes have been lacking. For example, one report by the Institute of Education Studies' examined 1,300 studies attempting to address the effect of teacher professional development on student outcomes and found only nine that met the What Works Clearinghouse standards for rigorous evidence<sup>14</sup>.

This paper identifies elements of professional development that have the greatest impact on student outcomes. Where possible, this paper will use meta-analyses because these reports compare and contrast conclusions drawn from multiple empirical studies. These kinds of reports can help 'overcome the issue of lack of statistical power in studies with small sample sizes and ... obtain a more precise estimate of the average impact of an intervention ... across multiple implementations'<sup>15</sup>.

## **Empirical Evidence**

Empirical evidence is a source of knowledge acquired by means of observation or experimentation. It is considered to be the most robust form of evidence.

### **Types of Empirical Evidence**

Randomised controlled trials measure an intervention's effect by randomly assigning individuals to an intervention group (that receives special treatment) or a control group (that does not receive any treatment) and then comparing achievement of the groups over time. RCTs are known as the 'gold standard' in policy research, and have informed policymaking in areas such as driver education, school vouchers, welfare reform, health insurance and rental subsidies.

Quasi-experiments compare outcomes for intervention participants with outcomes for a comparison group chosen through methods other than randomisation. For example, a comparison-group study might compare students participating in an intervention with students in neighbouring schools who have similar demographic characteristics (e.g. age, sex, race, socioeconomic status) and educational achievement levels.

Ref: A Leigh 2009, 'What evidence should social policymakers use?', *Economic Roundup* (1): 32; Coalition for Evidence-Based Policy 2007, *Hierarchy of study designs for evaluating the effectiveness of a STEM education project or practice*, <http://coalition4evidence.org/wp-content/uploads/2009/05/study-design-hierarchy-6-4-09.pdf>.

- 8 M Knapp 2003, 'Professional development as a policy pathway', in R Floden (ed.), *Review of research in education*, American Education Research Association: 112-113.
- 9 H Timperley 2008, 'Teacher professional learning and development', *Educational Practices Series* 18: 10; A Alton-Lee 2011, '(Using) evidence for educational improvement', *Cambridge Journal of Education* 41(3): 305; For an example see M Garet et al 2001, 'What makes professional development effective? Results from a national sample of teachers', *American Educational Research Journal* 38(4).
- 10 L Scher and F O'Reilly 2007, *Understanding professional development for K-12 teachers of math and science: A meta-analysis*, Paper presented to the American Educational Research Association Annual meeting, Chicago.
- 11 R Giallo and L Hayes 2007, 'The paradox of teacher professional development programs for behaviour management: Comparing program satisfaction alongside changes in behaviour management practices', *Australian Journal of Educational & Developmental Psychology* 7: 108-119; S Zentall and J Javorsky 2007, 'Professional Development for Teachers of Students with ADHD and Characteristics of ADHD', *Behavioral Disorders* 32(2): 78-93.
- 12 M Garet et al 2008, 'The impact of two professional development interventions on early reading instruction and achievement', Report prepared for the Institute of Education Sciences under Contract No. ED-01-CO-0026/0020.
- 13 D Hough 2011, 'Characteristics of effective professional development: An examination of the developmental designs character education classroom management approach in middle grades schools', *Middle Grades Research Journal*, 6(3): 131.
- 14 What Works Clearinghouse 2013, *Procedures and Standards Handbook: Version 3.0*, accessed 29 Jan 2014, at <http://ies.ed.gov/ncee/wwc/DocumentSum.aspx?sid=19>. The What Works Clearinghouse is an initiative of the US Department of Education's National Centre for Education Evaluation and Regional Assistance, within the Institute of Education Studies.
- 15 Scher and O'Reilly 2009, 'Professional development for K-12 math and science teachers: What do we really know?', *Journal of Research on Educational Effectiveness* 2: 222.

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## What elements of professional development are effective?

### *Professional development programs tend to be more effective when they focus on deepening teachers' content knowledge and knowledge about how students learn that content.*

The content-focus of professional development is concerned with both teachers' content knowledge of a particular subject matter and their understanding of how students learn that subject matter. The empirical evidence base supports claims that deepening teachers' subject matter knowledge and knowledge about how students learn can lead to significant and sustained positive impacts on student outcomes<sup>16</sup>.

