

ARTICLE



## Science teachers accelerated programme model: a joint partnership in the Pacific region

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### ABSTRACT

The paper heralds a new pedagogical model known as the Science Teachers Accelerated Programme as a platform to upgrade the qualifications of secondary school science teachers throughout the Pacific region. Based on a tripartite partnership between a higher education provider, a regional government and a cohort of science teachers, the model offers an accelerated Bachelor's degree programme to the cohort. Using this tripartite partnership model, a pilot of the Science Teachers Accelerated Programme is underway between the University of the South Pacific, the Government of Samoa and a cohort of science teachers in Samoa. The underpinning activities garnering social and academic integration are highlighted with analytics. The strengths, challenges and opportunities of the new, cohort-taught science model are presented with relevant diagnoses, interventions and adaptive works carried out in the first half of the delivery plan. While the Government of Samoa is considering the implementation of a second cycle, the University of the South Pacific is considering extending the model to other regional countries.

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## Introduction

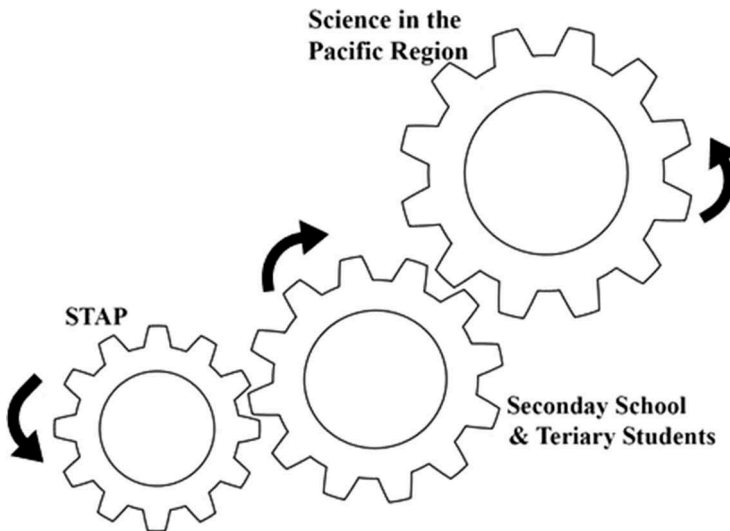
The Pacific region comprises 22 Pacific island countries with a total population of 11 million people (Pacific Community, 2016a). Spread across the Pacific Ocean, remoteness and isolation are sore realities of the Pacific countries, which are also classified as developing countries by the World Bank because they lack proper (or complete) infrastructure and have lower living standards, human development indexes and economies (The World Bank, 2013). Each regional country commits to its own needs and priorities, but a shared commitment of the Pacific region is to create learners of the 21st Century for the globalised world and mobilise social and cultural changes. While a scientifically literate populace is anticipated in most countries (International Council of Science [ICSU], 2011; Sjøberg, 2002), the Pacific needs to reform its science education, reinvigorate science through school curriculum, new pedagogies and qualified teachers, and

empower regional scientists for protection of its environment, improve the quality of life and institute a sustainable future (Asian Programme of Educational Innovation for Development, 1983; Dakuidreketi, Bakalevu, & Maiwaikatakata, 2016; Muralidhar, 1997; Sovaleni, 2016; Wolf et al., 2016).

There is a steady decline in student interests and the uptake of science subjects in schools, and serious challenges in science education are apparent in most countries around the world (Lyons, 2006; Organisation for Economic Corporation and Development [OECD], 2006; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2008); however, the trend is more pronounced in the Pacific region and is demonstrated further by the low student achievement at junior and senior levels in the science subjects (Dakuidreketi, 2014). Pasikale, Wang, and Apa (1998) highlighted that only 7% of Pacific school-leavers progress to tertiary education compared to 21% of all school-leavers. This further translates into even lower numbers of Pacific students who actually take up science programmes at tertiary level. For example, recent University of the South Pacific (USP) enrolment statistics show a three-to-one ratio favouring non-science courses and programmes (2016). The likely cornucopia of factors found in literature (Bonetta, 2010; Hipkins et al., 2002; Pasikale, 1996; Rennie & Dunne, 1994) which act as barriers to students' selecting science can be divided into 3 categories:

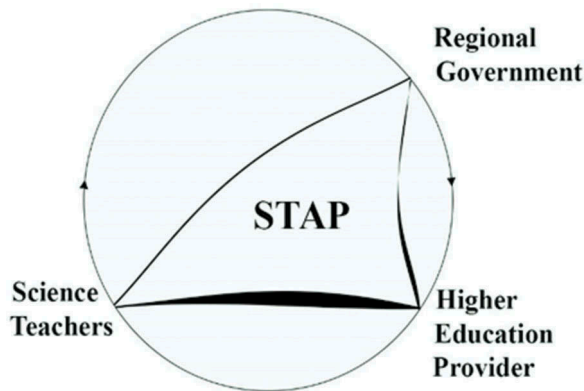
- (A) **Home:** factors which originate from students' home environment include parents' perceptions and low motivation for science, pressure for higher income to support family, life experiences of family and relatives, cultural demands, and the lack of role models and mentors in the family.
- (B) **School:** factors which originate from students' school include foreign resources, lack of qualified teachers, constrained resourcing and Information Communication Technologies (ICT) infrastructure, inefficient administration, minimum entry qualifications and low inspiration for science.
- (C) **Community:** factors which originate from students' community include science myths, perceptions of communities, graduates placement and stability in society, culture and language demands, job selection for family and community mobility.

These issues notwithstanding, there are pockets of activities witnessed in the region to address and arrest the problem. The Pacific-Europe Network for Science, Technology and Innovation (PACE-Net) brings together policy makers, funding agencies, representatives from research, innovation and development institutions to produce policy briefs and strengthen Pacific-European Union collaboration and dialogue in science (PACE-NET, 2015). In addition, the Untrained Teachers Project in Vanuatu and Kiribati (University of the South Pacific [USP], 2015), In-Service Teacher Workshops in Samoa (UNESCO, 2015a), Education for Sustainable Development in the education system of Tonga (UNESCO, 2015b), Competency Frameworks for Teachers and Principals in Fiji (UNESCO, 2015c) and the school-based assessments in Fiji, are among the recent science-related awareness and training activities held in the Pacific region. Nonetheless, the need for qualified teachers in the Pacific region remains an urgent issue (Dakuidreketi et al., 2016; UNESCO, 2014, 2016).



