NEW ABS STRATEGIES TO PROMOTE STATISTICAL EDUCATION UNDER A NEW NATIONAL CURRICULUM FOR STATISTICS

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ABSTRACT
The Australian Bureau of Statistics (ABS) seeks to positively support the teaching of statistics across the Australian education sector, and recognises the importance of national curricula as a vehicle for achieving this outcome. Working collaboratively with the Statistical Society of Australia (SSAI), ABS has taken a deliberate and strategic decision to influence, when possible, inclusion of more statistical content within Australian curricula. This paper discusses how ABS Education Services is adopting new strategies to promote statistical education in the context of new curricula, enhancing suites of free education resources, and building new partnerships to bring statistical literacy competencies to life for both teachers and students.

INTRODUCTION

The Australian Bureau of Statistics (ABS) recognises the crucial role that the education sector plays in building the statistical literacy of Australia's future decision makers. Our aim is to improve the statistical literacy of teachers and students in the school sector, communicating the importance of using, and understanding, statistics to investigate and engage with their local, regional and global community.

ABS Education Services applies a multifaceted approach to improving the statistical literacy of Australian teachers and students. Assisting teachers and students to recognise the value of statistical literacy to 21st century citizenship is a necessary first step. We aim to improve teacher and student confidence in the teaching and use of statistics, demonstrating how relevant technology and pedagogical frameworks can enhance statistical teaching and learning. These aims are complemented by the development of classroom teacher and student resources. ABS Education Services consists of education and other professionals who create and publish free teaching and learning materials that align with statistical (and other) components outlined in the new Australian Curriculum.

ABS places great value on - and has actively championed - increased statistical content in Australian curricula. To have achieved this in the new Australian Curriculum is only the first step - the increased content must be supported by appropriate resources that equip teachers with the skill and confidence to deliver the curricula. It is through authentic context and professional confidence, that teachers will deliver enhanced statistical content through curricula, achieving improved statistical literacy outcomes for Australian students.

SECTION 1: THE AUSTRALIAN CURRICULUM LANDSCAPE

1.1 ABS Contribution to Curriculum Development

In its ongoing bid to publicise the need for statistical literacy, ABS harnesses all available opportunities to influence the discussion on, and development of, curricula. The development and adoption of the new Australian Curriculum has presented a once in a generation opportunity to enhance the teaching and learning of statistics in Australia. In 2008-2009, ABS provided broad level input into the National Curriculum Board's original proposal and various framing papers for new Mathematics curricula, followed by collaboration with curriculum writing teams for Mathematics - the aim being to improve the scope of statistical concepts and contexts in which they are taught.

In late 2009, Education Services represented ABS at curriculum development workshops for the Foundation to Year 10 and Senior Years Mathematics curricula. A partnership with the Statistical

Society of Australia (SSAI), with a focus on securing appropriate inclusion of statistics in the new Mathematics curricula, commenced in the latter half of 2009, with a joint submission on the statistics component of the national curriculum and establishment of an ABS/SSAI working group. This working group has continued to collaborate on input into draft versions of the detailed mathematics curricula development phases from 2009-2012.

1.2 Structure of the Australian Curriculum

The new Australian Curriculum consists of three dimensions, all of which combine to support the needs of 21st century learning: Learning Areas, General Capabilities and Cross-Curriculum Priorities. Comprehensive information about the Australian Curriculum can be found at http://www.australiancurriculum.edu.au.

Learning Areas provide curriculum for 'subject' areas e.g. Mathematics, English etc. The curricula for these subjects are divided into content and proficiency strands. For example, Mathematics content strands include Number and Algebra, Measurement and Geometry, and Statistics and Probability. Proficiency strands then describe the actions taken by students when learning and using the learning area content e.g. Mathematics proficiency strands are Understanding, Fluency, Problem Solving and Reasoning.

