Teaching and learner variation

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This article describes how teachers have adapted instruction to address individual learner differences in group settings. After tracing adaptive teaching back to its roots in antiquity and reviewing psychological theory on adaptive teaching, the authors present examples of contemporary teachers creating a common and dynamic teaching ground in their classrooms, moving along both individuals and the class group. Drawing upon these examples, the authors begin to articulate common principles of adaptive teaching so that educators might benefit from theory that explains how student differences interact with instructional practices and researchers might benefit from information about how practicing teachers both adapt their instruction to students and guide students to adapt to different modes of instruction.

Our topic has a history dating back to antiquity. The idea that the success of education depends on adapting teaching to individual learners appears in writings from the ancient Chinese, Hebrews and Romans. The same understanding persists among modern educational psychologists, who have sought to explain the connection between teaching and learner variation at least since the middle of the nineteenth century (for more history, see Corno & Snow, 1986). Although teachers have always found ways to address students as individuals, today’s mode of educating follows an academic calendar with groups of increasingly diverse students, creating a need for efficient practices that successfully accommodate individuals \textit{within} groups.

In the past, to accommodate individuals within groups, teachers learned to supplement traditional whole-group instruction with differentiation practices such as individualizing, computer-based learning and ability grouping. Such accommodations allow teachers to work within their curricular time constraints to address the needs of a range of learners, including the gifted, students with learning disabilities and those with cultural and/or linguistic differences (Corno, 1995). However, the literature describing methods for accommodating individual differences has yet to contribute a dynamic theory that attends to how education changes individuals over time (Perry & Winne, 2001; Nuthall, 2004).

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Modern information-processing theory demonstrates the importance of particular combinations and sequences of student individual differences in learning from teaching. Students extend their knowledge using cognitive/intellectual resources fuelled, directed or impeded by related processes – including attitudes, goal striving and other affective and conative (i.e. motivational and volitional) qualities and dispositions. New ideas from situated aptitude theory help to explain how education develops such qualities in individuals (Stanford Aptitude Seminar, 2002). By viewing education as a process of aptitude development (Snow, 1996), teachers can organize instruction to promote growth in individuals and in groups of students at the same time.

It seems evident that educators would benefit from a better understanding of how student differences interact with instructional practices. Unfortunately, however, this theory, and most previous research-based knowledge about teaching and learner differences, hails from educational psychology traditions such as factor analysis and psychometrics, which are disconnected from what teachers actually do when they teach. Teachers connect to ideas from the community of practice intended to help them accommodate individual differences, ideas that can be faddish and rest on shaky grounds. Although there is research supporting some differentiation procedures (ways of grouping students, types of materials and media and levels of learning guidance; Corno, 1995), current mantras from the community of practice ask teachers to adjust their teaching to students’ ‘learning styles’, ‘intelligences’ or ‘special learning needs’ (see e.g. Silver, Strong, & Perini, 2000). This message is popular with teachers; multiple lines of development imply that all students can be reached by some mode of teaching. Accordingly, developers offer workshops that encourage teachers to assess various student differences and plan matched instruction (Tomlinson, 1999). However, in matching, teachers concentrate learning experiences where students have most need or promise, limiting opportunities to develop strengths in other areas.

There is also considerable controversy about how teachers should assess individual differences to determine a reliable instructional match. Results of even the best empirically validated instruments require careful interpretation to avoid sending incorrect messages; for example, that a child lacks ‘musical’ intelligence. Moreover, teachers are not as inclined as researchers would like to adopt assessment instruments that have empirical track records; they tend to rely on informal, ongoing observations and experiences with students. Formal testing can take time away from the curriculum, so teachers prefer assessments that can serve simultaneously as learning experiences.

As an alternative to matching, the research community calls for students to learn to adjust to whatever form of teaching they confront. The logic is that negotiating the demands of schooling is a life skill that students ought to acquire; by adapting their learning to whatever conditions of instruction they receive, students ultimately become skilful and productive learners, capable of independence (Corno, 2004). Research increasingly emphasizes strategies students can use to adapt to and fill the gaps in incomplete instruction. Particularly popular, as is evident elsewhere in this volume, are programmes for encouraging teachers to promote ‘self-regulated learning’ in students.

In self-regulating their learning, students engage actively and constructively in a process of meaning generation. They adapt their thoughts, feelings and actions to support their learning and motivation in the content covered. Theoretical models of self-regulation acknowledge that students have the capability to direct their learning, and will do so if encouraged by teachers. However, self-regulation models also assume that differences in biological and developmental factors, as well as the peer and instructional context, may interfere with as well as support efforts by students to self-regulate.
Discussion centres on how students can overcome internal as well as peer and other external distractions by modifying internal constraints (e.g. managing performance anxiety or expectations). Self-regulation is an explanatory construct; theories assume an indirect link between student achievement and individual differences, explaining achievement effects by the planning and implementation activities that students engage to reach learning and performance goals (see e.g. Boekaerts & Corno, 2005). Although research on self-regulated learning enjoys the regard of educational psychologists, related programmes and concepts have not yet been widely embraced by teachers.

There is no disagreement among scholars that student differences influence teaching and learning. The combination of theory and practice on the topic is prodigious. Nevertheless, the dilemma of how the education of individuals occurs within group settings remains unresolved. What is missing from extant theory and research?

From our perspective, researchers need to come closer to the ways that practising teachers successfully address student individual differences when they teach, and teachers need to be encouraged to evaluate the utility of this knowledge base for their own purposes. Accordingly, our research takes a first-hand look at teaching in relation to learning activities, processes and goals. Our intent is to identify effective procedures that some practising teachers use to reach and teach all students in their classrooms and our hope is that others may learn from these teachers. We attempt to distinguish the principles derived from our work that appear generalizable across contexts (see also Nuthall, 2004). Perhaps then, researchers, teachers and professional developers can come together and discuss accommodation strategies that directly address the psychological constructs underlying student individual differences using language all parties comprehend.

Before we illustrate how classroom teachers address learner variation, we review some central theoretical-historical ideas, noting that our evidence from practising teachers helps us to shape a new viewpoint. Whether our position can be supported beyond the preliminary data we describe is an important question for further research. However, with this article, we hope to stimulate some good thinking in this direction.

**Individual differences in context**

Some insights about teaching and individual differences that derive from an ancient source take us back to the root understandings of our topic, re-emphasizing their relevance today.

**Roots of teaching and adaptation**

Reference to the issue of individual differences in students is peppered throughout the history of scholarship on teaching. To give just one example, we turn to the Roman orator, Quintilian, who described his views on teaching in the first century BC:

Some students are slack and need to be encouraged; others work better when given a freer rein. Some respond best when there is some threat or fear; others are paralyzed by it. Some apply themselves to the task and over time, learn best; others learn best by concentration and focus in a single burst of energy (Quintilian, trans. Butler, 1920).