Scher and O'Reilly's meta-analysis of 18 robust studies (yielded from a total of 145) found that curriculum-focussed professional development programs that emphasised content, how to teach specific content and how students learn, generated a more positive effect on student outcomes (effect size: 0.56) than programs that focus on pedagogy only (effect size: 0.07)<sup>17</sup>. This example is based on maths-focussed professional development programs.

Other pieces of evidence also show statistically significant and positive effects of the content-focus of professional development. However these reports do not produce effect sizes as large as Scher and O'Reilly's.

For example, a 2009 meta-analysis conducted in the United States examined 74 pieces of evidence to quantify the effects of content-focussed professional development on student outcomes, again in maths and science. The study found 16 studies (12 in maths; four in science) that used robust research designs; all of which stressed the importance of improving teachers' specific content knowledge, knowledge of how students learn content, and pedagogical knowledge on how to teach the content to students<sup>18</sup>. For the maths studies, a mean effect size of 0.21 was found for pre-post research designs (comparing student performance before teacher professional development to their performance afterwards) and 0.13 for post-test only research designs (comparing student performance between those whose teachers participated in professional development and those whose teachers did not)<sup>19</sup>.

Another comprehensive meta-analysis of 97 studies on professional development, compiled in New Zealand in 2007, also found that successful programs were those informed by a deep understanding of the subject matter to be taught and how students were likely to learn that subject<sup>20</sup>. This conclusion was drawn from the analysis of 11 professional development programs in maths (effect sizes ranged from 0.18 to 4.63), eight science programs (effect sizes ranged from 0.19 to 2.85) and 13 literacy programs (effect sizes ranged from 0.06 to 3.73)<sup>21</sup>.

The professional development program producing the extremely high effect size of 4.63 involved teachers from two different schools participating in a three-day workshop to learn about teaching approaches designed to develop students' metacognition in mathematics. Students whose teachers had received the training improved their attitudes towards mathematics (effect size: 4.27) and their mathematical achievement (effect size: 4.63)<sup>22</sup>. High effect sizes were the result of very low initial scores.

A second study included in the New Zealand research investigated the impact on student outcomes of professional development in cognitively guided instruction<sup>23</sup>. The program was 'designed to provide teachers with a classification of addition and subtraction problems and descriptions of variations in students' thinking around those problems'<sup>24</sup>. Examination of student achievement data showed that students of teachers who participated in the program recalled number facts at a higher level and also showed better results in problem solving and confidence compared to their control group peers. Overall effect sizes of this program were calculated as 0.59 on students' maths grades, and 0.45 on students' attitudes towards maths<sup>25</sup>. According to Hattie's suggested guide on how

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16 L Desimone et al 2013, 'Linking student achievement growth to professional development participation and changes in instruction', *Teachers College Record* 115(5); G Saxe, M Gearhart and N Nasir 2001, 'Enhancing students' understanding of mathematics: A study of three contrasting approaches to professional support', *Journal of Mathematics Teacher Education* 4: 61; M Kennedy 1998, 'Form and substance in inservice teacher education', *National Institute for Science Education Research Monograph* 13; Alton-Lee 2011 (n 9 above): 311-312; for information regarding the sustained influence of developing teachers' pedagogical content knowledge on student outcomes, see H Timperley, A Wilson, H Barrar and I Fung 2007, *Teacher professional learning and development: Best evidence synthesis iteration*, New Zealand Ministry of Education: xlvii.

17 Scher and O'Reilly 2009 (n 15 above): 230.

18 R Blank and N de las Alas 2009, *Effects of teacher professional development on gains in student achievement: How meta analysis provides scientific evidence useful to education leaders*, Washington, Council of Chief State School Officers.

19 Blank 2009 (n 18 above): 27.

20 Timperley 2007 (n 16 above): 251.

21 Timperley 2007 (n 16 above): 78, 109 and 143. The research points out that greater emphases on content knowledge of subject matter were evident in mathematics, science and writing than in reading.

22 See M Cardelle-Elawar 1995, 'Effects of metacognitive instruction on low achievers in mathematics problems', *Teaching & Teacher Education* 11(1); see also Timperley 2007 (n 16 above): 67. The effect sizes were measured by a researcher-developed test.

