At the Rear Mirror and through the Wind Screen: Teachers Becoming Teacher-Researchers in Singapore Schools

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Abstract

Background: Action research (AR) for school-based curriculum innovations (SCI) has been ardently pursued in Singapore schools for the past few years, leading to a plethora of project reports published as monographs and in a new journal, the *North Star*. Training workshops were conducted at the national, zonal, and school levels to equip teachers with essential research competence, further supported by face-to-face and on-line consultation. Many and varied pedagogies in practically all subjects were trailed with the view to raise students' achievement.

Aims or focus of discussion: This paper is a sequel to a status report published in an earlier issue of this Journal (Soh, 2006a) and describes the efforts of the education authority, the teacher-education institution, the schools, the teachers, and the private consultants in promoting AR/SCI in Singapore schools. Project reports in various formats are briefly described. The experience of the past few years also pointed up some issues that deserve attention such as the identification of research topics, reference to theories, expectation of success, and assessment of probability of success.

Arguments/comments/suggestions: The writer believes that the effort of the past few years will bear fruit for Singapore schools in their effort in school improvement and the pragmatic approach is to be maintained. However, those issues identified above need be attended to if the effect is to be maximized so that resources will be properly utilized.

Conclusion: Using AR/SCI as a mean to raise student achievement is a pragmatic approach suited to Singapore's philosophy and this can be continued to benefit the schools and their students.

Keywords: action research, in-service training, teaching effectiveness

新加坡教師行動研究：前瞻與後顧

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摘要

*背景：*過去幾年來，新加坡中小學及初級學院積極通過行動研究尋求課程改革，帶來大量研究報告的出版，包括新學報《北極星》。行動研究工作坊在國家、地區、和學校的水準上舉辦，訓練教師以有關的概念和技術，並提供當面和網頁上的諮詢。多種教學策略在所有學科中試行探討，以期提高學生的學習成績和參與。

*目的：*本文承接以前在本刊的報告（Soh,2006a），描述教育當局、教師訓練機構，和私人諮詢在這方面的努力，以及有關的出版。過去數年的活動也帶出一些值得深入探討的課題，涉及理論的作用、成功的期望、和成就的評估。

*建議：*筆者相信，這種實際的行動研究如果得以持續，將會帶給新加坡的學校改善可觀的成效。然而，以上提到的課題必須善加處理，資源才能得到妥善的利用，發揮最高效率。

*結論：*通過行動研究進行校本課程改革是適合新加坡的信念，能繼續使學生和學校受益。

關鍵字：行動研究、在職訓練、教學效能

Over the past decade, action research and school-based curriculum innovations (AR/SCI) has been actively promoted among Singapore schools at all level from the primary through the secondary schools to the junior college. The methods, procedure, and outcomes of such a concerted effort at the various levels of schools, school-clusters, and ministry headquarters have been reported in this Journal earlier (Soh, 2006a). Such a task is undertaken collaboratively by the education authority (i.e., the Ministry of Education), the schools, teacher education institution (i.e., the National Institute of Education), and independent educational research consultants. This paper, as a sequel to the earlier report presents up-dated information of the continued effort, new development and recent outcomes since then. It is believed that the information will be of interest to teachers, teacher-educators, and education authorities especially of the region while they promote teacher research with varying degree of vigour, with the common aim of school improvement through teachers' professional up-grading. It is readily appreciated that, therefore, this paper is more factual than analytical, though critical comments are inserted where appropriate.

Teachers play important role in school improvement. This is emphatically stated in a handbook for principals, teachers, and school councils thus, "Since the ultimate objective of school improvement planning is to improve the level of student achievement, the person who has the greatest impact on the students during the school day - the teacher - plays several critical roles in the school improvement planning process (Education Improvement Commission, 2000, p.15)." Two of the six such roles identified by the Commission are relevant to AR/SCI as discussed in this paper: (1) to ensure that classroom strategies for improvement address the needs of students at all levels of learning, and (2) to assess students in a variety of ways and develop strategies for improving the level of students' achievement. These two roles are manifested in AR/SCI projects teacher-researchers undertake to improve student learning leading logically to school improvement.

