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Research Impacting Practice: Impetus to Change

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Abstract

One of the aims of science education research is to produce insights into improving the teaching and learning of science in schools. Unfortunately, many teachers continue to teach in the classroom as if no research has been done into the teaching and learning of their subjects. This can be because teachers are generally unaware of relevant work available and that few researchers are willing to translate research findings into resources which teachers can easily understand and use in class. A survey study which examined the impact of educational research on Singapore middle and high school chemistry teachers' instructional and curricular practices was conducted using semi-structured interviews from 2011 to 2013. This paper reports the findings of the study related to the factors which facilitated or impeded changes in the teachers' existing practices; the findings revealed that these were related to students, teachers, school, Ministry of Education, time, educational research and teacher professional development. The paper also discusses the sources of information that the teachers used to guide them in making changes or adopting new practices; these included colleagues, teacher educators, electronic resources, conferences and professional development courses, and educational research. This study can inform researchers of the issues that are important to teachers and ways of working with them to address these issues.

Research Impacting Practice: Impetus to Change

Introduction

Science education research needs to produce insights to inform teaching and learning of science in the classroom and policy decisions on science education issues (Millar, Leach, Osborne, & Ratcliffe, 2006; Treagust, 1995); it can challenge practices which are ineffective or dubious, endorse and provide support to those which are sound and effectual, and evaluate innovations to be implemented in the classrooms (Millar et al., 2006). However, researchers seem to have little understanding of the needs of policymakers and practitioners as studies have shown that policymakers and practitioners have difficulty finding research that is relevant for their immediate needs (Edwards, Sebba, & Rickinson, 2007; Nutley, Davies, & Walter, 2002; Tseng, 2008). One reason could be that research is generally researcher-driven than user-driven leading to the paucity of what policymakers and practitioners would consider as relevant research which could inform their work. Nelson, Leffler and Hansen (2009) reported that the policymakers and practitioners in their study believed that “there is a gulf between research design and real-world practice, and that research findings have limited applicability to their local contexts” (p. 50). They also stated that they had difficulty accessing, reading, interpreting and applying education research (Nelson et al., 2009; Ratcliffe et al., 2004; Walter, Nutley, Percy-Smith, McNeish, & Frost, 2004). Thus, understanding how, when and why research is used (or not used) by practitioners and policymakers are important to determine the interaction between research, practice and policy, as well as to increase the utilisation and impact of research (Davies & Nutley, 2008; Tseng, 2010, 2012).

Purpose of the study

A survey study which examined the impact of educational research on Singapore middle and high school chemistry teachers' instructional and curricular practices was conducted from 2011 to 2013. This paper reports the findings of the study related to the factors which encourage chemistry teachers to change their chemistry curriculum or the way they taught chemistry, and the factors which constrain changes. It also seeks to determine the sources of information which helped them to make the changes or adopt new practices. The research questions which guided the study are:

What are the factors which facilitated or impeded changes in the chemistry teachers' existing practices?

What are the sources of information that teachers use to guide them in making changes to their existing practices or adopting new ones?

Method

A survey study (Gall, Gall, & Borg, 2007) was utilised to obtain information on the factors which facilitated or impeded changes in the chemistry teachers' existing practices, and the resources that they used or people that they approached to help them in making the changes in their existing practice. The study received ethics approval (IRB 11/06/20) from first-named author's institution.

A combination of criterion-based, convenience and network sampling (Merriam, 2009) was used to select the teachers for the study. The sample consisted of 18 (62%) female teachers and 11 male teachers (38%) with different years of teaching experience from a mix of secondary (Years 7 to 10), pre-university (Years 11 and 12) and integrated programme (Years 7 to 12 or Years 9 to 12) schools as well as those working in the Singapore Ministry of Education and a teacher education institution.

Semi-structured interviews were employed and in cases where the teacher had consented to participate in the study but did not wish to be interviewed, he/she would answer the questions in the interview protocol as if he/she were answering an open-ended survey questionnaire and email his/her responses to the researcher. The questions in the interview protocol which are relevant to this paper are:

What are the factors that encouraged you to change your chemistry curriculum or scheme of work, or the way you teach chemistry?