23 T Carpenter et al 1989, 'Using knowledge of children's mathematical thinking in classroom teaching: An experimental study', *American Educational Research Journal* 26; E Fennema et al 1993, 'Using children's mathematical knowledge in instruction', *American Educational Research Journal* 30. See also Timperley 2007 (n 16 above): 43.

24 S Wilson and J Berne 1999, 'Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development', *American Educational Research Association* 24.

25 Timperley 2007 (n 16 above): 66.

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to interpret effect sizes, this program would be worthy for implementation consideration<sup>26</sup>.

A third case study calculated the impact of the Numeracy Development Project (NDP) on student outcomes. Outcomes were measured by the students' progression on the Number Framework, which consists of a sequence of global stages describing the mental processes students use to solve problems with numbers. This program provided teachers with the Number Framework to help them determine the level at which their students thought about maths, as well as teaching activities aligned to each level on the Framework. Teachers often found discrepancies between how well they thought students would perform and how well they actually did perform. As a result, teachers were encouraged to challenge their beliefs regarding current teaching practice and were provided with theoretical frameworks on which they could base new teaching practice. The impact on student learning was measured through progression on the Number Framework with an overall effect size of 0.34 (0.40 for Pasifika students; 0.35 for Maori students; 0.38 for low-decile school students)<sup>27</sup>. The effect sizes of this program however, fall just short of Hattie's suggested cut-off (0.40) and therefore might not be considered for implementation<sup>28</sup>.

Although we need to be guarded when it comes to cross-cultural comparisons and acknowledge that what has been true for these NZ studies in Maths may not be true for other subjects. The fact is they offer a basis for seriously considering a similar approach in NSW.

***Professional development programs tend to be more effective when they receive support from school leaders and are seen as part of achieving school-wide goals.***

The evidence base suggests that positive student outcomes are more likely to be achieved through professional development, if that professional development is supported by the wider school community<sup>29</sup>. Teachers do not work in isolation from their surroundings and their classroom practice will inevitably be affected by the school culture in which they work. If teachers are not supported in the implementation of new strategies, professional development will have a reduced impact<sup>30</sup>.

School-wide support should include support from schools' leadership teams. Results of a 2008 meta-analysis found that when school leaders promote, and participate in, teacher professional development, this activity produces an effect size on student outcomes of 0.84<sup>31</sup>. Alton-Lee claims that this practice has twice the impact on student outcomes of any other leadership dimension included in her synthesis<sup>32</sup>.

Teachers need the 'organisational support of their schools in terms of evidence base, collective goals to aim for, and circumstances that continue to motivate improvement' in order to enact sustainable improvements in student outcomes<sup>33</sup>.

***Professional development programs tend to be more effective when they are linked to clear and relevant goals that are related to student outcomes.***

Professional development has been proven to be more effective when it is aligned with specific contextual goals, whether individual or school-wide, that are clearly understood and considered relevant by the participating teachers<sup>34</sup>. Some studies further conclude that the integration of 'concrete, realistic and challenging goals' can not only initiate change in teacher practice, but sustain that change over time<sup>35</sup>.

The New Zealand meta-analysis shows that all of the studies identified as robust in maths (number: 11) and literacy (number: 13) included communication of clear goals related to student outcomes, and found evidence of moderate to high effect sizes on student outcomes<sup>36</sup>.

Some researchers have also quantified the effect that school leaders can have on student outcomes through their participation in goal setting. According to Alton-Lee's 2011 synthesis, the average effect size across seven studies that documented school leaders guiding the setting, communication and monitoring of goals was 0.35<sup>37</sup>.

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26 Hattie 2009 (n 1 above).

27 Timperley 2007 (n 16 above): 250. In New Zealand, a 1–10 system is used by the Ministry of Education to indicate the socio-economic status of the communities from which schools draw their students; low-decile schools receive a higher level of government funding.

28 Hattie 2009 (n 1 above).

29 Garet 2001 (n 9 above): 927 and 931.

30 L Darling-Hammond et al 2009, *Professional learning in the learning profession: A status report on teacher development in the United States and abroad*, the National Staff Development Council, 9: 10.

31 V Robinson, C Lloyd and K Rowe 2008, 'The impact of leadership on student outcomes: An analysis of the differential effects of leadership types', *Educational Administration Quarterly*: 663.

32 Alton-Lee 2011 (n 9 above): 306.

33 Timperley 2007 (n 16 above): xlv.

34 V Robinson and H Timperley 2007, 'The leadership of the improvement of teaching and learning: Lessons from initiatives with positive outcomes for students', *Australian Journal of Education* 51(3): 250; Timperley 2008 (n 9 above): 15.