It is understandable that teachers tend to look for external factors such as the parents and the students for explanation of low achievement. However, Timperley & Robinson (2010) managed to change a group of teachers' beliefs to seek internal factors such as their own teaching practices through the salience of discrepant data, the presences of an external agent to assist with the interpretation of those data, and the availability of information on alternative practices. This strategy of changing the beliefs to change teaching is in essence the purpose of AR/SCI discussed here. Through AR/SCI projects, teachers are guided and have a chance to look at their own teaching practices more objectively using quantitative data and qualitative information and to evaluate the outcomes of their efforts in enhancing students achievement which contributes to school improvement ultimately.

Traditionally, leadership in school has been assigned to school administrators. Teacher leadership is increasingly being seen as a key vehicle for school improvement although research on this phenomenon is limited, especially outside of the US (Muijs & Harris, 2006). The authors procured data indicating that teacher leadership was seen to empower teachers, and contributed to school improvement through this empowerment and the spreading of good practices and initiatives generated by teachers. They further pointed out that a range of conditions needed to be in place in

schools for teacher leadership to be successful. These include a culture of trust and support and engagement in innovative forms of professional development. When seen in this light, involving teachers in AR/SCI is empowering the teachers to play a leadership role in school improvement. The importance of teachers in school improvement cannot be over-emphasized. It is readily appreciated when Hargreaves (in Sparks, 2004, quoted by Seed, 2005) says, "If we want high-level, deep learning for students we have to have highly skilled and intellectually able teachers. That means attracting, developing and retaining teachers who have those qualities, and giving them working conditions that inspire them and offer them a chance to soar."

The success stories of two school improvement efforts, one in the UK and the other in Canada, were documented by Harris, (2000). The Improving the Quality of Education for All Project (IQEA) is based at Cambridge University and the Manitoba School Improvement Project (MSIP) was established as a result of the vision of the Walter and Duncan Gordon Foundation, a Canadian charitable foundation. In reviewing conditions that contributed to the success, the author identified, inter alia, a commitment to teacher development and professional growth as a contributor, stating that schools in both projects demonstrate a high level of commitment to teacher development and professional growth. This underlines that potential of teachers' professional growth can made to school improvement.

Admittedly, this brief review on the potential contribution to school improvement teachers can made is cursory.. What is of note is that in the recent years there are calls for teachers to be entrusted with greater leadership role in school improvement which have been seen traditionally as the role of school administrators in view especially of the teachers' critical functions in curriculum and instruction which are the core business of schools (Jenkins, Zimmerman, & Jenkins, 2004). Henceforth, the importance of the development of teachers' capability in AR/SCI cannot be under-estimated.

Capacity Building

For capacity building, training workshops to equip teachers in research competence were organized at different levels. First, there was the Ignite Programme at the Headquarters of the Ministry of Education. For this, teachers were released from the schools for full-day attachment twice a week for one academic year amounting to about 600 hours. They attended training in qualitative and quantitative research methods, curriculum theory and practice, learned data processing tools (e.g., SenseMaking, Excel, SPSS). In addition, these Research Activists (RAs as they are referred to) were involved in the development and refinement of the *PETALS*^{TM}, a set of rating scales for the measurement of student engagement (Curriculum Policy & Pedagogy Unit, 2008) and other related research work. Time was also assigned for self-directed learning for which the RAs read to familiarize themselves with research literature, especially literature relevant to their respective AR/SCI projects which mainly aimed to enhance student learning in a practical manner. During the training period, each RA planned and conducted a AR/SCI project that met the school's need, usually in some of curricula or instructional aspects, collaboratively with a few fellow-teachers who were yet to be trained in research methods and with the school principal or head of department as the project director. Thus, the RA functioned as a key investigator or methodological leader of the projects.

As almost all AR/SCI projects adopted a mixed method approach, the project plans were presented in the early part of the Ignite Programme for comments by two trainer-consultants. After the presentation, the RAs were expected to take the suggestions back to school and discuss with their team members for possible adaptations. Towards the end of the year-long training, the RAs were expected to complete the projects and present the findings in the form of a draft report for comments and suggestions by the trainer-consultants. Four cycles of the Ignite Programme has been planned. To-date, it is in the third cycle with another 80 RAs being trained. Thus, by the end of the present cycle, a total of about 320 RAs would have been trained. This means that on average each Singapore school will have one trained teacher-research who is in good stead to serve as an in-house research adviser.