**Figure 1.** The three-gear conceptual framework of the Science Teachers Accelerated Programme.

A new pedagogical model known as the Science Teachers Accelerated Programme (STAP) is proposed by USP to address the issue of qualified science teachers. The model provides a platform to upgrade the qualifications of underqualified teachers teaching science in secondary schools in the Pacific region. STAP is an intensive 2-year in-service programme offered to a cohort of teachers with certificate or diploma-level qualifications from recognised institutions and with at least 3 years of teaching experience. From the three-gear conceptual framework illustrated in [Figure 1](#), it can be seen that the cohort-teaching model at the center of this discussion, is envisaged as having the potential to cause a scaffolding effect in the education sector across Pacific island countries, in the process becoming a tool to mobilise a societal change in the Pacific. Just as an increased number of rotations of the inner gears would increase the rotations of the outer gears, a wide adoption of the STAP model would ensure greater numbers of qualified science teachers in the region who would produce higher numbers of good science students, thus feeding increased numbers of quality science students into mainstream, tertiary-level science programmes. Such a trend will subsequently translate to an increased number of science graduates serving their communities in the region. Admittedly, science graduates in the region often find more attractive employment packages with other government departments and the private sector. Thus, the relationship between employment opportunities and the demand for higher education is seen to be positively related to income differentials. A steady supply of an increased number of science graduates will help even out the market. More science graduates in the Pacific would also ensure capacity building by virtue of a greater collective intellectual and knowledge base being made available within the region to address the most pressing issues pertaining to the Pacific such as disaster management, climate change, digital divide, renewable energy, and entrepreneurship. Therefore, there would be key macro-economic benefits to creating jobs for science graduates, such as reducing the dependence on foreign expertise and building sustainable knowledge-based economies,



**Figure 2.** The tripartite partnership facilitating the Science Teachers Accelerated Programme model in the Pacific region. Modified from (National Institute of Education, 2009).

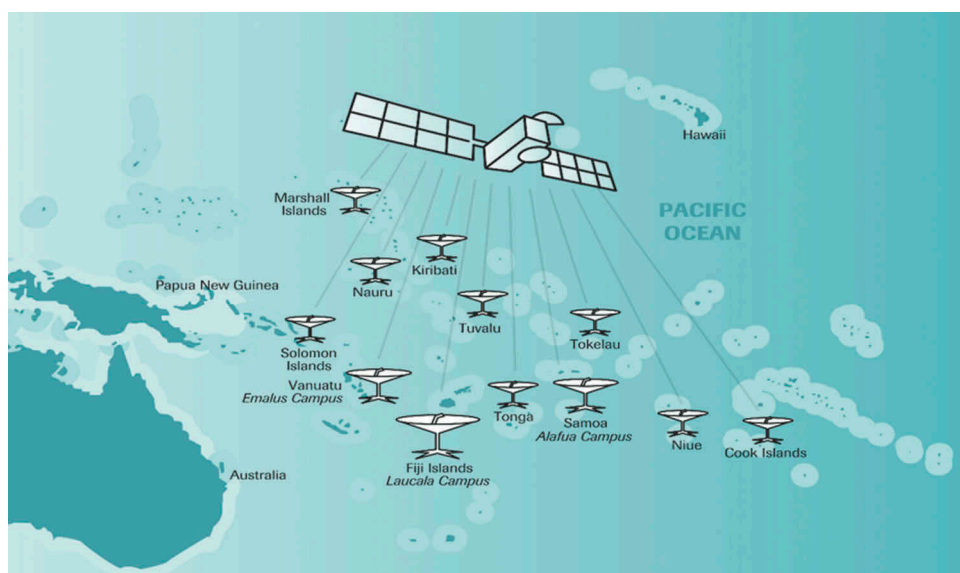
issues that are among the key structural deficiencies among Pacific island economies. These values essentially provide for the conceptual framework of the STAP model.

Figure 2 illustrates how the STAP model can be facilitated through a tripartite partnership between a higher education institution, regional government and science teachers. This being a partnership-based pedagogical model, each partner plays an indispensable role to ensuring its success. The design of the new model is adopted from, and has close similarities with, the “Enhanced Partnership Model” designed by the National Institute of Education partnering with the Ministry of Education and schools to provide teacher education programmes in Singapore (2009). The new model has the head and track of its sail tied to the regional government and the higher education provider, respectively. The model shows the sail flowing to the clew, which is tied to the science teachers. The mast signifies the strong hold and importance of the regional government and the higher education provider in the Pacific region. This strong partnership fuels the sail, with the energy flowing to the clew, which represents the science teachers.

In the STAP model, the higher education institution provides for the courses, classrooms and learning spaces, training and support services, innovative pedagogies, and ICT. Regional governments provide for the funding, and selection, support and management of the cohort through their education ministry. Both partners ensure that the cohort is trained and inducted towards a smooth transition into the programme. The partner that is most important in ensuring the model’s success is the cohort of in-service teachers. Specific attributes of USP are outlined next which show why it is best suited to, and most capable of executing the model in the Pacific region.

## Background

The University of the South Pacific is a regional multi-campus institution operating since 1968, with a student roll of 25,104 (USP, 2016) populating its 14 campuses and 10 centres spread over an area of 30 million square kilometres of the Pacific Ocean. The university is collectively owned by its 12 member countries – Cook Islands, Fiji Islands,



**Figure 3.** The USP member countries connected throughout the Pacific region using satellite telecommunication (USPNet). Adopted from USP strategic plan 2013–2018.