Roman schools of oratory included students at various levels of their rhetorical training. Quintilian provided an example of how teachers might address such differences:
Further, while emulation promotes progress in the more advanced pupils, beginners who are still of tender years derive greater pleasure from imitating the comrades than their masters, just because it is easier. For children still in the elementary stages of education can scarce dare hope to reach that complete eloquence which they understand to be their goal: their ambition will not soar so high, but they will imitate the vine which has to grasp the lower branches of the tree on which it is trained before it can reach the topmost boughs (Quintilian, trans. Butler, 1920).

Quintilian further described teachers coaching individual students while others studied independently. Long before Bandura (1977) elaborated a theory of social learning, Quintilian recognized that being educated in school, rather than at home, enabled learning from the experiences of others as well as one’s own. Quintilian’s description of adaptive teaching is also remarkably similar to Vygotsky’s (1978) concept of a *zone of proximal development* (or ZOPD). Within the ZOPD is the opportunity for guidance from a mentor; the student climbs one branch at a time, just a little farther than he or she could climb alone, until able to perform independently.

As we have said, the dilemma of how to promote individual learning within group settings remains present today. Unlike Quintilian, however, contemporary teachers, especially in public schools, rarely have the luxury of limiting their students to a preferred number. Society expects today’s teachers to provide instruction from which all students can learn across a broad range of special needs and talents, as well as societal conditions. Educational research has documented student variation in response to teaching associated with differences in any number of qualities - developmental level, cognitive/intellectual ability, gender, race, ethnicity and sociocultural background. Although research has shown that it is important for teaching to address individual student differences, teachers probably cannot be expected to adopt Quintilian’s methods in contemporary classrooms. So what can be learned from modern theory on individual differences in response to instruction?

**Psychological theory on adaptive teaching**

One proposed solution to the dilemma of teaching individuals within groups is the systematic use of adaptive teaching or adaptive instruction. Adaptive teaching, as defined in Corno and Snow (1986; see also Corno, 1995), is an attempt to address the needs of individuals in pursuit of both common and individual goals. In the context of classroom teaching, adaptation takes two paths (a) adapting instruction to student differences, and (b) adapting students to the instruction (Corno & Snow, 1986, p. 619).

Adaptive teaching recognizes that individual differences challenge educators who must teach students within groups. However, theories of adaptive teaching also acknowledge that individual differences contribute to the diversity of talent in the collective, and so they ought to be embraced and nurtured. Theorists agree that teachers should *adapt instruction* to individuals, placing equal emphasis on guiding students to *adapt themselves* to whatever instruction they receive (Corno & Snow, 1986). An important goal of education is the development of aptitude, where aptitude is defined as a readiness to perform in the various academic situations that students must confront (Snow, 1996).

Inattention to aptitude development, in part, leads to a proliferation of teaching practices that view student differences primarily as *obstacles to be surmounted* (see e.g. Good & Brophy, 2003). Take, for example, homogeneous grouping and individualized instruction; both practices assess student differences so that they can be minimized.
However, in both cases, the unintended consequence is to call attention to student differences instead. When singled out for individualization, or assigned to an ‘ability group’, students often sense they are different from other students. Instead of viewing student differences as obstacles, teachers can seek to capitalize on student differences in order to educate both individuals and the whole group. For example, by designing activities where students with different styles work together, the teacher can begin to adapt students to instruction, and different students can benefit from similar learning experiences. This approach views individual differences as assisting, rather than impeding, instruction in group settings. As students strengthen weak areas through close interaction with others who have different profiles or styles, differences among them should be less pronounced. As our examples illustrate, the theory is that students who learn in close connection with one another become more alike than different.

From macro- to microadaptation

Adaptive teaching theory makes a second important distinction between adaptations at the ‘macro’ and ‘micro’ levels (Corno & Snow, 1986). At the ‘macro’ level of adaptation, instructional programmes are planned for different groups of similar students based on formal assessments of qualities such as ability (as in gifted education) or sociocultural background factors that influence response to instruction (as in teaching for cultural congruence). Also known as homogeneous or levelled grouping, macroadaptations can be instituted district- or school wide, as well as directed at subject areas (such as maths and foreign language; Corno, 1995).

Educators recognize the practical advantages of planning instruction for similar students it provides an efficient means of matching instruction to learners’ needs. However, ability grouping or tracking has fallen into disfavour because research shows that social and economic inequities can be promoted when students are assigned to ability groups and otherwise tracked. This research also illustrates damage that can be done to student motivation and self-confidence (Oakes, 1985).

As an alternative to tracking, educators have begun to promote ‘dynamic’ or ‘flexible’ homogeneous grouping practices guided by ongoing assessment of needs. Proponents enthusiastically tout flexible ‘within class’ grouping, arguing that these temporary, levelled groups accommodate individual needs without the harmful effects associated with tracking (Tieso, 2003). However, frequent formal testing is necessary in flexible grouping, and this intrudes on instructional time and teacher curriculum making. Moreover, the teacher who targets groups of students within a class then has to manage several groups at once.

In general, evaluations of macroadaptation question the widespread use of large-scale interventions seeking to label certain practices as generally ‘effective’ across students and school contexts. Nevertheless, field experiments with some tailored programmes show particularly strong growth for targeted populations (e.g. Au, 1980). Whether the adaptation is culturally responsive teaching, or teaching self-regulation strategies to highly motivated students with learning disabilities, teaching matched specifically to the strengths of students with common needs can produce strong and important improvements in educational outcomes (Cronbach & Snow, 1977). Effects such as these may explain some of the reasons why individual differences matter to teachers, as well as how they respond to them, especially in contemporary classroom settings.
Nevertheless, researchers have repeatedly observed that teachers find it difficult to become faithful followers who rigorously adhere to programme developers’ best-laid plans (i.e. to ‘implement’ or ‘install’ instruction). The history of implementation research documents teacher resistance to administrative mandates (Randi & Corno, 1997). Practitioners often sense the possibility that some students will not do well with a given instructional programme, and so they prefer to create and adjust their curricula and instruction, even when they ‘buy in’ to the underlying tenets and particulars of given programmes or models (Randi, 1996). Teachers may prefer to operate from a personal mandate to reach their own students however they can (Gilbert, 2005).

So how do practising teachers select and adapt from the variety of instructional approaches to which they are exposed and in what ways do they integrate these approaches into their own instructional repertoires? As mentioned previously, a second avenue for adaptation described by extant theory is microadaptation.

Teachers make microadaptations in the course of instruction and in response to particular students. Research tends to focus on adaptation at the macro level, providing little insight into teachers’ microadaptations. However, microadaptations are critically important because they represent a direct response by the teacher to individual learner differences.

Two paths of microadaptation
Theory posits a continuum of microadaptation along two paths: aptitude circumvention and aptitude development (Corno & Snow, 1986). Fig. 1 shows how the two paths converge to meet learners where they are and move them along the continuum towards independence.