While face-to-face training is able to cover common grounds, there are individual needs for further consultation and clarification which will be difficult in a group context. To further consolidate the training and to meet the RAs' individual conceptual needs, an on-line consultation service was provided for which they posed questions related to topics recently covered and comprehensive answers were provided by the Resident Expert (the present writer). This service was available at EDUMALL2 of the Ministry's portal. Examples of questions asked were: "*How to do a good literature review? Is it merely quoting experts and their work & research? How to deepen discussion of their work? Do we just summarize or must we comment on the works?*" and "*What is the intent for using the chi-square in the research? When do we use it? How do we report the figures calculated?*" (For a complete list of the questions, see Appendix.)

As reported in the earlier paper (Soh, 2006), the North Zone Schools Clusters were very active in action research and they collaboratively organized workshops to train their teachers in methods. In the past four years, they continued to be highly active and have organized zonal symposia for the teachers to share experience within and beyond the Zone. They also continued to publish reports presented in the form of conference proceedings titled *CLEAR: Celebrating Learning through Action Research* (Ministry of Education, 2005, 2006, and 2007).

In addition to the centralized and zonal training workshops, Centres of Excellence (schools tasked to plan can coordinate professional up-grading activities in designated areas for 'member schools') and individual schools also organized training workshops of different duration for the teachers. These took the form of three-hour introduction workshops to full-length nine to 15-hour workshops. The introductory workshops briefed the participants on the essentials of action research and were usually followed up subsequently by project consultation sessions to help the teachers deal with methodological and technical problems (very often of measurement and statistical analysis). The Centres and schools organized their zonal or in-house sharing sessions and some schools even published their own monographs of AR/SCI reports. School-based workshops were organized for two possible purposes. First, a school wishing to embark on AR project organized whole-school workshops where all teachers participated. Secondly, a school which had earlier on organized such workshop organized one for teachers who joined the staff subsequent to it.

Besides general training described above, workshops were also conducted for specific projects in schools on research methods and

instrumentation. For instance, five Prototype Schools have been working projects trying to develop the 21st Century Skills (particularly, confidence, cooperation, and curiosity or the Three C's) of their primary pupils in the past two years with a whole-school approach involving practically all teachers and pupils in the schools. These schools developed course materials with different emphases (e.g., one on ICT, another on thinking skills). These schools formed their own evaluation teams which were trained in the development of assessment rubrics for the 21st Century Skills and data analysis. Moreover, they collaboratively contributed to the development of a *Learning Ability Test* which will be used within and across the five schools for validation purpose.

Whereas teachers of Malay Language and Tamil Language usually attended workshops conducted in English, AR workshops were conducted also in Mandarin for Chinese Language teachers. Understandably, some Chinese Language teachers found workshops conducted in English not easy to follow, especially teachers who were recruited from the Republic of China. Workshops in Mandarin have been organized by a Centre of Excellence in the North Zone in the past few years. Moreover, AR workshops in Mandarin were also conducted for Chinese Language teachers of 16 schools involved in the Ministry of Education's *10'C (Very Chinese "十分華文") Project* of the Ministry's Educational Technology Division. This is an on-line computer-based enrichment reading programme for primary and secondary schools with the objective to raise the Chinese Language standard by expanding the scope of reading beyond the schools' Chinese Language textbooks but correlated with them.

Publications

CLEAR   It is a natural process that research leads to reports and reports lead to publications. AR/SCI reports have become a popular publication in the educational scene in Singapore in the past few years. This reflects the productivity of teacher-researchers in research outputs. Teachers working in the school context do not face the threat of "publish or perish" as do the academics, but publication of their project reports serves not only to document the research efforts but also has a motivating effect as a recognition of the contribution to education through research.

As already mentioned above, *CLEAR* (*Celebrating Learning through Action Research*) has been published by the Ministry of Education for the North Zone School Clusters. This in essence is the symposium proceedings of the zonal symposia organized for the past few years. The AR/SCI projects cover literally every subject of the school curricula of primary and secondary schools as well as the junior colleges. New or alternative pedagogies were trialed and the findings were shared, providing impetus to further AR/SCI studies. Now in its third volume of the proceeding of a symposium of action research CLEAR's would have some two hundred such papers.