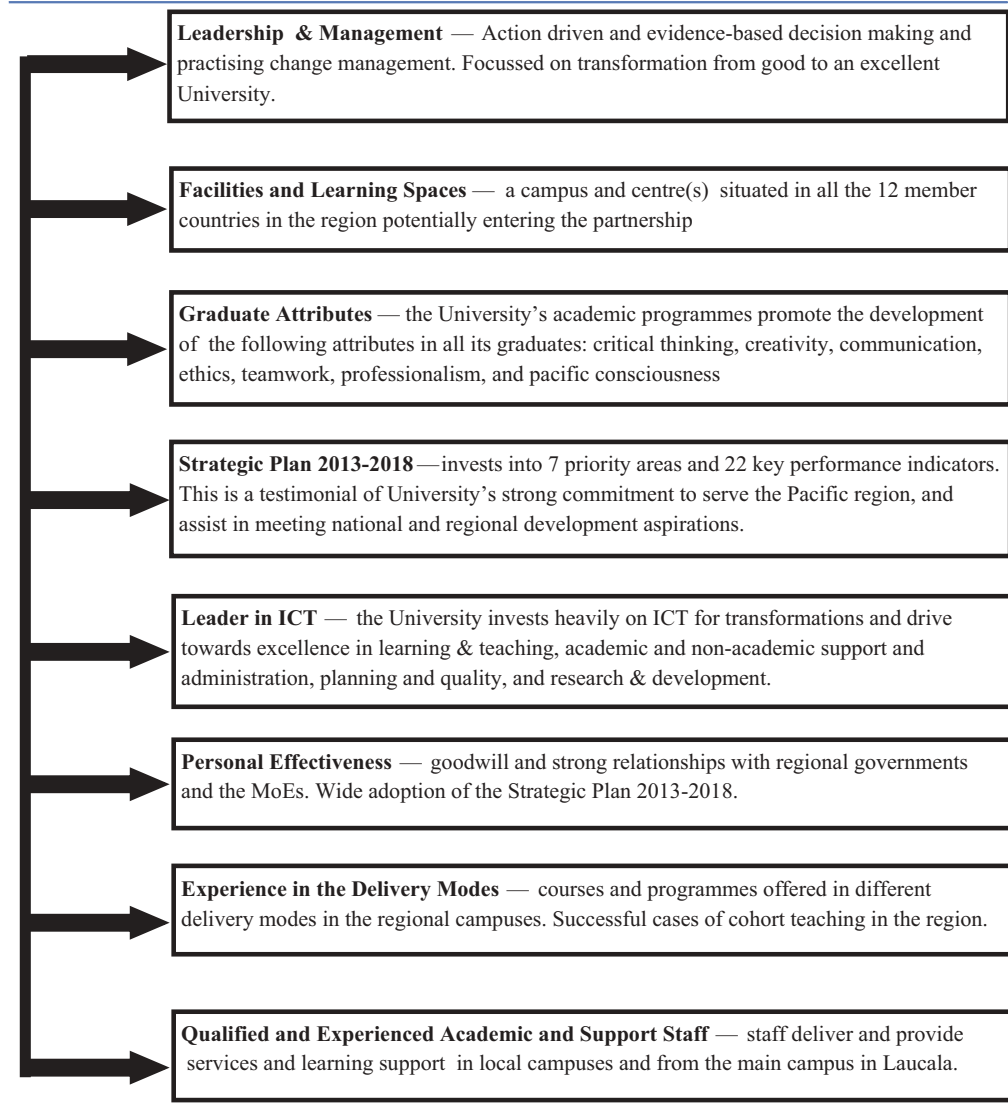
Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu (see [Figure 3](#)). The population of these countries range from a high 880,000 (Fiji Islands) to a low 1,400 (Tokelau). The land area also varies significantly, the smallest being Tokelau with about 12 km<sup>2</sup> of land area (Pacific Community, 2016b).

Each member country houses at least one campus, which usually varies from campuses in other member countries in size and student population, support services and facilities, infrastructure, and, modality of courses and programmes. The smaller centres are a part of the larger campuses normally spread across remote locations or based in the outer islands of some regional countries. For example, Solomon Islands hosts their campus in Honiara and the smaller centres in the Western and Temotu provinces. Similarly, Vanuatu has the Emalus Campus, and centres in Santo, Malampa, Torba and Tafea. The main campus (Laucala Campus) with the highest headcount is located in Suva (Fiji Islands) and is the hub of the university's administrative, academic and commercial operations (Jokhan & Sharma, 2010).

The university exercises multi-modality of courses and programmes, namely: day-to-day classes, referred to as *face-to-face mode*; *print mode* mostly for flexible education; full-time online, referred to as *online mode* and finally the *blended mode* which is a mix of face-to-face and online or print deliveries. Most of the courses and programmes offered in the region are usually coordinated and facilitated from the main campus. [Table 1](#) shows the STAP model competencies of USP which make it a suitable member of the STAP tripartite partnership.

### Birth of the science teachers accelerated programme

In 2013, the University of the South Pacific's Faculty of Science, Technology and Environment (FSTE) conducted a Science Outreach in Samoa. During visits to secondary

**Table 1.** The STAP model competencies of the University of the South Pacific.

schools it was established that there were many underqualified teachers teaching science subjects. Underqualified, in this respect, meant that there were teachers with certificates in education and majors in non-science disciplines who were teaching junior and senior-level science subjects. This was also a major concern for USP, since not many students were selecting science programmes at tertiary level, irrespective of the regional country of origin. The trend for Samoa was much the same. The non-science programmes generate two-thirds of the total USP intake in 2012–2015 (USP, 2016).

In recognition of this problem, USP considered the issue formally with the Samoan Ministry of Education, Sports and Culture (MESCC). Subsequent collaborations resulted in a joint initiative between the Government of Samoa and USP with a view to upgrading the qualifications of science teachers in Samoa. Such an initiative for the teachers while



**Figure 4.** Samoan Prime Minister delivering his keynote address during the STAP launch.

they remained in-service, appeared to be the only parameter needed to complete the equation that included other factors such as the willingness of teachers and the support from the government which were readily forthcoming. Essentially, a programme building on the existing qualifications of teachers, harnessing existing resources and bringing education to the teachers, was required.

The current Samoan Government has been a strong advocate of science in Samoa since coming into power in 2012 (Public Service Commission, 2013). The Prime Minister and the Minister of Education, Sports and Culture of Samoa have on numerous occasions highlighted the need for local scientists to mobilise changes and steer their country through issues such as natural disasters, changing weather patterns, adaptive capacity, unequal prosperity, and other challenges unique to the Pacific region. While the advocacy has been strong, the obvious dearth of science teachers compromised and adulterated the importance and focus of the tertiary-level science education. Samoa, as with other Pacific countries, has underqualified teachers and many non-science teachers inducted into teaching science because of the lack of qualified science teachers. This trend has compromised the quality of science teaching and student interest in science, resulting in fewer students and graduates of science at all levels. A consequential effort by the government has been upskilling teachers through regular training workshops. Also, upgrades to qualifications have been achieved by sending teachers for further studies on a full-time basis; however, their absence from the classroom further escalates the problem.