![Figure 1. The continuum of microadaptation (adapted from Corno & Snow, 1986).](image-url)
Along the first path, aptitude circumvention involves adjusting the level of support students receive from teachers. On one end of the support continuum are situations in which teachers seek to circumvent weaknesses by providing pointed instructional support. Support can be more or less intrusive – that is, vary in its control of an individual student’s activity. A high level of guidance serves to ‘short-circuit’ students’ own processes of thinking and behaviour, essentially doing some of the work for students that they cannot do for themselves (Salomon, 1979). High levels of guidance are often necessary when tasks are challenging or novel. With beginners, teachers use techniques such as motivational enhancements, forms of direct instruction and tools designed to remove some of the processing burden from students (e.g. calculators in maths).

The other pole of the support continuum represents minimal teacher guidance. Here, the teacher insists that students work independently, ferreting out solutions to problems and analysing issues. The intent is to activate students’ own thinking and motivation, and the teacher does so using techniques such as forms of discovery learning, independent study, and peer tutoring. In extreme cases, teachers deliberately try to trip-up or challenge errant reasoning.

At intermediate points on the support continuum, adaptive theory locates such instructional approaches as modelling, participant modelling or guided practice and ‘worked examples’ of problems. Such approaches serve the function of demonstrating and engaging students in directed practice with new skills. They are often used with students whose profiles suggest that appropriate scaffolding will move them along.

The theory holds that adaptive teachers traverse this support continuum according to their continuous assessments of students, making instructional decisions for individuals as well as the class group. Over time, with greater levels of support, weaker students can perform tasks previously outside their reach. With decreased or little support on difficult or complex tasks, able students will experience challenges that they might not have otherwise, and come to understand the value of hard work. Thus, as teachers move back and forth on the support continuum, they challenge stronger students and support weaker ones, so that these students become more alike than different, each building relative weaknesses into strengths. Eventually, all students can then benefit from instruction provided to the whole group. Note that here, as in macroadaptive within-class grouping, the teacher adapts instruction to groups of individuals, rather than to individuals alone. Otherwise, individuals may become more, rather than less, different from their peers, making the education of individuals within groups a challenging, if not impossible, task.

We can illustrate this aspect of the theory using an example provided by one teacher at a magnet school. Because magnet schools draw students from both urban and suburban districts, their student populations are especially diverse. One teacher in this particular magnet school explained that he deals with diversity by including some reading content that is ‘just beyond the reach’ of his most advanced students. This strategy ensures that his less advanced students are not the only ones who experience difficulty stretching in his class. In addition, because advanced students have to think through and articulate the strategies they use to access the difficult content, as a result, the weaker readers get the benefit of the more advanced content as well as the thinking of their peers. One interpretation of this practice is that the teacher ‘created’ two groups of students in his class who, in the sense of reaching and learning, again, were more alike than different. It is important to note from this example that both advanced and weaker students are afforded opportunities to be challenged as well as supported.
The second path of microadaptation is direct aptitude development. Again, adaptive theory holds that teachers can use more or less support to develop student skills and abilities. However, in this case, they do so by teaching their students the strategies of self-regulated learning. As with aptitude circumvention, direct aptitude development serves to create a middle ground or a common centre in which all students can participate in learning experiences. In this case, it does so by developing in less successful students some of the academic skills notable in their more successful peers; namely, the skills and habits of self-regulated learning (Corno, 2004). Again, students become more alike than different so that they can be offered the same opportunities to learn.

Direct aptitude development emphasizes the aspect of adaptive theory that targets ways to help students learn to adapt themselves to instruction they receive. It centres on the finding that students’ own efforts enable, rather than impede, learning. For example, during reading instruction, teachers may teach cognitive strategies that good readers use to help weaker readers become more strategic (see e.g. Palincsar & Brown, 1984). Consistent with Snow’s (1992) notion that having aptitude means ‘being equipped’ to work in particular situations, astute teachers will harness student differences and use them to equip others who struggle with better ways to get the most out of learning from teaching. This aptitude development path is under-explored by research on teaching, despite its potential for successfully addressing the dilemma of teaching individuals within group settings.

The aptitudes that teachers might develop in students to help them succeed in school extend beyond cognitive skills and strategies, and, indeed, teachers do have non-cognitive goals. One early study (Hummel-Rossi, 1981) observed that teachers deliberately using directive techniques with apprehensive or insecure students and more permissive techniques with those who were self-assured. The teachers posed intellectual challenges to emotionally stable students and gave encouragement to anxious students. Hummel-Rossi noted that these adaptations were based on teachers’ observations of student affect and conation more than cognitive abilities – what has been called \textit{affcon} for short (Stanford Aptitude Seminar, 2002).

Scholars increasingly acknowledge affective and conative learner differences for the important role they serve in school performance (Snow, Corno, & Jackson, 1996). Practising teachers view conation (i.e. students’ purpoose striving to gain expertise in the material at hand) as ‘effort’ or active engagement. Yet, psychologists have demonstrated that the processes underlying effort are deeply motivational and volitional; they include ways to plan for, establish, and persist towards goals (Corno, 2004). Teachers can develop such qualities in their students (Snow \textit{et al.}, 1996). In addition to conation, affective differences also influence learning. All teachers know that feelings and emotions can determine whether or not students will even attempt some challenging tasks. Because they can be rooted in temperamental differences, however, many affective processes are more difficult for teachers to influence (Stanford Aptitude Seminar, 2002).

Just how aptitude development occurs in classrooms remains hypothetical. According to social cognitive theory, what individuals know comes about through common interaction and experience with shared resources in the learning environment. The jargon that mentors acculturate apprentices into communities of practice means that beginning students learn to participate in a classroom community (Lave & Wenger, 1991). The roles of learners and mentors are fluid; individual differences are valued as opportunities for learning. The theory of ‘distributed cognition’ holds that because
expertise is distributed across a community, in turn, individual cognitions serve a role in changing the system (Salomon, 1993). Thus, the nature of a classroom community and its knowledge base are dynamic reflections of the collective knowledge of the individuals that comprise it.

Social cognitive theory may also explain how teachers shape the classroom learning community. For example, teachers can build on some students’ prior knowledge to create benchmarks (points of reference) for the larger class group, thus providing a foundation for common knowledge. Teachers can also make ability differences less problematic by adapting situations to learners and learners to situations, the two paths of adaptive teaching theory. As Snow (1994) explained, ‘[a]bility differences are invisible when inner and outer environments are perfectly adapted to one another’ (p. 31). The same can be said for other, non-cognitive, student differences as well.

Adaptive teaching depends on teachers’ immediate assessment of students. An awareness of important learner differences allows the teacher to adjust features of the learning environment accordingly. For example, when teachers sense that students are losing interest in the content to be covered, they can add embellishments, such as field trips or guest speakers. They can adjust the level of task difficulty to encourage anxious students or challenge those who are capable of advanced work. They can shape group values towards learning goals by de-emphasizing grades and offering credit for progress. Noting that particular students are spending too much time socializing, they can re-emphasize that performance will be evaluated. The ultimate goal is to increase the number of learners who are capable of working independently within the class group. Thus, adaptive teachers will show students how to create their own embellishments, how to streamline tasks to add interest, to set their own contingencies for engagement and to seek out mentors and resources for additional guidance (see e.g. Randi & Corno, 2000).