Research Reports 2007   Another Ministry of Education publication which puts together 29 AR/SCI reports is the *Research Reports 2007* (Tan, Ee, Lee, & Lam, 2007). Efforts of instructional innovations attempted in the projects include self-esteem, aesthetics education, multicultural project work, development of independent or self-directed learners, engaged learning, problem-solving learning, Socratic Questioning, Habits of Mind, etc.

North Star   At the national level, a new journal *North Star* was instituted as a Ministry of Education

publication. As its sub-title "*A Publication for Educational Practitioners*" indicates, the publication has school teachers as its target audience. It may not be wrong to say that the *North Star* pitches its standard somewhere between a learned journal and an educational magazine. It is meant to be relevant to teaching, readable to teachers and it maintains a certain degree of respectability in terms of methodology yet avoiding being too theoretical or academic.

The objective of publishing the *North Star* is to develop teachers' interest and habit in professional reading. AR/SCI reports were carefully selected and edited with the intention that the papers serve as benchmarks for teachers' research papers. Three issues have by now been published and the fourth is in the pipeline. As would be expected, in the main, the papers therein report on AR/SCI projects completed by teacher-researchers and curriculum specialists in the various subjects. In addition, each issue also includes a paper on research methodology, especially on data analysis and interpretation as this is an aspect for which teacher-researchers need help most.

10'C Reports   "10'C" Project was started in 2008 by the Educational Technology Division of the Ministry of Education in collaboration with a number of primary and secondary schools, with the objective to enhance Chinese Language learning in the context of "Teach less, learn more" (TLLM). It integrates character recognition, reading, and composition writing in an e-environment. Basically, pupils in the Project read more Chinese texts that are related to textbooks topics but go beyond. They are also challenged to do more in-depth thinking. And, most importantly, 'writing' on the computer literally relieves them from the difficulty of remembering and wring the Chinese characters needed while expressing their ideas. (As an aside, the present writer strongly believes that this is going to be the mode of Chinese 'writing' in the not too distant time. From the historical perspective, writing tools for Chinese characters have been changed, from carving on bones through painting on silk to writing on paper. In time to come, typing on computer will replace this last mode, with the added benefit of not having to face the difficulty of remembering the strokes - a problem of writing in Chinese that has been long recognized, hence the introduction of Hanyu Pinyin, the Chinese phonetics system.) To-date, there are two reports on the AR projects in the context of the "10'C" (Educational Technology Division, 2000, and 2010). Sub-skills of Chinese Language covered in the two reports include oral reading of Chinese Language texts, reading comprehension, vocabulary understanding and use, word-formation, picture-guided composition and unguided topic composition.

AR Training Manuals   It is readily appreciated that training workshops are able to cover only the essentials teacher-researchers need to know enough to start their AR/SCI projects (which very often are needed urgently by their schools). Short workshops (of three to 15 hours) are able to only initiate them into the frame of mind of trained researchers and much more learning has to take place subsequent workshop, both technically and, more importantly, conceptually. To meet such needs, a training manual (Soh, 2006b) was published in the format of power-point notes. It was later translated into a Chinese version (Soh, 2007). This first English version was later revised and published (Soh & Tan, 2008). While these provide the basic framework for planning AR/SCI projects, many practical problems and issues were encountered by teacher-researchers, especially in handling non-equivalent groups and statistical

analysis. For this, a statistical toolbox was published accompanied by Excel templates (Soh, 2009).

Feedback

In addition to capacity building, training workshops for RAs described above also enabled net-working at the national scale for teachers coming from different schools with different experiences. Teachers working in the classroom are isolated from each others in the normal classroom life and net-working with like-minded fellow teachers are needed for mutual support both morally and technically. This net-working makes them more resourceful as they have contacts built through the training programme which enable they to tap into other teachers' experience and resource. The relationships developed with teachers from other schools teaching the same subjects and are doing similar AR/SCI projects lend teachers further confidence professionally and personally. This connectivity helps the teacher-researchers see more meaning in what they are doing for the projects specifically and teaching in general. Generalizing beyond this, it can be assumed that the same net-working effect will take place among teachers who attended zonal workshops, thus building up their resources and confidence, both in terms of research and teaching.