Finally, to formalise the tripartite partnership between the University of the South Pacific, the Government of Samoa and the cohort of science teachers, a Memorandum of Understanding was signed during the official STAP launch at Alafua Campus. Officiating at the event (see Figure 4), Samoan Prime Minister, Honorable Tuilaepa Aiono Sailele Malielegaoi acknowledged the University of the South Pacific for acting on the request from the Minister for Education by introducing a new cohort teaching model for its science teachers.

*"We are embarking today on an important journey that will see many benefits for our education system and that is the awarding of 60 Government Scholarships for science*

*teachers to undertake a Bachelor of Science Programme at the University of the South Pacific,” Samoa Prime Minister, Tuilaepa Aiono Sailele Malielegaoi.*

## Theoretical framework of the STAP model

The theoretical framework underpinning the STAP model hinges strongly upon the constructivist theory, which as a philosophy of education, suggests that learners construct knowledge out of their personal and social experiences. Given the distance-based and flexible nature of STAP, it was imperative that students took an active role in their learning as they only had intermittent face-to-face contact with the facilitators. Such an approach was essential since the majority of the cohort were mature-age Samoan students with extensive secondary school-level teaching experience and who had therefore accumulated a wealth of experience and knowledge beneficial to the cohort.

The STAP model required students to engage more in group discussions within the cohort. This was aided by eMentoring support where online study buddies provided scaffolding for the students to develop their zones of proximal development. The zone of proximal development concept, originally developed by Vygotsky in 1962, is essentially about what a learner can or cannot do without help (Atherton, 2013). In this context, the model represents the development potential that unqualified teachers with experience have versus when given scaffolding or guidance through the eMentoring programme. Vygotsky proposed that an individual had limits to what could be learnt alone; however, these limits are extended under a framework of scaffolding or guidance and support. Scaffolding was blended into STAP at 3 points of interface – with the virtual study buddy system, with the active use of tablets, computers and other ICT tools, and finally, through face-to-face tutorials and lectures. The cohort was provided more assistance at the beginning of the programme. However, the assistance was progressively reduced. For example, there were frequent visits by the support team from the main campus at the beginning, but these were later reduced as the students were able to learn and complete tasks independently.

This kind of constructivist-oriented framework also helped to move away from the dependency on the banking education model.

Banking education is a relationship of domination in which the teacher has knowledge that she deposits in the heads of the passive objects of assistance – her students. Banking education maintains students’ immersion in a culture of silence and positions them as objects, outside of history and agency. (Bartlett, 2008, p. 2)

While the banking education model already has an inherent “culture of silence” due to its teacher-centeredness, it represents another layer of learning dysfunction in the context of Pacific students. The culture of silence innate to Pacific cultures becomes further legitimised when such a model is brought into play in the kind of formal classroom setting that would inevitably amplify such a culture of silence. Unaisi Nabobo-Baba (2006, p. 94) in her book *Knowing and Learning: An indigenous Fijian approach* argues that in many Pacific communities, silence is seen as a culturally appropriate mode of behaviour. To pre-empt students not engaging in discussion or asking questions out of the fear of being disrespectful, pre-STAP workshops were held to



help break this mindset among participants and nurture active learners by cultivating a culture of interactive learning in both face-to-face and online modes.

The STAP model has a mixture of distance and flexible learning deliveries complemented by flexi schools and a boot camp, enabled by a host of ICT tools. These delivery methods and learning tools are adopted to enable teachers to study from any location and at any point during their school calendar. Over the past decade, higher education institutions have been leveraging on and integrating ICT in their teaching, learning and support processes to make tertiary education more accessible and flexible, with an enhanced degree of student ownership. ICT serves as the backbone of the STAP model because it provides the cohort with the flexibility of completing activities and assessments through online instructions via the higher education provider's learning management system and the use of tablets, distributed free to every member of the STAP cohort. Therefore, there is an overall cumulative effect of increased knowledge creation, collaborative learning and micro-learning at any point in time, in less structured spaces, and, through using mobile devices compared to the traditional brick-and-mortar classrooms.

The Substitution Augmentation Modification Redefinition (SAMR) model, developed by Dr. Ruben Puentedura (2006), shows how technology can act to enhance the learning and teaching processes by being a means of augmentation and substitution as well as being an effective facilitator that redefines and modifies these processes. The use of technology in education has made obsolete, the traditional hardcopies of course materials. There is access to a plethora of online and offline content, devices such as laptops and iPods, as well as a functional improvement of searching and sharing, uploading and downloading, watching and making videos, and, listening to and producing audio clips. ICT in this tripartite model plays a core role, defined as "the principle way of organising the learning experience" by Kirschner and Davis (2003). These ICT-enabled attributes of STAP position the model into the 4th quadrant of the consolidated continuum of approaches for ICT integration in teacher professional development, a conceptual framework from Olakulehin (2007). Tablets are becoming increasingly important as one moves along the various facets of the SAMR model. The STAP cohort is reinventing its learning through the online group discussions, hence creating new knowledge and sharing through the tablets.

### Design and delivery plan of the STAP model

The design of the STAP model was centered upon having sufficient teachers with appropriate qualifications. The teachers needed to successfully complete 16–18 out of the 24 courses prescribed in a standard Bachelor's degree. The remaining 6–8 courses would be credited from their existing Diploma qualifications. Other variations were also appropriately considered. The accelerated programme, offered with different combinations of disciplines such as mathematics and computing or chemistry and biology, would build on the existing qualifications of the cohort and upgrade to a Bachelor of Science degree.

The geographical location was a concern as the cohort included teachers from the 2 major islands in Samoa; Upolu and Savai'i. The Alafua Campus is located on the Island of Upolu and on Savai'i there is the out-reach Saleleloga Centre (see Figure 5). It was decided that all the teachers would convene at the Alafua Campus for face-to-face tutorials and laboratory sessions due to resource and capacity issues. The Savai'i



**Figure 5.** Map of Samoa showing the location of the Alafua Campus and the Salelologa Centre.

teachers would travel to the Salelologa Centre to attend the satellite tutorials and eMentoring sessions.

### *Delivery plan*

After an intensive review of the logistics and constraints, a 2-year delivery plan for STAP was established. The plan was executed from June 2014 to June 2016, with graduation in November 2016 (see [Table 2](#)).