35 S Baker and S Smith 1999, 'Starting off on the right foot: The influence of four principles of professional development in improving literacy instruction in two kindergarten programs', *Learning Disabilities Research & Practice* 14(4): 240.

36 Timperley 2007 (n 16 above): Chapter 6 and Chapter 8.

37 Alton-Lee 2011 (n 9 above): 307.

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The importance of setting professional development goals in relation to student outcomes brings into light the importance of teachers knowing how to collect and use student assessment data.

The advantages of using assessment data for formative purposes are well documented<sup>38</sup>. Research presented at an Australian Council for Educational Research conference in 2009 showed that student achievement gains accelerated at twice the expected rate when their teachers were using high-quality assessment data effectively. For all schools that focussed on writing, the effect size was 1.20 and for reading, 0.92. Gains were even more pronounced for the lowest performing students, with effect sizes of 2.25 in writing and 1.90 in reading<sup>39</sup>.

Building teachers' abilities to test student outcomes also allows teachers to evaluate the initial and ongoing impact of changes in their teaching practice that have taken place as a result of their participation in professional development programs<sup>40</sup>. These practices can foster sustained improvements in student outcomes.

*There is insufficient evidence to calculate an appropriate number of contact hours or delivery timeframe needed to ensure professional development programs are effective.*

Overall, the empirical evidence base does not identify a specific number of contact hours or a specific delivery timeframe that will ensure professional development translates into improved student outcomes.

A US meta-analysis examined nine rigorous studies to conclude that programs offering between 30 and 100 contact hours and delivered over six to 12 months, were more likely to show a significant positive effect on student outcomes. Conversely, programs of less than 14 hours in total showed no statistically significant effects on student outcomes<sup>41</sup>.

However another meta-analysis concludes that professional development programs that were delivered over more than 12 months displayed a more pronounced effect on student outcomes (effect size: 0.59) than programs that took place over 12 months or less (effect size: 0.14)<sup>42</sup>. Alton-Lee also found that professional development programs delivered over 12 to 24 months were found to have the greatest impact on student outcomes<sup>43</sup>.

Another meta-analysis found 16 studies that all showed positive effects on student outcomes, but varied greatly in both contact hours and overall delivery timeframes<sup>44</sup>. The overall evidence is mixed.

It may be that positive relationships between professional development contact hours or delivery timeframes and student outcomes are the result of how the time is used rather than its quantity. Darling-Hammond, although a proponent of sustained and intensive professional development, proposes that longer programs may be seen as more effective because they are typically associated with professional development activities such as coaching or study groups<sup>45</sup>. It should be noted, however, that other meta-analyses conclude that no particular professional development activity, such as coaching or study groups, can be heralded as more effective than others<sup>46</sup>.

What the research does agree on is that professional development programs that include follow-up sessions with participants after the initial program has taken place are more likely to have positive effects student outcomes<sup>47</sup>.

The research also unites in its aversion to short, one-off, professional development programs such as one-day workshops or conference talks<sup>48</sup>. Relative to other types of professional development, Australian teachers reported that participation in education conferences and seminars was less effective<sup>49</sup>. The only exception to this consensus seems to be in regards to programs that target narrow curriculum goals or students experiencing very low level outcomes, for example, 'a single one-hour session showing teachers how to screen students for auditory processing problems and then address implications for classroom communication'<sup>50</sup>.

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38 See for example, P Black and D Wiliam 1998, 'Inside the black box: Raising standards through classroom assessment', Phi Delta Kappan 80(2).

39 H Timperley 2009, 'Using assessment data for improving teacher practice', Paper presented at the Australian Council for Educational Research Conference, 16-18 August.

40 Timperley 2007 (n 16 above): xlvii.

41 Yoon 2007 (n 3 above): 12.

42 Scher and O'Reilly 2009 (n 15 above): 230. Scher & O'Reilly's results were only in regards to maths-focussed programs.