While large scale study is awaited, some preliminary findings are found by Lee and Kang (2010). They surveyed the views of 81 RAs currently attending the headquarters-based workshop mentioned earlier. The 80-item questionnaire has two parts: MOE Top-Down Support and Group Dynamics. Table 1 below shows the RAs' responses on four-point scale with higher scores denoting agreement to with the statement.

Table 1.

Responses to Support and Dynamics Survey (Means and Standard Deviations)

MOE Top-Down Support		Group Dynamic	
Project Facilitation	3.5 (0.46)	Knowledge	3.2 (0.40)
Curriculum Partnership	3.0 (0.85)	Value Creation	3.0 (0.29)
Network Grouping	3.4 (0.44)	Reciprocity	3.2 (0.40)
Resource Provision	3.2 (0.33)	Leadership	2.9 (0.60)

Source: Lee & Kang (2010)

It is of note that the responses are generally positive and the five highest ratings are for Project Facilitation, Network Group, Resource Provision, Knowledge, and Reciprocity. These suggest that the RAs were happy with the training and support accorded them and they enjoyed networking and reciprocity among the peers.

In addition to the above study, free responses were gathered by the present writer from RAs with a simple question *"What benefits have you got from participating in the training programme?"* The following quotes show that they have become more thoughtful, sensitive to issues, critical, and objective with instructional problems and more scientific in their outlook:

- *Systematic, critical, balanced (seeking to know the positive and negative views).*
- *Questioning myself more before acting.*

- *More critical in my thinking and when viewing others.*
- *Look at things in a more objective perspectives.*
- *Growing of ideas, practices among RAs.*
- *To be more reflective in our research. Don't take for granted that having the whole cohort for the project is good as it may make research more difficult to carry out or there may be a need to look for equivalent school to check the effectiveness.*
- *It has made me more sensitive to issues regarding learning, teaching, and assessment.*
- *That doing a research project is not that simple. It entails lot of reading, and analysis of what every item to be taught/tested, etc., and may be stretched to a number of years. Not just a touch and go item.*
- *I love reading now and finding out more about research done thus far.*
- *Need for data/evidence for judgment-making with regard to programmes/curriculum.*
- *Be more objective and clear in setting objectives. More precise in reviewing and writing.*
- *To look at things scientifically. Solving problems the informed way. Learning about forming hypothesis based on knowledge. Using language carefully. How to analyze data. How to conduct tests properly.*

Doing AR/SCI project in the school context is not always a smooth sailing. The RAs can always use some understanding and moral support from the school administration. This is reflected in the answer to the question *"What do you expect your school leaders do to help?"* as quoted below:

- *Support the teacher in case parents object (to) the project, e.g., may not want their children to go through the experiment.*
- *Provide the flexibility of allowing some classes to have alternative assessment as a major form of assessment (no final exams) so as to give teachers 'space' to experiment with 'new' pedagogy.*
- *What if there is difficulty in completing the syllabus as a result of too much time taken up in conducting the project.*
- *Understanding from school leaders and teachers*
- *Time factor - a lot of time school for meetings, workshops, remedial lessons, house practice, etc. How to find time for carrying out the research?*
- *As AR requires time and resources to carry out the project, would school management reduce the workload of teachers involved in the project.*
- *Must be forgiving if the research is not successful, the management must give us the support to re-think and learn*

Quo vadis? Having come this far, where do we go from here? To answer this question, it is useful to reflect on what has happened and discuss what may have to happen next. Such reflection will be useful to nations in the region where similar efforts are put in place to up-grade teachers professionally through teacher research, so that conceptual and technical problems can be foreseen and prevented or minimized.

Problems identification All research begins with problems or gaps between what is desired and what it now is. Practically all AR/SCI projects published thus far have their origins in some kind of instructional problems encountered by teacher-researchers in their classrooms, as they should be. However, they also seem to come from two main sources: (a) teachers'

experiences with the students and (b) interests in some conceptual framework (e.g., PBL, MI, HOM, etc.). Nothing is wrong from the research perspective except that this creates an impression that the projects have little to do with school improvement.