It was recognised that this work-intensive plan would require recalibration(s) based on the performances of the members of the cohort. The courses failed were rescheduled within this two-year plan. The plan also integrated a number of learning support services such as eMentoring, social media, mLearning tools, satellite tutorials, video conferences and face-to-face visits, which are discussed in a later section. One of the peripheral objectives of the STAP model is to improve access to course content and enhance communication through online tools and technologies, and, directed resourcing. Keeping in mind the students' accessibility to online resources, time constraints and the high cost of Internet usage for home users, the University of the South Pacific provided Android tablets to the cohort. The cohort also continuously received academic advice, support and timely feedback from the administrators, teaching teams and MESC.

### *Surveys and questionnaires*

To determine the internal reliability of the Likert scale data from the three different questionnaires listed in [Table 3](#), the Cronbach's alpha reliability test was carried out with an alpha value greater than 0.8, indicating a high reliability of the data.

**Table 2.** The delivery plan with the number of courses to be taken (taught) in STAP.

	2014		2015		2016	
	Taken	Offered	Taken	Offered	Taken	Offered
Summer ( <i>January</i> )			2	5	2	3
Semester 1 ( <i>February-June</i> )			2	4	1	3
Winter ( <i>June- September</i> )	1	1	2	5	2	5
Semester 2 ( <i>July – November</i> )	1	2	1	3		
Summer ( <i>December</i> )	2	5	2	5		Graduation

**Table 3.** The Questionnaires in STAP.

Questionnaires	Respondents
The first questionnaire was circulated to 25 teachers to get feedback on the preparatory workshop on time management and ICT skills	18
The second questionnaire was circulated to 68 students to collect information on ICT skills	51
The third questionnaire was circulated to 68 students to garner their views on support services	37

Data were obtained on the total marks achieved by the STAP and non-STAP students, when the same courses were offered in years 2012 to 2014. These data sets were subjected to statistical analysis using the IBM SPSS Statistics software. Exploratory tests were conducted to determine the normality of the data considering the distribution of data in the histogram, the position of the points along the reference line in the quantile-quantile plot and the calculated probability ( $p$ ) value of the Shapiro-Wilk test. Since the data were not normally distributed, the Mann-Whitney test was employed to compare the difference between the 2 groups.

### **Laboratory work**

Historically, science courses have not been offered on USP's regional campuses due to the unavailability of specialised laboratory equipment required for the practical components of such courses. Practical work is integral to science courses, hence the delivery of these courses are largely restricted to the main campus. In the case of the programme, either virtual or recorded laboratory sessions were scheduled. Alternatively, the facilitators travelled with essential equipment during their tutorial visits. In addition, a two-week boot camp on the main campus was planned towards the end of the programme for more specialised laboratory work requiring large or expensive equipment.

### **Cohort of science teachers**

#### **Selection criteria**

The major criteria for selection was a Diploma qualification with at least one major in science. Teachers who did not major in science were required to have at least 3 years of teaching experience in a science subject. Other requirements included good references, a clean police record and attendance at past teacher training workshops.

#### **Cohort background**

The STAP cohort comprises 63 teachers of diverse educational and socio-economic backgrounds, with 63% from Upolu and 37% from Savai'i. There are 57% males and 43% females in the cohort. While 60 teachers have been provided with government scholarships, 2 teachers were initially funded by the Methodist Church and there is 1 private student. With the exception of the private student, rest of the cohort teaches science subjects at junior and senior levels in secondary schools.

Figure 6 shows the qualifications of the cohort prior to STAP. Some 84.1% of the cohort hold diplomas in education from the National University of Samoa, which is the

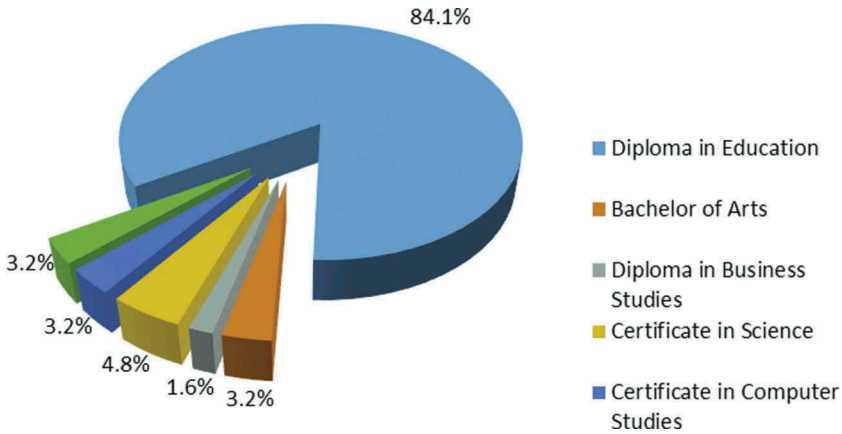


Figure 6. The percentage of teachers categorized according to their highest level of qualification.

only national university operating alongside the University of the South Pacific in Samoa. Although this percentage is noteworthy, the problem is that the majority of the cohort teach science subjects outside their formal qualifications. In addition, with such qualifications, the teachers are considered to be underqualified to teach science subjects at senior levels. Due to the shortage of science teachers in Samoa, many diploma-level graduates are employed as temporary substitutes, with most eventually recruited permanently due to the persistent shortage of qualified teachers.

The preliminary survey indicated that the age distribution of the cohort ranged from 23 to 52 years of age. Teachers below the age of 30 represented 41% of the cohort with the highest number falling in the 25–29 age group. A further one-third of the cohort was in the 40–49 age group, holding key positions such as heads of department, vice-principals and principals. It was commendable to see the Samoan government committed to upgrade these experienced teachers to garner positive changes not only through adaptive challenges and shifting pedagogies but also through internal mentorship of younger and less experienced teachers.