We have talked about factors which facilitate changes, so let's talk about factors which impedes or constrain changes.

What sources of information do you use most often to help you make changes or adopt new practices?

All interviews were audio-recorded with the permission of the teachers and transcribed verbatim. The transcripts were coded, collated under various themes and the frequencies of occurrences were tallied.

Results

As the number of teachers involved in the study was small, the responses of the teachers to the interview questions were collated and analysed as a whole group. Excerpts of the interviews used to illustrate the findings were lightly edited, where necessary, to improve their readability. Only factors mentioned by 3 (10%) or more teachers are highlighted.

Factors that facilitated changes

Teachers mentioned factors such as those related to students, teachers, schools, research and the Ministry of Education facilitated changes in their practice.

Factors related to students

The factors related to students mentioned by teachers which facilitated changes in their practice were students’ understanding of concepts and engagement during lessons (see Table 1).

Table 1

Factors related to students that facilitated changes

	Understanding of concepts	Engagement during lessons
No of teachers	14	8

The teachers explored alternative ways of teaching when they found that students did not seem to understand the concepts taught. Teacher T21 stated that he regularly reflected on his teaching and how he could deepen his students understanding of the concepts while Teacher T10 would respond to her students’ feedback on their learning difficulties.

Teachers also wanted to engage students during lessons, so they would think of ways to make their lessons interesting and relevant. Teacher T13 stated that she would change her way of teaching for “topics which are harder or seem boring to the students” by “using videos, showing demonstration, having more group activities or getting students to do more hands on so as to engage the students better and help them understand the concept better too”. Teacher T12 would link concepts to relevant everyday life examples to motivate students to help them understand the concepts better as well as make chemistry more meaningful to them.

Factors related to teachers

The factors related to teachers which facilitated changes in curriculum and/or instructions included teacher characteristics and inputs from peers (see Table 2).

Table 2

Factors related to teachers that facilitated changes

	Teacher characteristics	Inputs from peers
No of teachers	4	5

Teachers need to have to desire and willingness to change as well as have the expertise to effect the changes. Teacher T12 mentioned that she had the desire to change and she took small steps at a time to overcome inertia to change while Teacher T23 stressed the importance of increasing the expertise of teachers to help them implement new initiatives.

Learning from their peers and collaborating with peers are also important for teachers to help them effect changes. Teacher T19 said that he observed his colleague using Twitter Deck to allow students to twit their answers or comments during lessons and that pushed him to “rethink and relook” the way he taught and to explore other possibilities. Teacher T10 was grateful that a few of her colleagues shared her passion in improving practice and collaborated with her to introduce new ideas in the classroom.

Factors related to school

School support for initiatives and the school’s directions played essential roles in facilitating changes to curriculum and instruction (see Table 3).

Table 3

Factors related to school that facilitated changes

	Support for initiatives	School directions
No of teachers	4	10

Teacher T24's school was involved in a national education project in transforming teaching and learning in the classroom and it was successful because the school leaders provided much support for the team involved.

The directions or goals of the school also influence changes in curriculum and instruction as teachers have to work with these directions or goals in mind or the school may exert pressure on the teachers to change accordingly.

Factors related to education research and professional development

Several teachers said that educational research and professional development courses, for example, conferences, workshops and courses provided ideas or support for them to change their practices (see Table 4).

Table 4

Factors related to educational research and professional development courses that facilitated changes

	Suggestions for teaching/ learning from research	Learning from conferences/ workshops/in-service courses
No of teachers	6	5

Teacher T15 mentioned that she would read research articles to find out what others had done and whether if she could replicate what they did with her students, while Teacher T10 described how a workshop on modelling influenced a change in the way she taught.

Factors related to the Ministry of Education

Revision of the curriculum, changes in assessment or initiatives launched by the Ministry of Education had an impact on practices in school (see Table 5).