All Singapore schools have gone through at least the first round of external appraisal under the School Excellence Model (SEM) which is an adaptation of the European Foundation Quality Model (EFQM). School appraisal reports usually contain AFIs (Areas for Improvement) for school improvement. The AFIs are based on the findings of the appraisal team's study of the data provided by the schools and on-site observations and personnel interviews. Thus, the AFIs function actually as the very first step of AR -the identification of problems.

Therefore, to maximize the benefit of AR/SCI, a closer link between school appraisal, school improvement, and school-based research need be forged. The AFIs could well be the starting of any such project. However, AFIs have been only occasionally referenced to in AR/SCI reports available hitherto. A closer link between teacher research and school appraisal will enable the school administrators and teacher-researchers to see the value of AR in contributing to school improvement and not, as it seems to be seen, an additional professional activities done for its own sake or some other reasons. Linking AR/SCI project with AFIs kills two birds with one stone, so to speak; it satisfies the school administration's need in school improvement and, at the same time through the same process, the teacher-researchers' need for professional up-grading.

In fact, AR need not be confined to solving curriculum and instructional problems only and can and should go beyond to help any aspect of school improvement (with reference to the AFIs identified in the process of school appraisal). Almost anything that needs be improved in the school involving students, teachers, management can become topics of action research, for instance, students' behaviors (punctuality, courtesy, proper language, etc.), teachers' morale and training needs, and resource acquisition procedures, etc. In this sense, AR projects functions like QCC (Quality Control Circle) and WIT (Work Improvement Team), though with some subtle methodological differences (the discussion of which is beyond this paper).

Pragmatic approach As rightly pointed out by Tan, Macdonald, and Rossi (2009), the rise of educational action research amongst schools in Singapore can be attributed to the government's belief that educational research can improve school performance. Singapore, being a pragmatic nation, has done well and continues to do well in many practical realms of nationhood. It is quite natural that the same philosophy and approach prevail to guide educational effort. In short, AR/SCI is used almost exclusively as a tool to attain a higher level of student achievements, although from the theoretical viewpoint it need not be confined to this narrow focus. However, there is nothing to be shy about this pragmatic orientation. Basically, the purpose of doing AR/SCI in Singapore schools is to improve students' achievement and not to prove or disprove any theoretical beliefs; to prove or disprove is the task of the academics, not the practising teachers.

However, some teacher-researchers were guided (or rather, misguided) to believe that AR/SCI projects always need some kind of theoretical underpinnings (which are necessary for academic research) and, worse, that their responsibility (though not the only one) is to *prove* whatever theoretical frameworks

their project were based right. This has to do with the function of literature review.

A theory is a summary statement of carefully thought-through relations among factors pertaining to a problem, presented concisely to guide thinking and action. Using a theory in an AR/SCI project is to provide a conceptual framework within which the relevant factors can be selected and their relations evaluated empirically. In a sense, using a particular theory in an AR/SCI project is to short-circuit the much needed literature review. Useful as it may be, it is definitely not the responsibility of teacher-researchers (who have practical instructional problems to cope with or solve) to prove the theory right; that, as alluded above, is the job of academics in the university context. In short, the emphasis of 'action research' is on *action*, not *research*.

Therefore, a non-theoretical orientation is consistent with pragmatism. Since AR/SCI is to help solve practical instructional problems encountered in the classroom and not for verifying the validity of some pet theories (always packed in some mysterious acronyms), teacher-researchers need to focus on *thinking and creating their own alternative pedagogies* that are promising, and not to lean heavily on some high sounding theories or models, especially those associated with big names. Consulting the pertinent literature is necessary; it is to help teacher-researchers in understanding the problems and conceptualize alternative pedagogies. Let them stay with this as the purpose of professional reading.