When teaching and learners are adapted simultaneously, differences once again become less visible because all students participate fully in the learning experiences. Adaptive teachers keep all learners in the teaching ground by adjusting teaching to learners and learners to teaching. They do this not only by providing appropriate instructional support and challenge, but also by attending equally to other factors that influence learning, such as motivation. Microadaptive teaching involves adjusting all these levels of support for students - support for affect, conation and cognitive information-processing, as well as assisting learners to take charge of their own cognition, affect and conation in response to their learning environments. In addition, teaching at the microadaptive level means seeing differences both within and across learners in the ongoing stream of regular classroom and extracurricular events.

Improving practices for addressing individual differences

As sensible as extant adaptive theory seems, it has had little influence on teachers and their practice. Teachers remain unfamiliar with well-regarded psychological research findings that might profitably guide their efforts to teach individuals within groups. Instead, teachers rely on practical teacher development activities to learn about differentiating, presently including the work of Howard Gardner (1993) and related programmes (Silver et al., 2000). Unfortunately, however, some professional development activities encourage teachers to adopt inefficient and ill-supported practices that may even make student differences more pronounced.
The dilemma of addressing individual differences within groups is reflected in the polarities of practice. At one pole are practices such as individualized instruction that emphasize the needs or styles of individual learners. At the opposite pole are strategies such as homogeneous grouping that attempt to minimize individual differences in order for instruction to proceed. The current practice of *instructional differentiation* encourages practitioners to provide ‘different strokes for different folks’ within the classroom (group) setting (see e.g. Tomlinson, 1999). Like individualized instruction and homogeneous grouping, however, even differentiation practices that seek to strike a balance between the individual and the group assume that student differences are obstacles to be overcome.

### Valuing student differences

In contrast to the ‘difference as obstacle’ point of view, other practices for addressing individual differences may be described as *affording learning opportunities*, especially within supportive environments. In these practices, successful instruction follows the line of theory that encourages learners to capitalize on their strengths at the same time it compensates for weaknesses. Imagine as well that student differences could enable teaching as well as student learning.

From the perspective of social cognitive theory, classroom learning communities afford students opportunities to meet common educational goals through multiple approaches (Brown & Campione, 1996). One example of this is heterogeneous or cooperative learning in which small groups of students work together with less able students learning from more able peers, thus leveraging both teacher support and class time (Corno, 1995). Such small group arrangements permit teachers to devote instructional time to coaching, as one might do in individualized instruction. In very large classrooms with a wide range of student differences, however, it can be a challenge to orchestrate instruction for small groups of students who reflect a variety of individual differences.

### Valuing teachers’ contributions

Whether student differences are viewed as problems or valued as learning opportunities, educating individuals within groups is seldom an easy task for teachers. Accordingly, staff developers tend to simplify the complex task of adaptive teaching, offering ‘packaged’ solutions as models or strategies for teachers to imitate. Recognizing that assessment is a critical component of adaptive teaching, researchers push staff developers to promote the use of instruments that have empirical track records and demonstrated validity (see Nuthall, 2004). In our view, both researchers and developers devalue teachers’ own creative contributions to the dilemma of teaching individuals within groups when they dictate from their respective agendas rather than collaborate with teachers on solutions to their problems. Nevertheless, *teachers do invent immediate solutions* to problems that arise within the course of their practice - they do this all the time; their work cannot wait for research to lead the way. We agree with Darling-Hammond (1993) that teachers will always need the latitude to adapt instruction to particular students. Teachers, students, classrooms and schools do indeed demand immediate attention; teachers are acutely aware that waiting for research and policy to invent solutions is both inefficient and foolish.

To be quick in responding to the diverse and dynamic contexts in which they teach (McLaughlin, 1993), teachers have to work in *sensitive and informal ways* making decisions ‘on the fly’ (Kounin, 1970; McNair, 1978). For teachers, there is little time to
use structured (or psychometrically reliable) assessments of their students’ learning-related psychological qualities. Effective scaffolding (the practice of providing supportive assistance to learners just when they need it; Vygotsky, 1978) depends on the teacher’s ability to simultaneously assess and respond to students’ learning needs (Pressley, Hogan, Wharton-McDonald, Mistretta, & Ettenberger, 1996). This observation explains why, even when valid and reliable assessment instruments are available for measuring qualities that ought to be taken into account in planning and teaching, few teachers actually use them routinely. It also explains the frequently noted observation that teachers resist over-use of standardized tests. Teachers address student differences on an ongoing basis. If teachers are not formally assessing students to address student differences, just what are they doing?

We come finally to the section of this article in which our own research makes contributions to the literature. We have found that teachers tend to respond directly to, rather than measure or formally assess, individual student differences. They collect data on students rather quickly and informally but in a number of sensitive and continuous ways to which we shall refer; then, they search for patterns and group students for efficient teaching. Our evidence for this comes from observations and interviews with particular teachers; however, the finding reoccurs across teaching contexts and grade levels.

One aspect of the theory is that teachers engage in a process of information processing called cognitive organizing as they teach (Corno, 1981); they attend selectively to salient cues in the classroom environment and immediately categorize them to make the ‘rapid judgments’ that teaching demands (p. 365). A study by Eraut (1994, 2002) illustrates this hypothesis. Eraut found that teachers constructed their knowledge of students by implicitly aggregating successive ‘episodes’ or experiences with individual students over time. Episodes involving children who commanded attention by acting out, displayed weak study habits or consistently performed poorly were particularly salient for these teachers. Eraut concluded that teachers construct their knowledge of individual students based on atypical rather than typical behaviour patterns and that knowledge so constructed is fallible and biased, but nonetheless immediately usable as a mechanism for classroom control. Another way of interpreting these findings is that these teachers paid particular attention to student behaviour that they considered likely to impede learning, for both individuals and for the group. For example, teachers might focus attention on redirecting inappropriate behaviour that distracts others in order to ensure that all students retain opportunities to learn.

The examples we provide in this section suggest that, as teachers gain experience with particular students, they begin to see them as falling within subgroups. Teachers’ penchant for organizing the information they process tell them that some students are ‘well-behaved and quiet’, for example, or others are ‘less advanced in the performance range’. These teacher-created subgroups then are viewed as needing more or less immediate attention and support. Teachers provide appropriate support when it is called for, and withdraw support as needed when students are more capable of working on their own. Again, it is important to note that adaptive teachers provide all students with opportunities to be supported and challenged, although not always at the same time. Without formal knowledge of individual difference theory and research, and without objectively assessing individual differences, some teachers manage to teach in ways that are both efficient for group instruction and respectful of the individual characteristics their students bring to classroom learning tasks. Consistent with modern situated aptitude theory, our research suggests that when it comes to ensuring that all
students learn in a classroom setting, teachers continuously use and develop the affective and conative (or affcon) qualities of individuals as well as their cognitive/intellectual skills and abilities (Stanford Aptitude Seminar, 2002). This responsiveness, as a pattern of behaviour, in turn serves to change their teaching practices. In our work, we asked how teachers actually use student individual differences in their teaching and in what ways teachers’ use of individual differences affects how they teach their class as a whole.