Figure 7 illustrates that although members of the cohort had many years of teaching experience, a high percentage has had a long lapse from studying at tertiary level. To be

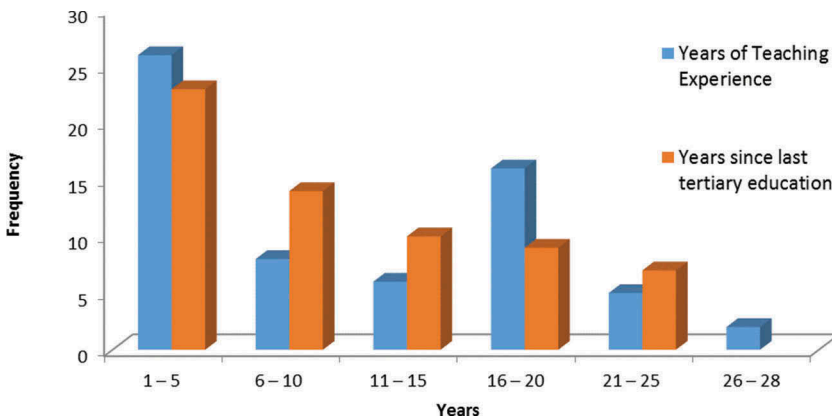


Figure 7. The number of years in the teaching force and the years lapsed since last tertiary experience.

precise, 25% of the teachers had re-commenced studies after a lapse of 16 or more years. Hence, being enrolled as a student after a long break proved very challenging to many, creating teething problems for STAP. The following is a sample of student testimonies recorded from the survey:

*Student A: It was hard to catch up with some new things in the beginning.*

*Student B: It took me time to familiarise with the new study tools that I'd never used before.*

### **Preparatory work**

For the accelerated programme to be genuinely received and embraced, there was a dire need for refresher and induction modules, given that the cohort included teachers returning to tertiary education after long lapses (see [Figure 7](#)). Since the STAP model has a significant portion of its delivery and learning support online, it was also essential to survey the study skills and ICT competency of the cohort and provide pre-STAP support accordingly. A face-to-face orientation programme was designed to include carefully articulated refresher and induction modules and training workshops for STAP candidates. Faculty learning support staff and the programme coordinator travelled to Samoa for a 4-day training workshop covering an array of topics to enhance ICT and basic learning skills vital for a wider uptake of STAP.

The training workshop with 25 participants was successful in a number of ways. From the facilitator viewpoint, the  $\bar{x} = 4.80$ ,  $sd = 0.38$  from a 5-point Likert scale [strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5)] on the level of student satisfaction with the workshop meant the students were responsive to the preparatory materials. The Cronbach's alpha value was found to be 0.83, which indicated a high internal consistency of the data. Interestingly, the workshop also highlighted the following:

- (1) 52% of the 25 participants were computer illiterate
- (2) 80% of the 25 participants had never used the Internet before
- (3) Only 8% participants had existing email accounts
- (4) Approximately 88% of the participants had their Facebook account created

The workshop further exposed gaps in the participants' ICT-related skillset, which had to be addressed before STAP commenced. The following is a sample of student testimonies recorded from the survey:

*Participant 1: Personally I need another workshop to familiarise with courses especially the using of computers*

*Participant 2: I really need more to help me out this course, especially in computer*

Meanwhile, the presentation of the STAP delivery plan motivated the Samoan Minister of Education to increase the total number of scholarships to 60.

With another 40 new students joining the programme and based on the findings of the first workshop, a second training workshop was conducted to help the growing



**Figure 8.** Hands-on during ICT workshop.

cohort prepare for the ICT-driven accelerated programme (See [Figure 8](#)). Sessions were designed to further enhance ICT skills and create awareness of the functionalities and features of Moodle. The ICT workshop was attended by 32 (of 40) new teachers and 20 participants from the first workshop. The new teachers did not have an email account before the workshop. At the end of the workshop, all the participants had email and Facebook accounts, and had successfully navigated the Learning Management System – Modular Object-Oriented Dynamic Learning Environment (Moodle) which is the preferred online platform used to deliver courses in USP.

Upon completion, the students expressed that the workshop was useful with  $\bar{x} = 4.79$ ;  $sd = 0.45$  from a 5-point Likert scale [strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5)]; however, their ICT competency greatly varied. An evaluation using a 4-point Likert scale [not good (1), satisfactory (2), good (3), very good (4)] showed  $\bar{x} = 2.79$  and  $sd = 0.91$ , which indicated an average rating towards ICT skills. [Table 4](#) further shows that 38.5% of the students self-analysed their ICT skills to a mere satisfactory level.

The analysis showed that the workshop equipped the students with ICT skills but to varying degrees, and that some students needed further help before they could comfortably take up an ICT-leveraged programme such as STAP. Consequentially, the

**Table 4.** Teachers' self-rating of the ICT skills.

How many teachers for this survey = 52	Very Good (=4)	Good (=3)	Satisfactory (=2)	Not Good (=1)
Percentage of teachers giving their rating of ICT Skills (%)	25.0	36.5	30.8	7.7

University course “UU100 – Communications and Information Literacy” was offered first in the programme to fully familiarise students with the online learning and associated ICT support tools.

## Learning support included in the package

### *Ementoring*

Mentoring is a well-established programme, deployed by the higher education institutions to work in an array of ways to assist their students. Peer mentoring involves more experienced students supporting new students during their academic and personal development. It has been found to be effective in improving the first-year experience of students and increasing student retention (Smailes & Gannon-Leary, 2011). The live-mentoring programme coordinated by the faculty-based Student Learning Specialists (SLS) at USP has benefitted many students, especially those based at the main campus – Laucala. Not only has the student response been positive, the mentees have grown three-fold in the past 5 years (Anzeg, 2009). This student-centred learning tool encourages many students to discuss and clarify their doubts with their peers and seniors, engaging in more informal sessions of the kind that many Pacific students are not comfortable attending with their lecturers and tutors.

Due to the nature of STAP, the mentoring team in the Faculty introduced online mentoring using the Big Blue Button, an open source software low on Bandwidth. The eMentoring provided a platform to the cohort to collaborate online in real-time with pre-selected mentors from the main campus. It must be added though, that accessibility and the high cost of Internet usage from outside of Alafua Campus and Saleleloga Centre were major obstacles to the use of this support tool.

During the course of the study, a total of 11 eMentoring sessions were conducted for the 2 first-year mathematics courses with an attendance of 40 students. A 5-point Likert scale was used to evaluate students’ satisfaction; the results showed  $\bar{x} = 4.22$ ,  $sd = 0.48$ , which is a good indication that this new support service is deemed useful.

### *Tablets*

As mentioned earlier in the paper, the science faculty (FSTE) provided an Android tablet to each student enrolled in STAP. In this ICT-driven era, mobile devices such as tablets are being frequently trialled in schools and higher education institutions to enhance learning through engagement, sharing knowledge and accessibility of resources (Hursh, n.d.). In the STAP model, the tablets play an indispensable role in empowering students and garnering the overall success of the programme.