Obsession with positive results As regarding the results, teacher-researchers need the understanding of the 'project sponsor' (i.e., school administration) that the projects, however well conceptualized and with or without a theory, may succeed and may not. This is the very nature of experimentation, in

sciences and even more so in education where many factors work together often beyond the control of teacher-researchers. It is only in the recent years that scientists recognize even failed experiments have lessons to learn from; hence, the creation of such publications as *The Journal of Failed Experiments* of the American Scientific Association of America to provide a safe haven for scientists to share their failure with the (scientific) community. When a project 'fails to deliver', reflect on it (from its conceptualization to many of the ensuing actions taken) and learn from the experience, with the intent to control some of the uncontrolled and hope for a better outcome the next round, and the next round. This is the basic tenet of action research being reflective and cyclical. By doing this, teacher-researchers become more thoughtful, experienced, matured and discerning teachers; and, that is what is needed in any school. With this positive attitude, no AR/SCI project is a failure.

Scientific research (and human beings) benefits from replication and accumulation. 'Education science' has much more uncontrolled factors to contend with and has to depend even more on replication and accumulation. Seen this way, an AR/SCI project may and may not solve the practical problem in hand but at the same time contributes yet another data point to the understanding of one or a few factors relevant to student achievement. Large-scale educational research project which answers a theoretical question once and for all is as rare a white blackbird (a natural one and not cloned). Even the almost only randomized large-scale (involving 7000 students in 79 schools) longitudinal (four years) Project STAR, sponsored by the Tennessee General Assembly (HEROS, 2009), does not resolve the issue of class size effect on student achievement. In

this sense, a large number of small-scale AR/SCI projects conducted in a variety of school environment and different curriculum contexts may prove more illuminating and convincing when their findings are pooled through meta-analysis (e.g., Hattie, 2009; Soh, 2010).

Ensuring success   Not infrequently, teacher-researchers asked the question "*What if my project does not work?*" They were overtly and often overly concerned with their ability to produce results that will be considered *significant* by the school administration. There are two issues here. Firstly, the word *significant* (or *significance*) has been used in its common daily usage and is confused with '*statistically signifi*cant' (or '*statistical significance'*), so much so that a probability value of, say, 0.0012345 (the computer will give more than these decimal values) is celebrated for a small mean difference obtained for a large number of students involved in a project. Such a misreading of statistics is not uncommon and needs be rectified. Secondly, while careful conceptualization, planning and execution enhance the probability of securing the desired project outcomes, there is no guarantee - anything that may go wrong will go wrong (so says Murphy's Law). Concern with positive project outcomes may be administratively desirable but over-concern imposes unnecessary pressure on teacher-researchers and distracts them from the proper attitude of experimentation and, worse, generates a fear for failure.

Many pedagogies have been trialed with associations to some kind of theoretical framework encapsulated in attractive acronyms (e.g., PBL, IBL, MI, HOM, P4C, SQ, etc.), lending the projects an element of academic respectability and magical persuasiveness. There is nothing wrong to associate

projects with well-established theoretical framework if these help, but this is different from guaranteeing success. (As an aside, Howard Gardner did not mean MI to be an educational strategy, but somehow someone turned it into one and thence followed by many others!)

To enhance success rate of AR/SCI projects, a different approach can be followed. From a pragmatic perspective, it is necessary to evaluate the probability of success before embarking on an AR/SCI project with the view of school improvement. Teacher-researchers or school administration may be strongly attracted by certain theories (models) or pedagogies for some reasons best know to them. There is a danger in such blind faith leading to over-confidence and dogmatism about the theory and results. One way to prevent this and possible waste of resources (especially in terms of teacher-researchers' and students' time) is to learn from past similar projects. This is where literature review becomes useful.

Literature review is supposed to be the first thing to do when a research topic has been initially identified. Due to enthusiasm or other reasons, this may not always be the case. Perhaps, more often than not, literature review is done more as a cosmetic (or worse, a necessary evil) to project reports only when projects are well in the way or completed even, just to comply with the research reporting convention. One danger of this is that only past studies that are consistent with the findings are selectively selected as a form of *post hoc* rationalization, telling half of the story and misleading the audience. Worse, this reinforces the blind faith and, as a consequence, the trialed pedagogy is recommended to continue, leading to more waste of resources.