**Practitioners’ solutions**

Implementation research describes teachers as ‘reluctant’ to change their teaching practices (see e.g. Randi & Corno, 1997, for a review). However, working as collaborators with practitioners, we see exactly the opposite. Teachers continually and deliberately adapt their instruction – from class group to class group, lesson to lesson, and moment to moment – within various segments of the curriculum. The following research memo captures the flexibility in teaching that classrooms and schools demand:

> What has impressed me most has been the flexibility of the teachers. One teacher postponed a lesson that I had planned to observe, after she learned, only minutes before her lesson, that I had been called away from the school on another assignment. When she realised that I would not be there for her lesson, she taught another lesson, putting aside the one she knew I would want to see later. Another teacher put aside her planned lesson when ‘it became apparent to her that her students would learn so much more by just asking questions (of an exchange student)’. All teachers, at one time or another, changed their plans to accommodate the inevitable and frequent interruptions of the real world of practice – field trips, unanticipated student absences and fire drills. Although these interruptions were surely intrusive, what impressed me was the ease with which these teachers adapted, as though they had much practice with such changes. Can these be the same inflexible and resistant teachers we so often read about in the implementation literature? These teachers are never satisfied with the status quo, always seeking to do better for their students. Each new strategy teachers are provided becomes a catalyst for future change in response to in the dynamics of practice (Randi, 1996).

These teachers, with a range of 5–33 years teaching experience, seemed comfortable with the unpredictable and dynamic nature of teaching practice. Indeed, our hypothesis based on these data is that teachers’ ongoing experience in classrooms develops an aptitude for adaptation and responsiveness to the demands of the teaching situations they confront; designing instruction develops the capacity to adapt.

**Teachers’ adaptations**

This same study investigated how teachers invented new instructional practices in the process of tailoring externally developed instructional innovations to their particular classrooms and students. Thirty secondary teachers had previously participated in staff development to learn to implement a programme designed to teach higher-order thinking strategies to students in the content areas. Randi (1996) used a theoretical sampling process to select eight teachers for intensive study of their planning, teaching and reflections. The eight teachers provided information about implementation practices and the reasons why they used or did not use the instructional strategies involved. In a cycle of interviews, think-aloud planning, observations and reflective discussions, the teachers traced the development of their lessons from sources of ideas to enactment in the classroom. The study captured ‘in-flight’ decisions (McNair, 1978) in moments when instruction deviated from initial plans. In addition, post-lesson
reflections illustrated how teachers’ spontaneous, process-oriented assessments of students affected their future planning for instruction.

Adapting content
When asked how they decided about the benefits of using new instructional strategies, all eight teachers noted the ‘fit’ between the instructional strategy and their curriculum. From the adaptations they made, it was apparent that these teachers thought about curriculum making as a dynamic process that they directed towards particular groups of students.

Curriculum ‘enactment’ – that is, curriculum making (Snyder, Bolin, & Zumwalt, 1992) – was evident in the planning and implementation strategies of one teacher who taught physics. Thinking ahead to his students’ future, the teacher explained, ‘There are certain skills they need. Once you get something that works for you, . . . you’re willing to change some things, but not everything you do, to fit that new style’. This teacher’s curriculum included a lesson in which he led students to find the shortest distance between three points using a computer programme he had developed. He initially expressed reluctance to make changes to this lesson, claiming that he did not want to compromise his instructional purpose. In the end, however, the teacher decided to design a ‘discovery’ lesson and evaluate the outcome based on student learning. Through the teacher’s guidance, students ‘discovered’ their own methods for solving the physics problem. This type of lesson, he noted, required moment-to-moment decisions in response to students. ‘I would not have been able to plan that ahead of time. I had to see what they were doing to figure out how I would present it. It’s kind of like you just keep watching how things are going and then you figure out what to do next. I really wouldn’t have been able to plan that out ahead of time’.

The teacher subsequently evaluated the lesson in terms of his purpose, which he said included both ‘content’ and ‘process’ goals:

They learned the same principles involved. So, there’s probably not much difference as far as general outcome. I think it’s probably a matter of emphasis. They were getting away from the cookbook emphasis. I think the overall thing that I was trying to do was to give them the opportunity to use their own brains to solve a problem without the same amount of structure that I used to give them, and to see if they could come up on their own with the rules. I think I wanted to try to put them into a more real-life situation where they had to try to figure things out, do a little more problem solving – where they weren’t being handed everything on a platter, where they could enjoy themselves and have fun, to have the opportunity to follow false leads for a while.

The curriculum enactment perspective was equally evident in the practice of another teacher who taught a social studies lesson. In this case, the teacher observed her students generate pictures based on a textbook assignment. Thinking these pictures might replace the lecture she planned for her next class, the teacher collected the pictures, took them to the next class, and improvised a student task using the pictures as ‘text’. She explained that this activity provided an alternative way into the content for students who had difficulty reading or who might not benefit from merely listening to her lecture.

Thus, in enacting curriculum, teachers consider their students’ current and future aptitudes – that is, their propensities and current dispositions, as well as how these might be developed – the nature of the subjects they teach, and factors external to their classrooms, such as students’ future curricular requirements.
Adapting to students

‘The real test of any teaching is face-to-face with those kids’. As this teacher observation implies, teachers often make instructional decisions by considering how particular groups of students will interact with content and instructional strategies. Teachers in this study judged the effectiveness of their instruction by observing students’ immediate and spontaneous reactions. Criteria teachers described range from ‘what’s fair’ to what ‘inspires’ their students.

Although these teachers’ decisions reflected what they noticed about individuals, teachers also thought collectively about groups of students or classes. For example, one teacher explained, ‘Every class makeup is drastically different. You know what works in one group; you know it won’t work in another’. She considered the appropriate level of difficulty for a particular class: ‘I didn’t know if it would work because I gave them a blank piece of paper to list their ideas and then to sketch the idea, which is difficult’. Teachers considered how different groups of students responded to particular tasks. For example, one teacher explained what happens when she implements different instructional strategies, ‘If I had had a slower group, I don’t think they would have gotten quite as much out of it and it has happened at times, when you’re trying something, you’ll say, last year this worked beautifully’.

These illustrations bring us to another tentative hypothesis: that teachers tend to characterize students collectively. Nevertheless, the teachers we studied also said that no two class groups are alike, even when the groups comprise students with similar academic skills studying the same curriculum. Even homogeneously ‘levelled’ groups differ from one another in other ways. Consistent with situated aptitude theory, the nature of groups is a function of the aptitude profiles for different individuals that comprise them.