Broadly speaking, the new Mathematics curriculum is split between Foundation to Year 10 (F-10) and Senior Years (Years 11& 12) curriculum. Within the F-10 curriculum, students learn about statistics through the Statistics and Probability strand, placing statistics on equal footing with the traditional mathematical areas of algebra and geometry. This formalises statistical and probability thinking and skills, which previously have been taught with great variation across previous jurisdiction based curricula. The Senior Years curriculum differs in that it is constructed as four subjects: Essential, General, Mathematical Methods and Specialist Mathematics. The conjoined efforts of ABS and SSAI have aimed to influence the importance of continuity of learning and building of statistical skill and knowledge progressively, rather than learning concepts in isolation and devoid of real world context.

The inclusion of *General Capabilities* as a dimension of the Australian Curriculum acknowledges the need for students to develop a set of abilities that they can apply across learning area content. The F-10 Australian Curriculum identifies seven General Capabilities: Literacy, Numeracy, Information and communication technology (ICT) Capability, Critical and Creative Thinking, Ethical Understanding, Personal and Social Capability, and Intercultural Understanding.

Cross-Curriculum Priorities, which are also incorporated across the learning areas, acknowledge a need for the Australian Curriculum to connect with the lives of students and address the issues they face at a local, regional and global level. The curriculum identifies the following three priorities: Aboriginal and Torres Strait Islander Histories and Cultures, Asia and Australia's Engagement with Asia, and Sustainability.

The nature of the design of the Australian Curriculum provides a rich and diverse means of incorporating the authentic and contextual teaching of statistical concepts. The following section of this paper will explore these opportunities in more detail.

SECTION 2: NEW STRATEGIES AND PARTNERSHIPS FOR NEW CURRICULA

2.1 Using ABS Products to Support Deeper Statistical Understanding: Entry Points into the Australian Curriculum

ABS Education Services has embraced the new Australian Curriculum as an opportunity to view the three dimensions of the curriculum as 'entry points' for teaching statistics. In the belief, and acknowledgement, that statistical literacy can be enhanced beyond the traditional domain of the Mathematics learning area, ABS has undertaken to demonstrate how statistical learning can be accomplished in tandem with the General Capabilities and the Cross Curriculum priorities.

In development of its teaching and learning resources, ABS Education Services has never restricted its focus to Mathematics - it is our belief that if teachers from other subject areas which use statistics (such as geography, economics and science) misuse, misunderstand or misinterpret statistics, this will have a flow on effect on statistical learning in the mathematics classroom. In contrast, if these areas embrace frameworks such as the 'Investigation Process (or Cycle)' in their learning areas, a ready opportunity reveals itself for incorporating the teaching of statistics.

The Australian Curriculum consists of a new, and challenging, level of statistical content for some Mathematics teachers. With the inclusion of designing deep learning that connects to General Capabilities and Cross Curriculum Priorities, teachers have an ever growing need for access to authentic and multifaceted resources. One of the key strategies employed by the ABS to meet this need is to improve the connections between existing ABS and Education Services products and the new curriculum. The CensusAtSchool-Australia program, for example, provides myriad connections or 'entry points' to all three dimensions of the Australian Curriculum. From a cross-curricular perspective, it can be taught through a variety of learning areas, whilst completion of the questionnaire and manipulation of its data draws on many of the General Capabilities (such as ICT capability, literacy and numeracy) and the Cross-Curriculum Priority of sustainability (through questions around environment).

Further entry points into the curriculum are found in other ABS data products, including Census of Population and Housing data and data visualisations and animations. Harnessing these 'authentic' sources of data recognises that statistical literacy is not just about numbers and calculation, but also understanding the context of data collection. The use of animations and interactive data visualisation also allows teachers to apply pedagogies that use relevant and appropriate technology - the goal is to not only source and analyse data, but to understand why it was collected, what questions it helps us to answer and what valuable information is provided by metadata.

The preceding points represent our ambition and intent when it comes to supporting teachers' engagement with the Australian Curriculum by harnessing and enhancing our existing products. Where the ABS brings additional value is in how we embed statistical literacy by framing pedagogy in the statistical investigation process. Through this process of inquiry, the ABS profiles the exploratory context of the learning, to give proper meaning to statistical concepts e.g. knowing why the mean is a useful statistic and how it can be used, rather than simply being able to create the mean from a random data set. ABS Education Services actively models this investigation process in its resources - extended CensusAtSchool lessons actually provide this process as a framework for students to pose and investigate questions. The statistical investigation cycle carries statistical learning across the year levels, taking teachers and students beyond discrete skills, to understand the meaning and value behind the creation and use of statistics.