Table 5

Factors related to the Ministry of Education that facilitated changes

	Changes in curriculum/assessment	Ministry initiatives
No of teachers	8	11

Teacher T7 stated that he modified his teaching for “(b)etter alignment to current method of assessment, and style of questions asked in ‘A’ Levels” and Teacher T25 “had to improve the quality of the questions that we expose students to in normal tutorials” in order to help students answer higher order thinking questions. Similarly, Teachers T27 had to focus more on thinking skills in his lessons in response to the greater emphasis on thinking questions in the national examinations.

One of the recent initiative of the Ministry of Education is to enhance students’ “life-ready competencies like creativity, innovation, cross-cultural understanding and resilience” (Ministry of Education, 2010). Thus, Teacher T12 explained that teachers “need to move... with the direction that the MOE has set”.

Factors that impede or constrain change

The factors which facilitated change as mentioned in the previous section, for example, factors related to student, teacher and school, could also impede or constrain change. The limited time that the teacher has also does not encourage them to make changes in their practice.

Factors related to students and teachers

Table 6 shows the factors related to students and teachers which impeded or constrained changes.

Table 6

Factors related to students and teachers that impeded changes

	Student characteristics	Teacher characteristics	Teachers' assessment concerns
No of teachers	10	9	10

There was a tendency to stick to tried and tested methods, didactic teaching or following the syllabus closely when teaching weaker students as teachers feared the students could have learning difficulties if they employed new pedagogies or teach more than what was required in the syllabus. Teacher T6 explained that several of his junior college students wanted to be taught the way they were taught in secondary school, that is, through drill and practice and be “provided with ‘guaranteed to score’ model answers” which would help them do well in the national examinations.

Teachers might also not want to or be ready to change their ways of teaching. Teacher T6 believed that teachers “must feel confident that such changes are viable in their opinion” and would weigh the cost and benefit of introducing the changes. So, if teachers were not ready for the changes or not convinced that the changes would be beneficial, then their implementation would be problematic.

The teachers’ assessment concerns are closely related to time constraints as they need to complete the syllabus and prepare students for the examination. These are highlighted by the following excerpt of interview with Teacher T18; she mentioned that she was unlikely carry out activities which are not in the syllabus and hence not assessed.

Factors related to school

The directions or goals of the school, lack of support from the school and availability of resources in the school were factors mentioned by teachers which impeded changes (see

Table 7). Teacher T31 said that she needed to heed directions from her Head of Department or school and “if the school says no, you cannot do, you cannot innovate, everybody must follow”. Similarly, Teacher T10 mentioned that if her “school or rather the Principal, the management doesn't really encourage us to...try out new ideas” then she would not want to do so.

Table 7

Factors related to school that impeded changes

	School directions	Support for initiatives	Availability of resources
No of teachers	4	4	4

The availability of resources determined what was possible to implement in school. Teacher T21 mentioned that his school did not subscribe to an online resource site, so his students were not able to do the online experiments that he wanted them to experience. The lack of laboratory equipment prevented Teacher T25 from introducing organic synthesis practical work to his students.

Factors related to time

The limited time for classroom teaching that the teacher had and the time required to make instructional and curricular changes hindered their efforts to make changes to their practice (see Table 8).

Table 8

Factors related to time that impeded changes

	Instructional time	Time to make curricular changes
No of teachers	11	5

Teacher T7 stated that he could not scale up an innovative way of teaching in his junior college, even though that the feedback on the trial seminar style teaching he experimented with was good, because it took too much curriculum time. Teacher T22 also complained that he had to continue teacher-centred teaching because of the need to complete the syllabus in time for the examinations.

Teachers may also have little time to think about how to improve practice, or to develop or source for new material and strategies. Teacher T15 mentioned that when her teaching was over for the day, she had to attend meetings in the afternoons, so “we really have very little time left to, you know...to prepare our lessons, in that sense, like having very innovative kind of teaching”. Teachers T18 also said that administrative work and co-curricular activities (CCA) took up much time such that she could not focus much on her teaching.