Adapting students to groups

Although individual differences account for many group differences, our evidence shows that teachers seldom plan with individuals in mind. Instead, they plan instruction for this group or that group. When beginning a new topic, teachers in the Randi study planned to get the group ‘up to speed’ so instruction could proceed according to curriculum topics. Although teachers were establishing benchmark goals for the class group, they were also establishing the same goals for individuals within the group, thus making the whole group more homogeneous.

‘Benchmarking’ in this sense includes both adapting tasks and supporting students as they process information. One English teacher explained how she got started when she had to teach new material:

If I have a new book I have to teach, I think, ‘what should I do with this?’ I can’t just read the book, or say that I’ll have the kids do . . . I might get the idea but the kids can’t do that. So they might need study questions first to get them thinking about key themes and ideas. Or they might need to be told to look for these particular things, and then we’ll pull it together afterwards. It’s really only the top-notch kids who are exceptional and can do something on their own.

This teacher created a common foundation for all her students. The foundation included ‘a lot of prep because some kids might be better at that and other kids might struggle. So I’ll give them an example’. As a general rule, we find that teachers do ‘a lot of prep’ to get students up to the task. As this teacher explained, she could ‘do cooperative learning’
with this group because her students were accustomed to working in groups and sharing. As it happened, this was her second semester with this same group of students, and she had previously taught them the skills they needed to get the most out of cooperative learning tasks. On the other hand, the teacher claimed that another class, 'would have a difficult time with something like that. I think you can tell based on the nature of the kids who need a hands-on activity. If you want them to think, you have to give them pieces of the puzzle that they can put together. Whereas, with [the other group], I asked these kids to find the pieces of the puzzle first'.

Not only did this teacher change her instruction from group to group, but she also set a goal to develop aptitude for accomplishing the task at hand in the first group. That is, she deliberately prepared her first group to 'find the pieces' by sharing information with others in their cooperative groups. In short, these teachers seemed to bring groups of students along, working with the group at the edge of its competence, and using some strategic coaching to scaffold the learning of individuals.

Another English teacher provides an example of how teachers develop aptitude in groups of students. This particular teacher had previously taught contemporary drama to seniors and she now wanted to introduce a similar drama curriculum to a class of juniors. To do this, she had to prepare students for learning new content. She began to introduce her students to Arthur Miller's expressionism, including how the author manipulated time and space. However, after realizing that the juniors did not have the 'theatre background' to understand these techniques, she brought in a video of the drama to demonstrate Miller's techniques. She said she had forgotten that her students were 'English' students and not 'theatre' students. Nevertheless, this teacher created a group of beginning 'theatre' students who could then grasp the point of her more advanced instruction.

These teachers adapted students to group instruction by creating more homogeneity in the whole class group. They provided students with like experiences considered necessary to prepare them for further instruction. When students do not bring like experiences into the classroom, and teachers can provide them, instruction serves the function of aptitude development.

Teachers are criticized when they say they 'teach to the middle' of a class. Teaching to the middle means targeting instruction to a single readiness level. However, the teachers that we worked with did not do this. They did something markedly different, which we have termed creating a middle ground; that is, they managed to adapt task to students and students to task at the same time. By simultaneously adjusting teaching and learners, teachers create a teaching ground for the particular teaching moment. Our 'middle ground' is a common and dynamic centre that expands to include all learners. The goal is to adjust teaching and learners so that all students can fully participate in classroom learning opportunities at any given teaching moment.

Differences that matter
Differences in students’ cognitive skills and abilities are often salient to teachers when they plan instruction. This is unsurprising because academic work requires these skills, but teachers we studied also viewed as obvious the finding that academic facility is not the only factor that accounts for learner differences in school (Snow et al., 1996). Our teachers routinely directed instruction to students’ non-cognitive, affective and conative qualities. For example, one maths teacher expressed an awareness of how student motivation influenced her instruction in academic and general classes, noting that grades seemed to be the primary motivators for her more successful students who
sought to compete for ‘bonus points’. However, grades seemed to undermine the efforts of her less successful students. These students, she said,

were uncomfortable having their grade depend on something they were developing themselves in case it didn’t work out the way they wanted it to. Now I think level one [higher ability group] is very confident about doing it on their own, and much more excited about doing this . . . The level two [students] were a little hesitant to do that.

Another teacher who taught a lesson on fashion design described a motivational strategy she used with her ‘creative’ students. This teacher judged the impact of her instruction based on her students’ motivational states:

. . . if they are involved, if they are enjoying it, if they do wonderful things without realizing the work they are doing. And the work they are producing is superior to the work that they have ever produced. So I know that worked and I know I will do that again – trick them into learning.

Csikszentmihalyi (1990) described the motivational state of total involvement as ‘flow’. Apparently, the ‘flow’ that these students experienced not only engaged them but moved them further towards the teacher’s identified instructional purpose as well – the production of superior work.

Aspects of student motivation are important considerations for teachers (Nuthall, 2004). For example, one English teacher said she tried to attend to students’ interests when she planned lessons on contemporary drama. In one case, she anticipated how her students would react to the lesson she was planning: ‘So I think that will work. It’s interesting how themes of family really appeal to these kids. Obviously because that’s where they are in life’. This teacher planned to assign a project that required students to read a contemporary play and present the themes and issues in an original parody. Her expressed purpose was twofold: to incorporate more contemporary drama into her course and to encourage her students to be creative themselves. After the lesson, she noted what she learned about how student motivation could affect student work:

I was disappointed because I felt it didn’t come alive. I thought they did fine in terms of information. But I didn’t give them high marks in terms of the creative process . . . What I learned was to give them more choices in terms of what they were going to present . . . and not require that everyone do this and this.

Assessing student work to determine learning in conjunction with motivation is one way these teachers were able to evaluate and change their instructional practices at the same time. However, teachers also used more subtle assessment techniques that were less apparent, even, it seemed, to students.

Informally assessing students
The moment-to-moment decisions we observed teachers making might seem intuitive. They certainly appeared to be spontaneous. We found, however, that teachers’ decisions were often based on sophisticated and subtle assessments of student qualities that influence learning, including the aforementioned qualities of affect and conation. However, their assessments were not of the same kind that researchers develop when seeking to evaluate curriculum or measure student performance. What we see in our work is that teachers use informal, ongoing assessments to guide instruction, whereas researchers use formal measures to predict and confirm outcomes.
We have found that teachers assess and revise their instruction in a continual evaluation process that includes direct observation of students’ response to instruction. Teachers reported that they regularly assessed students’ affect and altered their instruction accordingly. Some teachers took the time to describe students’ response to instruction:

They were giving me the ‘face’.
The kids, especially the brighter ones, would start raising their eyes as soon as I’d start using the [thinking skill programme’s] phraseology.
The seniors were almost insulted.
The real test of any teaching is face-to-face with those kids; they are so astute at seeing through that which is not natural.
The kids never really expressed any enthusiasm. Never.
If they are involved, if they are enjoying it . . .
There isn’t a day that goes by that you don’t look at the kids and see . . .