Tablet-based learning has been an on-going initiative of USP since 2013 when it distributed around 600 tablets to support students studying via the distance mode in selected regional campuses. The tablets in STAP became a virtual electronic repository of pre-loaded course materials and OERs, which the cohort could access offline. This was done keeping in mind that not all students have access to the Internet outside of the campus. The tablets had Wi-Fi capability which allowed students to connect to the

wireless Internet services on campus or to wireless networks from elsewhere. The following benefits of using tablets were recorded from the feedback provided by the cohort through surveys carried out at various checkpoints in the programme:

- (1) Portable and more convenient than textbooks
- (2) Easily used for studying when free at work or home
- (3) Availability of applications such as the calendar to set reminders
- (4) Internet access via Wi-Fi on campus
- (5) Viewing of pre-loaded course videos

Interestingly, this type of learning may still be encapsulated in the teacher-centred learning approach confined to the availability of online materials and guided tasks, but devoid of the capacity to share and create knowledge.

### *Harnessing social media*

Social media was harnessed to allow flexibility in communications with the facilitators and administrators and to improve academic and social integration. A Facebook STAP group was created: <https://www.facebook.com/groups/STAP.FSTE/>. The Facebook posts were favoured by the cohort over the contributions made on the more structured and formal Moodle. On this social platform, students posted queries, shared their feelings and motivated each other. The course facilitators also found it easier to make announcements through Facebook, which became the most popular platform for the cohort for online collaboration and social integration. Interestingly, the Asia Pacific region accounts for 28.8% of the global Facebook user population (Internet World Stats, 2015). Additionally, from 2011–2014, the number of Facebook users in the Pacific region more than doubled, from 157,000 to 457,000. Penetration rose from 8% to 20% of the population (Pacific Region Infrastructure Facility, 2015). Exchanges and communication on the Facebook page are also carried out in the Samoan language, which enables effective engagement by the cohort. Communications in the mother-tongue in the Pacific have been seen to be very strong and effective, and education is no exception. The following has been captured from the STAP Facebook post:

*Participant: We can't change the direction of the wind, but we can adjust our sails to always reach our destination. We can do this STAP... Let's make it to the finish line and be happy together Faamalolosi everyone!!! We can do it and I know we can.*

### *Other support tools*

#### *Moodle support*

A course shell hosted on Moodle acted as a repository of resources and an online platform for engagement and interactions. News, information on upcoming activities and important announcements were also shared using these shells. In addition, to enable engagement in virtual discussions and to provide access to STAP-related information, a separate online group was created for the cohort within the course shells. On



the other hand, to learn about Moodle, the cohort was directed to an in-house designed web-based edutainment module “Get to know Moodle”, via this link: <http://mlearn.usp.ac.fj/game/mdl/>.

### *Tutorial support*

Tutorial visits were also included for Alafua Campus and Saleleloga Centre. These visits were arranged at “off-peak” times so as not to disrupt the regular teaching duties of the cohort. A total of 2, 1-week tutorial visits per course were allocated to facilitate face-to-face interactions.

### *Video conferencing*

The USPNet (Figure 1) is the USP owned satellite-communications network that *in alia* has provision for video conferencing for regional students. STAP facilitators held video conferencing throughout the semester. The sessions were also recorded and posted on the course shells for the benefit of those who could not attend. This support tool greatly supplemented the online courses on Moodle.

### *SMS notifications*

An SMS-based notification service at USP is utilised to update the cohort on important matters, send timely reminders, provide motivation and make announcements. For the STAP programme, these messages were sent from the Moodle course shells directly to the students’ mobiles through an in-house built SMS Gateway. The reader is referred to Sharma et al. (2015) for a detailed account of the SMS services at USP. Although this tool was a potential intrusion upon the students’ personal spaces, it saved them time and travel costs to campus for Moodle updates. The tool was also useful to the facilitators and administrators due to the easy and timely access to SMS-based notifications by the cohort.

## **Status quo**

### *Courses*

It is not possible to consider a statistical review of all 15 courses offered to the cohort until halfway through the programme, hence the reviews of a selected few are presented here. UU100 was the first course offered to the cohort and this was during the winter school through blended mode (online and face-to-face components).

This gateway course garnered an excellent pass rate of 95.2% including the EX (did not sit for the final examination) and IP (in progress) grades with  $\mu = 65.6$  and  $\sigma = 15.8$ . Figure 9 shows the grade distribution of the cohort which had benefitted from the various support services put in place for STAP. Using the Mann-Whitney test, UU100 STAP final marks were found to be statistically significantly lower than the 2012–2014 flexi school results. The finding was attributed to the cohort’s long lapse from tertiary education and the average competency in ICT. Refer to Table 5 for the analytical data.

The math service course for non-mathematics majors, coded MA102, is designed to provide a knowledge of commonly used core mathematical methods. The course provided the first exposure to a fully online semester-long course after UU100, which

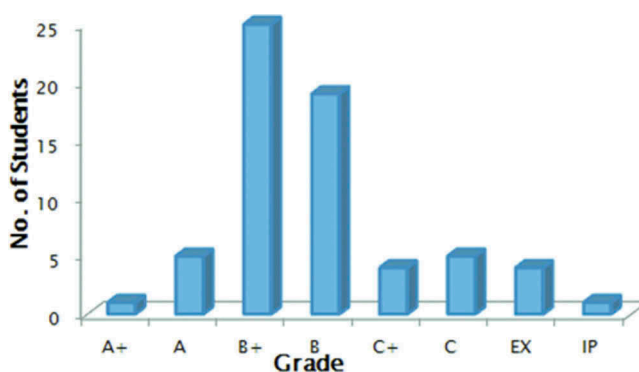


Figure 9. Grade distribution for UU100 course.

Table 5. The comparative analysis of selected STAP courses with past results.