Sources of information for teachers

The people that teachers approach and resources that teachers use to help them make changes or adopt new practices are summarized in Table 9.

Table 9

Sources of information for teachers

	Colleagues	Electronic resources	Conferences/ workshops/ courses	Educational research
No of teachers	25	15	14	20

Colleagues

Colleagues, especially those who are more experienced or senior, are commonly relied upon for advice or ideas. Teacher T7 stated that observing the lessons of more senior

teachers would help others “gain a different perspective” or “compensate for potential blind spots”. In addition to peer observations, Teacher T13 “would look for other chemistry teachers in my school, share with them my ideas or the difficulties that I faced”.

Electronic resources

Teachers normally search the internet for resources such as simulations, animations and videos to include in their lessons or even lesson plans. However, Teachers T11 stated that she did not have access to many journal articles which appeared in the internet search results and T20 complained about the cost of buying or downloading such articles.

Conferences/workshops/courses

Conferences and professional development workshops or courses are avenues for teacher learning, building expertise and for making contacts with people who can help teachers implement new pedagogies back in their schools.

Educational research

Twenty teachers mentioned that they regarded educational research as a source of information on how to teach more effectively and how to help students learn more meaningfully. Teacher T7 mentioned that he consulted “educational research for alternative conceptions, common issues, different modes/ways of teaching that topic” and Teacher T20 would “try to read, journals, articles, just to see what the recent trends are, and be aware of the challenges that people experienced”. Teacher T25 referred to research literature to identify frameworks and tools which could be used to facilitate inquiry in class.

Discussion

The data seem to suggest that if (a) students are doing well in the examinations or prefer didactic teaching; (b) teachers judge that their students may have learning difficulties if they try something new or teach material outside of the syllabus; (c) teachers are not ready or do not have the expertise to implement the changes; (d) there is a lack of resources or support

from school to implement changes, or the changes are not in line with the school directions, then there is little incentive for teachers to move away from tried and tested methods of teaching. In addition, teaching tasks (such as completing the syllabus and preparing students for the examinations) and other competing demands (such as meetings, committee work, running co-curricular activities and school events) restrict the time that teachers have to read and think about or introduce new ways of teaching (Walter et al., 2004; Nutley, Walter, & Davies, 2009). However, the teachers mentioned that they might consider changing their practice if their students have difficulty in understanding what was taught and/or they wanted students to be more engaged during lessons. In addition, if they were required to implement initiatives of the school or the Ministry of Education, or there were changes in the national curriculum and assessment, the teachers would review their schemes of work and lesson plans to determine how to incorporate the initiatives or changes into their practice.

The data also show that the main sources of information for teachers to help them to make changes or adopt new practices are fellow teachers (86%) and this agrees with the finding of Ratcliffe et al. (2004) that “colleagues were seen as the most important source of ideas and guidance” (p. 34). Other sources of information include educational research (69%), the internet (52%) and professional development courses (48%). Teachers can have access to educational research directly through reading or participation in research, or indirectly through research-informed resources available on the internet, professional development courses and relevant discussions with fellow teachers. The impact of these sources of information on the teacher’s practice may not be great, for example, due to limited contact time, but they do offer opportunities for teachers to get new ideas and instructional material, as well as network with other teachers, teacher educators and researchers (Mamlok-Naaman, Rauch, Markic, & Fernandez, 2013).

Limitations

The small sample sizes of the teachers involved in the study and the non-random sampling of teachers are limitations to the study. Thus, the data obtained are not representative of the chemistry teachers in Singapore schools. The findings of the study are also limited by the nature of the data collected as there was no substantiation of the information given by the teachers, for example, through document analysis and direct observations (Nelson et al., 2009).

Conclusion

This findings of the study showed that the factors which facilitated or impeded changes in the teachers' existing practices were related to students, teachers, school, the Ministry of Education, time, educational research and teacher professional development. In general, teachers will not change their practices unless there are compelling reasons to do. The sources of information that the teachers used to guide them in making changes or adopting new practices included colleagues, electronic resources, conferences and professional development courses, and educational research.

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