Student affect was even important to the principal in this school, who said she judged instruction by observing students and noting that, ‘They’re [students] happy and they’re clearly involved in actually learning and learning has been fun’.

We referred earlier to theory arguing that effective teachers selectively attend to certain non-cognitive cues during interactive teaching, such as students’ faces, actions, behaviours and voices (Corno, 1981, p. 369). In our data, teachers saw student reactions as providing immediate feedback about motivation and engagement, and teachers said they used this information to evaluate the learning that occurred in their classrooms. One teacher reported that she spontaneously revised a lesson ‘because there was so much enthusiasm and it was so obvious they were going to learn so much more’. This teacher believed in a relationship between interest and learning, between active engagement with material and what is taken away. Other evidence from research on teacher thinking suggests that our finding is generalizable; teachers are concerned with engagement and motivation, and sometimes they incorrectly assume that engagement is strong evidence of learning (Prawat, 1992, as quoted in Nuthall, 2004). However, teachers may have accumulated evidence in their teaching experience to convince them that the relationship between motivation and learning is so strong that factors such as interest are predictors of learning. That is, teachers believe that without interest, learning is unlikely to occur, and so they consider the interests of individuals within the group along with their learning capabilities in planning instruction.

Teachers assessed instruction when they observed students engaged in learning activities in small groups. In these settings, teachers’ observations focused on what students could, as well as what they could not, do. Observing what students could do sometimes provided teachers ideas for new instructional strategies. Teachers judged strategies that originated from students themselves as most likely to be effective. For example, one teacher described how she developed a task that required students to demonstrate their knowledge of graphing equations after observing a group of students extend her original graphing assignment and create their own picture including the equations that produced it. She then incorporated that activity into future graphing lessons and continued to refine it as she noted the number and types of equations students used to generate their original pictures. For example, she again modified her assignment by explicitly requiring different equations: ‘to be able to do this creates a need for a command of it. You have to really understand what you’re doing’, she concluded, noting that students ‘did a much better job and . . . used more equations,
more complicated ones [all the conics], than the ones who had chosen to create an
original graph last year’. The teachers continually adapted instruction for particular
groups of students, based on their observations of how similar students in previous
classes responded. Observing present students, they continued to refine their
instruction based on student response.

Another English teacher’s students helped resolve a conflict between her requests
that students write about what they knew and a ‘brainstorming’ activity encouraging
creativity. This teacher described ‘eavesdropping’ on her students working in small
groups in a writing laboratory:

They would debate and discuss and then there was always a decision . . . What did happen
was some of them still chose to do a short story about a place that they knew nothing about.
But then they did research. I actually saw students saying, ‘Well, our story’s going to take
place in Australia’. They went and got a map so they could name the cities where their
character visited.

Thus, through classroom discourse, students themselves resolved the dilemma of
writing about something ‘unusual’ concurrent with something they ‘knew well’. Observing
students working informally provided the teacher with insight into how her
students learned to write, which she then used in future instruction. For example, she
taught other students about the research good writers do before writing. This scenario
exemplifies how teachers use information from students to inform their instruction,
and suggests that teachers learn from their students just as students learn from the
instruction they provide.

Teachers also used individual students’ misconceptions as a guide towards deeper
understanding. One geometry teacher in our study observed students using mathematical
reasoning to determine the volume of pinatas they were constructing. Noting one
student’s misconception of ‘volume’, she demonstrated the concept by placing pieces of
candy in a cone. Similarly, another maths teacher noted her students’ thinking in solving
and graphing equations: ‘some of them had the wrong X and Y values’. She used this
information to ask pointed questions to assist students in correcting their misconceptions
(e.g. ‘How could you get that? Where did it come from?’).

When students worked together to accomplish assigned tasks, teachers seemed to
have more opportunities to learn about students’ thinking and assess understanding. The
group activities not only made student work products visible, but also their thinking
processes. These teachers frequently used group activities, explaining that group
activities not only afford opportunities to evaluate students’ work, they also lead to
guidance for students as they work. The lesson here is that differentiation in these
classrooms was not something teachers did routinely, or even an experience they could
plan ahead. These teachers did not ‘implement’ particular ‘models of differentiation’
provided as tools in staff development. Rather, their adaptations were spontaneously
responsive to the individuals in their particular classroom at the particular moment of
instruction that occurred. And the teachers, nevertheless, engaged in adaptive teaching.

Learning to assess informally

Our experience with pre-service teachers suggests that assessment and motivation are
areas that even novices deem important enough to learn about quickly. All teachers
spend time getting to know each new group of students at the beginning of a course of
instruction. Because student teaching field experiences are typically of short duration
(e.g. 8–16 weeks), student teachers are faced with the challenge of becoming familiar with new students, while simultaneously learning new content and honing pedagogical skills.

Recently, we studied small group discussions among elementary student teachers in the seventh week of student teaching practicum. These pre-service teachers had already begun to use sensitive assessment strategies such as those we observed in experienced teachers. When sharing what they noticed early on about students, these pre-service teachers described affective and conative qualities as well as cognition (see Table 1).

Although data from this small sample are only suggestive, the novices reported more student differences in conative qualities and processes than those that were cognitive or affective. For example, one teacher described a student who was so disorganized that his lack of attention to details actually impeded instruction for the larger class group. The teacher said she had to stop teaching to help the student organize his notes. She also said that this student missed instruction based on homework because he rarely completed his homework. The teacher’s strategy in this case was to provide the student with a checklist of ‘things to do’, and require an adult at home to sign and return the checklist each day. She also individualized instruction to target this student’s organizational skills. In one sense, this teacher ‘differentiated instruction’; in another, however, the teacher increased her middle ground by developing the student’s aptitude to participate in group instruction, which meant taking notes during lessons.

The pre-service teachers in our sample affirmed that they looked for student characteristics that might impede instruction, including qualities such as attentiveness and participation that could be noticed easily. Even these novice teachers described effective classroom management skills and alerting strategies for use in response to student needs, including using proximity to engage a student, and calling on students who had not raised their hands.