43 Alton-Lee 2011 (n 9 above): 308.

44 Blank 2009 (n 18 above): 18.

45 Darling-Hammond 2009 (n 30 above).

46 Kennedy 1998 (n 16 above); Timperley 2007 (n 16 above): xxxv; Scher and O'Reilly 2009 (n 15 above): 231.

47 Timperley 2008 (n 9 above): 21.

48 Yoon 2007 (n 3 above): 1.

49 OECD 2009 (n 2 above): 74.

50 Timperley 2007 (n 16 above): xxviii.

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### *The effectiveness of professional learning communities depends upon their composition.*

Another element of professional development that is contested within the evidence base is the impact of professional learning communities on student outcomes.

A number of literature reviews on the impact of professional development on student outcomes emphasise the importance of creating professional learning communities<sup>51</sup>. One study that examined a professional development program that aimed to train teachers in co-operative learning activities, reported small overall effect sizes (0.20 in maths; 0.25 in reading), but larger effect sizes for students with a disability (0.47 in maths; 0.81 in reading) and gifted students (0.39 in maths; 0.67 in reading)<sup>52</sup>.

However, professional learning communities are also associated with negative effects on student outcomes in the evidence base. Alton-Lee's synthesis of 72 studies concludes that counterproductive professional learning communities can 'reinforce existing deficit thinking and structural inequalities'<sup>53</sup>.

The authors of the New Zealand meta-analysis offer a resolution to this contradiction, noting that if professional learning communities are to positively affect student outcomes, the communities need to continually focus on improving student outcomes and include experts who will work to ensure teaching practice is continually linked to student outcomes as well as challenge entrenched beliefs<sup>54</sup>. External expertise was a feature of nearly all the studies examined in this meta-analysis that were effective.

However, the common use of experts in these studies could be an artefact of study selection in that researchers may be more likely than practitioners to publish their findings in ways that meet the study design criteria used by the authors when identifying suitable studies for inclusion.

Overall, the evidence base on the effectiveness of professional learning communities is mixed. Hattie suggests that professional learning communities might work to improve student outcomes, but they are not sufficient by themselves. He suggests that something is needed to challenge problematic beliefs, test the efficacy of competing ideas, and ground discussions in student outcomes<sup>55</sup>. The New Zealand researchers suggest that experts could be used to take on this role.

### *Teachers and schools should start asking professional development providers more questions about the ultimate impact of their courses on student outcomes.*

Here in Australia, as well as overseas, there has been a conscious shift by governments and policymakers toward supporting high-quality teaching with evidence-based research.

We have found some empirical evidence that attempts to identify which characteristics of professional development more often result in higher student outcomes, such as the content-focus, school-wide support, incorporation of goals, and use of assessment data. Teachers and schools that are selecting professional development programs may be informed by this research, but should also be aware that as a whole, the evidence base is thin. This is especially true in regards to Australian research.

Furthermore, teachers and schools must seriously commit to implementation and reflection processes after the conclusion of professional development. Even the most empirically validated professional development will not impact student outcomes if teachers do not subsequently change their classroom practice or monitor corresponding changes in classroom performance.

Nevertheless, more focussed, rigorous, systematic work needs to be done that can identify when, how, in what forms, and under what conditions professional development can be successful. However, understanding where research gaps lie is the first step to bolstering this evidence base. By acknowledging what we don't know, we can create 'a methodical blueprint for future research and evaluation of professional development programs'<sup>56</sup>.

As professional development research matures, more empirical studies of professional development programs will eventually make it possible to judge the effectiveness of individual programs. More meta-analyses will be able to combine these studies to provide us with a deeper understanding of which characteristics of professional development are more likely to raise student outcomes<sup>57</sup>.

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51 Menter et al 2010, *Literature review on teacher education in the 21st century*, Scottish Government Social Research; R Bolam and D Weindling 2006, 'Synthesis of research and evaluation projects concerned with capacity-building through teachers' professional development', General Teaching Council England (now abolished); Blank 2009 (n 18 above): 21; L Desimone 2009, 'Improving impact studies of teachers' professional development: Towards better conceptualizations and measures', *Educational Researcher* 38(3).

52 R Slavin and R Stevens 1995, 'The cooperative elementary school: Effects on students' achievement, attitudes, and social relations', *American Educational Research Journal* 32(2).

53 Alton-Lee 2011 (n 9 above): 311.

54 Timperley 2008 (n 9 above): 19.

55 Hattie 2009 (n 1 above): 121.

56 Scher and O'Reilly 2009 (n 15 above): 235.

57 Yoon 2007 (n 3 above): 18.

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