	UU100	BI102	CS112
STAP	n = 65	n = 42	n = 18
	Pass rate = 95.3%	Pass rate = 90.5	Pass rate = 88.9
	Average Total = 69.0	Average Total = 55.0	Average Total = 57.0
2014	n = 186	n = 243	n = 111
	Pass rate = 81.7%	Pass rate = 68.7%	Pass rate = 49.5%
	Average Total = 72.2	Average Total = 56.4	Average Total = 44.6
	STAP results significantly lower, $U = 3583.5, p < 0.001$	STAP results significantly higher, $U = 2868.5, p < 0.001$	STAP results significantly higher, $U = 674.0, p = 0.03$
2013	n = 261	n = 296	n = 137
	Pass rate = 82.0%	Pass rate = 67.6%	Pass rate = 43.7%
	Average Total = 78.7	Average Total = 55.6	Average Total = 48.4
	STAP results significantly lower, $U = 2460.5, p < 0.001$	STAP results significantly higher, $U = 3280.5, p < 0.001$	STAP results significantly higher, $U = 723.5, p = 0.02$
2012	n = 216	n = 275	n = 158
	Pass rate = 92.6%	Pass rate = 74.9%	Pass rate = 56.3%
	Average Total = 73.8	Average Total = 61.4	Average Total = 50.3
	STAP results significantly lower, $U = 3791, p < 0.001$	No significant difference, $U = 4520.5, p = 0.220$	STAP results significantly higher, $U = 965, p = 0.048$

proved to be difficult for most teachers, thus resulting in a low 46.4% pass rate. The course facilitators also attributed the low pass rate to other factors, including intermittent Internet connection, low numeracy skills of the non-mathematic teaching teachers, low academic integration and an ineffective usage of tablets. Notwithstanding these factors, as shown in Table 5, the final marks had no statistically significant difference when compared with the 2012 and 2014 Laucala-based final marks.

The results for the first year biology course (BI102) were found to be statistically significantly higher than the 2013 and 2014 Laucala-based results. Similarly, the results for the first year computing course (CS112) were found to be statistically significantly higher than the 2012–2014 Laucala-based results.

The overall average pass rate of the 63 STAP students is an impressive figure of 88%, with 15 courses having been offered until halfway through the programme. A breakdown of the performance showed that 9.5% of the teachers were in the high achieving category ( $GPA \geq 3.5$ ), 49.2% were in the good category ( $2.5 \leq GPA < 3.5$ ), 23.8% were in

the average ( $2.0 \leq \text{GPA} < 2.5$ ) and 13.3% were in the at-risk ( $\text{GPA} < 2.0$ ) category. Remedial actions were put into place for at-risk students. The cohort members had significant familial and socio-cultural commitments in addition to their workloads and studies. The at-risk teachers faced difficulties managing their time, therefore one-to-one counselling was conducted where avenues were identified to help maximise study time while attending to other commitments.

### **Awards**

FSTE has instituted a new award scheme to recognise the efforts of students achieving outstanding grades in their first year of studies. Two students from the cohort were identified as outstanding first year STAP students with a  $\text{GPA} > 4.0$ , matching the outstanding performances of Laucala-based students. The Samoan Minister of Education inaugurated an awards ceremony in Alafua Campus which not only added to the social integration of the cohort but also showed the potential strengths and effectiveness of the new science model for the Pacific region. (For more information, the reader is referred to <http://www.usp.ac.fj/news/story.php?id=1787#.V4sARvI95pg>.)

### **Future directions**

Pacific societies are not unaware of the vicious cycle rooted deeply within their education sector that contributes to the ever-growing attrition and dwindling interest in science. The cycle heavily compromises the quality and quantity of science graduates at secondary and tertiary levels. It usually is a manifestation of challenges, beliefs and values, foreign materials, lack of qualified teachers and administrators, and, poor resourcing from regional countries.

To break this cycle, a concerted and combined effort such as joint partnerships between regional states and higher education providers is required. The STAP model is an exemplification of a tripartite partnership model between the University of the South Pacific, the Government of Samoa and the cohort of science teachers that permeates the importance of education in the Pacific region, in particular, the genuine need for stronger science education while proposing workable solutions that transcend the geographical and social limitations of trying to accelerate science education training and qualification for in-service teachers.

Alongside the need to upskill and/or upgrade current teachers, there is an unprecedented increase in the number of non-traditional students who are genuinely interested in furthering their skills and knowledge to adapt to the dynamic forces driving the job market. These and similar cohorts across Pacific communities need such empowerment, especially while they are still in employment and fully committed to their respective workforces. Such growing needs can be efficiently met through cohort teaching.

STAP, a first-of-its-kind science model piloted in the Pacific region, and backed by the kind of magnitude of commitment from various parties, is a multi-modal cocktail of hand-picked ICT tools and technologies which work to help upgrade the qualifications of teachers delivering science education at the junior and senior levels in secondary schools. As an addition to the category of cohort teaching, this new model can be a feasible solution or a sincere attempt to resolve an obvious technical problem. Its

internal mechanics and compositions are invariably an adaptive work in the changing face of learning and amidst the dynamic congregation of learners, assuming good ICT infrastructure and low Internet costs.

The model showcases the advantages of taking a programme through with a selected cohort where its close-knit structure helps in sharing information and making learning more effective. The cohort spend a lot of time together attending face-to-face and virtual classes and discussions, labs and study clinics, group work and taking assessments. The discussions are productive and the quality of work improves over time. When the cohort is not together, they are connected through ICT tools and continue to assist each other, sharing knowledge and learning together. Such academic proximity develops healthy inter-personal relationships which foster better performances, empower the facilitators to redefine and modify activities for higher level attributes and garner higher individual success rates that translate into a greater overall success rate for the STAP model.

However, care must be taken to avoid injecting negative impacts, create factions and discomfort, and, risk attrition of interests. On the other hand, unique yet essential factors have to be carefully injected into the model. This paper essays the underpinning strengths, challenges and opportunities through observations, interpretations and timely interventions from the University of the South Pacific under this STAP model. STAP enables individual teachers to study at university level while remaining in-service, and receive ongoing academic advice, support and feedback from all partners in addressing academic and social integration to strengthen cohort persistence in the programme.

Given the strongly positive student achievement trajectory at the half-way mark of the programme, STAP holds a highly favourable future outlook at the University of the South Pacific. There is a possibility of further editions of the programme accompanied by extensions that are mindful of the structural and systematic differences between countries, potentially mobilising a social change in the Pacific, and enhancing the region's adaptive capacity in the 21<sup>st</sup> Century. There is also the opportunity to consider an extended STAP model, where the programme is delivered in parallel to smaller cohorts from different regional countries combined into one, while maintaining the essential leveraging upon ICT for its success.

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No potential conflict of interest was reported by the authors.

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