Practical adjustments and additions to our online resources are providing increased value to teachers. Education Services actively devises, and publishes information on, the General Capabilities included in assessment rubrics. Existing resources are being progressively 'aligned' to the mathematics curriculum, providing content descriptions that 'link' our resources to relevant parts of the curriculum. The Australian Curriculum, designed in an online accessible form, is a transparent document that aims to facilitate greater community awareness of Australian education. Details of curricula are now easily accessible to all who have an interest in Australian education. The online model of the Australian Curriculum makes it easy to access and easily adaptable to the changing needs of Australian educators. It also assists ABS to more easily align our resources with teachers' needs.

A further area of ABS innovation to support Australian Curriculum is in providing increased access to official statistics through means that engage with young people. One such product is the ABS Census application called 'Run That Town'. This interactive resource simulates community level decision making, using real 2011 Census of Population and Housing data as a basis for these decisions. Students experience a direct connection between the purpose of data collection, and its use

for decisions that affect various groups within a community. An online game with high demand on literacy, numeracy, critical and creative thinking, and ICT capability, 'Run That Town' delivers statistical learning in an environment that concurrently develops general capabilities. A truly cross-curricular resource, the game draws on learning outcomes relevant to areas beyond Mathematics: Civics and Citizenship, Economics and Business Studies, Geography. The many projects and events proposed during the course of the game also challenge an understanding of sustainability.

In summary, the ABS has demonstrated agility in harnessing the already good work evident in existing products and is working diligently and innovatively to align these to the burgeoning needs of Australian teachers in a new curriculum context.

2.2 Harnessing External Partnerships to Enhance Support for the Australian Curriculum

Whilst our products are the practical resources supplied to support teacher and students, Education Services maintains significant and relevant partnerships to enhance the profile and 'discoverability' of our resources. The Australian Curriculum is designed to support 21st century learning - Education Services endeavours to mirror this focus through provision of digital and equitably accessible resources for teachers and students. A key strategy for achieving this outcome has been to harness partnerships that increase the online 'discoverability' of Education Services and other ABS products.

The leading digital resource currently available to support teachers' engagement with the new Australian Curriculum is Scootle - this portal hosts more than 20,000 digital curriculum resources through the National Digital Learning Resources Network (NDLRN). Through Scootle, teachers can easily find, organise and use quality digital resources which are aligned to the Australian Curriculum. All of the digital resources contained in Scootle are quality assured, and include activities for students, teacher support materials and interactive assessment resources. As one of the first learning areas finalised during curriculum development, there are currently one or more digital resources to support all content descriptions for the published Australian Curriculum for Mathematics - a number of these are ABS or Education Services resources, including ABS data sets and CensusAtSchool learning tasks. In addition, the ABS has been selected as a participant in a pilot program as a 'trusted provider' to explore authoring metadata to support ‘discoverability’ of our resources within Scootle. This partnership acknowledges the calibre of ABS products, our credibility and recognition in the education sector, and the degree of need for statistical learning resources. Such authoring access would effectively fast track inclusion of ABS resources to Scootle, allowing us to provide a more timely service to our clients and enhance resource 'discoverability'.

Since 2011, ABS has partnered with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Australian Mathematical Sciences Institute (AMSI) to produce Maths and Stats by Email (MaSBE). MaSBE is a free fortnightly e-newsletter targeted at 9-13 year old children; each edition includes interesting articles and activities about maths and statistics which are easily transferable to the classroom for use by teachers. As regular contributors to the e-newsletter content, ABS has been able to introduce actual links to the new Australian Curriculum, thereby profiling statistics curricular content for student, teacher and parent engagement. The articles written by Education Services aim to teach a core statistical concept e.g. what does it mean to be 'average'?; this theoretical learning is then supported by a practical activity to apply the learning, often complemented by links to relevant ABS or Education Services products (CensusAtSchool, Census of Population and Housing etc.). ABS articles and activities from MaSBE are also included in the Helix@CSIRO blog, further extending the discoverability of ABS education products.