To prevent this from happening, it is prudent to search for meta-analyses that are directly or even

just indirectly relevant to the intended project before they are carried out. The relevant meta-analysis should be able to help teacher-researchers and school administrators assess whether the intended projects will be worthy of their efforts. For instance, *individualized instruction* has a small average effect size of 0.23, *problem-based learning* an even smaller effect size of 0.15, and *student control over learning* an effect size close to zero (0.04) . On the other hand, there are innovations which have more impressive effect sizes; for instance, 0.90 for *providing formative information* (to use a more fashionable phrase, *assess for learning*), 0.74 for reciprocal teaching, and 0.61 for problem-solving teaching (Hattie, 2009).

If what works is what counts (being pragmatic), then resources should be channeled to projects that have high probability of success as indicated by medium or large effect sizes in relevant meta-analyses. In contrast, it takes a combination of blind faith and dogmatism to embark on projects which are likely to fail even before they start, notwithstanding the magical power of acronyms or attractiveness of ideas. The list of effect sizes for 138 different innovations (of 165,258 studies) attempted in mainly American schools needs be consulted when planning AR/SCI projects (Hattie, 2009; Soh, 2010). Admittedly, while this ensures a higher rate of success, it also prevents teacher-researchers from creativity in coming up with their own ideas. But, then, with the comprehensive information of 138 different kinds of innovation trialed, one wonders what the 139th innovation could be.

Conclusion

AR/SCI project are meant to help solve problems arising from ineffective or less effective pedagogies in the classroom. They should be seen as an approach to school improvement efforts. And, as is true of all research, problems are the starting point. Hence, AR/SCI projects need to begin with problems identification and this is always done in school appraisal. In other words, in the Singapore context, the AFIs (Areas for Improvement) in the school appraisal reports should be the main source of research problems for AR/SCI projects. In short, AR/SCI projects need be seen as a kind of SIPs (school improvement projects) and not something of an academic nature and theoretical interest. Based on the experience of AR/SCI of the past few years, greater success in school improvement through such research will accrue with an approach that is pragmatic, non-theoretical, and truly experimental.

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Appendix: Questions Raised by the RAs

1. Other than SMD, what are the other statistical tools which are suitable for school-based research, particularly effectiveness of SCI? And their applications? Implications?
2. What should we do if the quantitative and qualitative data contradict?
3. How do you use qualitative data to support quantitative data?
4. Many different views from consultants. "Many cooks spoil the broth". So as a researcher, any guiding principles to decide which suggestion to incorporate?
5. If results are not as expected, how to explain or convince layman on the limiting conditions?
6. How does action research differ from experimental design?
7. Should there always be a control group?
8. Must there always be a problem?
9. How wide should the scope of research be?
10. How to do a good literature review? Is it merely quoting experts and their work & research? How to deepen discussion of their work? Do we just summarise or must we comment on the works?
11. What are the general guidelines for a good survey instrument? How can a survey be validated for reliability and validity?
12. How can we guide pupils to give qualitative feedback that can be extracted for research, for instance, using journals?)
    a. How to come out with good questions?
    b. How to analyse pupils' descriptive data?
13. Can alterative assessment, other than paper-and-pen tests, be used as data points within the research design?
14. If we design our own assessments, how do we test the validity and reliability?
15. Is it a must to have 2 assessors in the course of the research to ascertain reliability of data results?
16. To ensure consistency (reliability) of marking, what is a good sample size, i.e. number of scripts, for double marking?
17. How many measures should be needed to validate your research?
18. What is the intent for using chi-square in the research? When do we use it? How do we report the figures calculated?
19. What is the intent for using p value in the research? When do we use it? How do we report the figures calculated?
20. What does 'regression to the mean' mean?
21. Are "median", "quartiles", "Co-variance" and "Box and whisker diagram" useful for analysis? How?
22. How can we use ANNOVA and ANCOVA on SPSS? Difference between the two? When is it applicable to use each of these measures?
23. Which significant level can be used in our analysis (95 or 99%)?
24. What is standard deviation?
25. Tell us in greater details how we can measure and analyse non-equivalence groups results?
26. When do we accept or reject hypothesis and what tools do we use? E.g. standard error?
27. Can we have a glossary of the different tests and what they are used for?
28. Research process is still a bit hazy. Can we have a flowchart as a guide?
29. What is the reasonable time frame to conduct a research project?