<table>
<thead>
<tr>
<th>Affective domain</th>
<th>Conative domain</th>
<th>Cognitive domain</th>
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</thead>
<tbody>
<tr>
<td>Personality (shy or extrovert)</td>
<td>Listen to/follow directions and class rules</td>
<td>Journal responses stay on topic, correct grammar</td>
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<tr>
<td>Enthusiasm</td>
<td>Attention issues (too much or too little)</td>
<td>Ability to use language</td>
</tr>
<tr>
<td>Facial expressions</td>
<td>Eyes on teacher during directions</td>
<td>Assignments done accurately</td>
</tr>
<tr>
<td>Body language</td>
<td>Stay on task</td>
<td>Questions they ask</td>
</tr>
<tr>
<td>Interaction with others</td>
<td>Engagement (active vs. passive)</td>
<td></td>
</tr>
<tr>
<td>Eagerness</td>
<td>Complete assignments (neatness and promptness)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use of free time (productivity)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Participation (hands raised)</td>
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<tr>
<td></td>
<td>Organizational skills</td>
<td></td>
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<tr>
<td></td>
<td>Quickly begin tasks</td>
<td></td>
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<tr>
<td></td>
<td>Rushing work</td>
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No doubt, these teachers learned some management strategies in their teacher education programme and from mentors. Their student teaching evaluation plans included indicators for ‘differentiated instruction strategies’, for example. This rubric may have prompted consideration of individual student needs. Even as novices, these teachers used assessment strategies and their knowledge of particular students to inform their teaching. When prompted, they described informal and spontaneous assessments, and were able to provide examples from particular students (‘mental documentation’). For example, one student teacher characterized a student who ‘needs to be helped to become excited about learning. I thought I would plan a lesson about dinosaurs because I knew [that student] would be interested’.

When asked to describe some formal assessment systems that assisted them to document information about students, the pre-service teachers referred to notes recorded on index cards (e.g. how many times a student participated, which students read aloud), and checklists that listed behaviour patterns and rewards. One student teacher said she saved and discussed ‘questionable’ work with students, focusing limited time and attention where it was needed most. Like the experienced secondary teachers we described, these novices clearly considered their students when they planned instruction. In short, our evidence suggests that both novice and experienced teachers plan instruction and respond during instruction to what they observe on the fly about individual students. Planned or not, adaptation happens. It cannot be otherwise, if teaching is to move forward.

Conclusion

We began by tracing adaptive teaching back to its roots in antiquity. History records many examples of teachers who resolved the dilemma of teaching individuals within group settings. In our work with teachers, we have begun to articulate the common principles, by describing how practising teachers create a common and dynamic teaching ground, moving along both individuals and the class group. Early in this article, we said that researchers need to come closer to the ways that practising teachers address student individual differences when they teach, and teachers need to be encouraged to evaluate the utility of this knowledge base for their own purposes.

Our position is echoed by Nuthall (2004), who suggested that teachers would benefit from an understanding of how particular kinds of educational experiences affect learning for different students in different situations; in theory, such knowledge would give teachers the ability to predict (and design activities for) student learning. Setting an agenda for future research relating classroom teaching to student learning, Nuthall challenged researchers to collect ‘in-depth and continuous data on classroom activities, student experiences, and learning processes’ (p.296). The goal is to produce explanatory theory that allows teachers to distinguish principles that are generalizable across contexts from those that are unique to specific contexts.

Table 2 lists a preliminary set of principles for microadaptation in teaching derived from our own research. These principles seem generalizable from the evidence at hand. Future research, we hope, will assess this claim.

We believe that new theory about how teachers address student differences within groups can lead to promising new approaches to teacher development for adaptive teaching. A primary goal for new approaches would be to capture the dynamic teaching strategies of practitioners that illustrate the general principles shown in Table 2 so other
### Table 2. Towards some generalizable principles of microadaptive teaching

<table>
<thead>
<tr>
<th>Establishing a mindset for microadaptive teaching</th>
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<tbody>
<tr>
<td>Adaptive teachers view individual differences as</td>
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<tr>
<td>• assisting, rather than impeding, instruction in classroom settings;</td>
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<tr>
<td>• affording learning opportunities for other students in the class group;</td>
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<tr>
<td>• interrelated in complex ways – for example, they believe in a relationship between active engagement with material and what is taken away;</td>
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<tr>
<td>• simultaneously enabling teaching and student learning</td>
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</tbody>
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<tr>
<th>Microadaptive assessment</th>
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<tbody>
<tr>
<td>Adaptive teachers</td>
</tr>
<tr>
<td>• see student individual differences both within and between learners in the ongoing stream of regular student responses to given classroom and extracurricular events;</td>
</tr>
<tr>
<td>• begin, based on experience with particular students, to view a large class group as composed of meaningful subgroups;</td>
</tr>
<tr>
<td>• simultaneously respond directly to individual differences among students while using sensitive and continuous assessment to guide instruction;</td>
</tr>
<tr>
<td>• capitalize on opportunities to assess students during group activities that not only make students’ products visible, but also their thinking processes;</td>
</tr>
<tr>
<td>• immediately use assessments and knowledge of how similar students in previous classrooms respond to inform their teaching;</td>
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<tr>
<td>• assess student work to gauge what is learned in conjunction with motivation and emotional engagement.</td>
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<tr>
<th>Engaging in microadaptive teaching</th>
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<tr>
<td>Adaptive teaching strategies include:</td>
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<tr>
<td>• adapting instruction to student differences, and adapting students to the instruction;</td>
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<tr>
<td>• adjusting features in the learning environment to meet students where they are and developing learner aptitude to take advantage of learning opportunities;</td>
</tr>
<tr>
<td>• microadaptations made during the course of instruction and in response to particular students;</td>
</tr>
<tr>
<td>• moving back and forth on the support continuum, providing pointed instructional support when needed and withdrawing support for more able students;</td>
</tr>
<tr>
<td>• creating a ‘middle ground’ for teaching by</td>
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<tr>
<td>- developing relative weaknesses into strengths (developing aptitude)</td>
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<tr>
<td>- providing opportunities for common and shared experiences when students do not bring them into the classroom</td>
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<tr>
<td>- building on knowledge of higher performers to as a point of reference for the entire group</td>
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<tr>
<td>• spontaneously responding to the individuals in a class at particular moments of instruction;</td>
</tr>
<tr>
<td>• using and developing affective and conative (affcon) qualities of individuals as well as cognitive/intellectual skills and abilities.</td>
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<tr>
<th>Developing expertise with microadaptive teaching</th>
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</thead>
<tbody>
<tr>
<td>• Ongoing experience in classroom teaching develops an aptitude for adaptation and responsiveness to the demands of any teaching situation; curriculum making and instructional design develops the capacity to adapt.</td>
</tr>
<tr>
<td>• Teachers continually adapt instruction for particular groups of students, based in part on observations of how similar students in previous classes responded.</td>
</tr>
<tr>
<td>• Inventions provide immediate solutions to problems that arise in the course of teaching.</td>
</tr>
<tr>
<td>• As teachers use information provided by students to inform instruction, they learn as much from their students as students learn from them.</td>
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</table>
teachers might model and adapt them for their own classrooms. We do not think it productive to continue to ask teachers to ‘install’ differentiation programmes, or ‘implement’ differentiation practices, that they have learned through current or trendy professional workshops. Future research on aptitude development would also profitably investigate how teachers encourage adaptation by students to different teaching situations. Teachers who take different paths to meet learners where they are should ultimately help them set a course towards independence.

References