These partnerships are only two examples of how the ABS effectively harnesses the opportunities and expertise of its stakeholders to appropriately advance our core objective to enhance statistical literacy support for teachers and students.

SECTION 3: EDUCATION RESOURCE ENHANCEMENT - MEETING THE CHALLENGES

In light of increased statistical (and other) content in the new curriculum, challenges for Australian teachers include competition for preparation and classroom time. Mathematics teachers' understanding and familiarity with statistical (as opposed to mathematical) content is a further area identified in need of support. Finally, the focus, integrity and alignment of resources are imperative in the design of new materials: teachers need (and highly value) resources that deliver the learning they claim to, come from a reputable and verifiable source, and align to the new curriculum. One method by which ABS delivers on these three components of quality resources is through the employment of Teacher Consultants; these individuals apply recent classroom experience and insight into teachers' priorities to develop credible resources that meet curricular requirements. Currently, a Mathematics specialist is employed by Education Services. The teacher consultant informs the work of Education Services to ensure that resources are pedagogically sound and align with the Australian Curriculum to deliver deep statistical learning.

Professional development offerings must be relevant, collaborative and future focused - 'PD for teachers, developed by teachers' has the greatest chance of translating to improved student outcomes. ABS Education Services is constantly challenged to meet the wide ranging needs of teachers spread across remote, rural, regional and metropolitan areas. The priority is to deliver reliable, accessible and consistent resources under the trusted and credible banner of the ABS, which enhance teacher capability. Face to face professional development is not always the optimal solution. The Australian geography is at times prohibitive to attendance at conferences or workshops; ABS is committed to diversifying its offerings in this space, enabling equitable access for all. Similar to the growing e-learning trend in other areas of statistical training, this includes online offerings that can be accessed at any time, for free, as well as working to make our resources more discoverable outside of the ABS website.

Teaching of statistics must be based on the fundamental understanding that statistics and mathematics are different, with statistics requiring a different skill set in addition to mathematical expertise. This necessarily requires that teachers possess specialised skills and teaching methods. ABS is increasingly cognisant that many mathematics teachers need reliable and authoritative assistance. Our conference workshops and customised professional development sessions focus on three core areas: technical skill development, curriculum 'entry points' and alignment, and application of specific ABS or Education Services data products. From May to December in 2012, Education Services presented workshops and delivered professional development on an approximately monthly basis in five of the eight Australian jurisdictions. Complementing these face to face methods, individual advice and support is also provided to our clients via email and free phone call. Through these varied methods, ABS can assist teachers with varying degree of need to improve their confidence and competence in teaching statistical content.

Learning and assessment tasks that teach statistical concepts should use authentic data from real world contexts - tasks that are authentic are those that are purposeful and engaging, model how people solve real problems, put knowledge to work, offer support for meaningful learning and higher order cognitive thinking, and result in a product, presentation or outcome as a result of work. To teach authentic tasks and use authentic data, teachers must be able to easily find and use these data - Education Services continues to enhance its provision of, and easy access to, customised ABS datasets suitable for classroom use and sample data from CensusAtSchool. These myriad sources of authentic data, about students and their lives and communities, equip teachers to deliver authentic statistical learning opportunities.

Rigour in the teaching of the statistical cycle is paramount - modelling an investigative cycle that recognises the higher order skills of defining, designing, hypothesising and checking. Development of investigation projects that use authentic data and/or real life context will improve student outcomes. The ABS is uniquely placed to model the relevance and application of the cycle in the teaching of new statistical curriculum, supporting it with teacher and student resources to help evaluate skills in this area and apply them to student-centred investigations.

CONCLUSION

ABS is well placed to meet the ongoing demands of statistical education under a new Australian curriculum. Existing resources and partnerships provide a stable platform from which to undertake further enhancements to serve the diverse needs of Australian teachers as they grapple with increased statistical content. Future efforts for the ABS will focus on strategies and partnerships to provide appropriate support to improve teachers' professional learning in the teaching of statistics, as well as continued improvement of online classroom materials.