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Case study

Analysing responses of Year-12 students to a hands-on IT workshop: Implications for increasing participation in tertiary IT education in regional Australia

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Abstract: Two hand-on workshops on social media apps were conducted for the Year-12 students from two schools, one from a regional city and the other from a remote community, in a computer laboratory on the Rockhampton campus at Central Queensland University before the COVID-19 pandemic. The school in the regional city offered a specialist Digital Technologies Curriculum (DTC) to students in Years 11 & 12 whereas the remote school did not offer a similar DTC to students in Years 11 & 12. Statistical analyses of the students' responses to two casual questions during the workshop indicated that firstly the hands-on activities improved all students' general IT knowledge, and secondly the Year-12 students from the regional city were more determined to undertake tertiary IT education than the students from the remote school. Therefore, it is recommended that a mandatory specialist DTC for students in Years 11 &12 in ALL schools should be included in the national curriculum in the future. Implications of these findings on improving the participation rate of post-secondary education in Australian regional communities are also discussed in this article. In particular, regional universities can play a unique role in producing "IT allrounders" to meet the needs of the regional communities through collaborations with governments, secondary schools, regional industries and businesses.

Keywords: specialist digital technologies curriculum (DTC), tertiary IT education, regional, rural and remote (RRR) communities, low socioeconomic status, regional universities, regional IT career, IT allrounders

1. Introduction

Australia has a large territory with relatively a small population of just over 25 million people and more than 70% of them are living in about 20 major cities mainly along the coastal zones (Figure 1). By Australian Standard Geographical Classification (ASGC), Australian regions are classified into five categories: Major Cities, Inner Regional, Outer Regional, Remote, and Very Remote areas [1,2]. Except Major Cities, the other four regions are commonly referred to as the regional, rural and remote (RRR) areas, which count more than 95% of the territory.

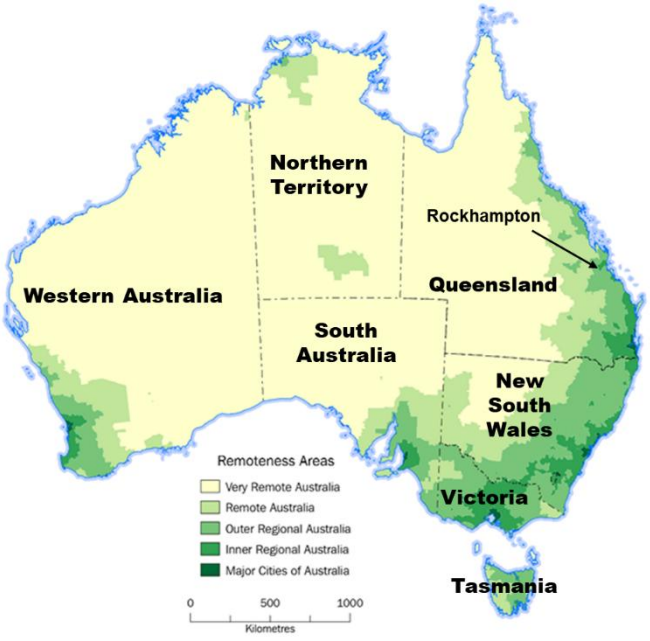

Figure 1. Regional classification of Australia (modified from [1]).

Most RRR schools have been operating under challenging conditions due to many constraints, including infrastructure and resources in the region, school characteristics, teachers' support and professional competencies, family socioeconomic status (SES), parental educational attainment and expectations for their kids, student's attitude towards education and social behaviours, and so on [3–6]. Digital communication and information technologies have been at the centre of almost all the advancements that change our real world and people's daily lives. However, adoption of modern digital communication and information technologies requires huge investments in building an effective, affordable, adaptive and long-lasting digital communication network. The more concentration of a large population in a confined area, like a capital city with millions of people, the more affordable for the users of the costly digital communication network, hence the more likely the investment in the digital communication infrastructure governments and industries are to commit. For the RRR communities mostly classified as low SES with a small population scattered over a vast territory, it would be disadvantageous for every household, organization, and business to access the digital communication services with the same level of quality and costs as provided to those in the large cities in Australia [7–9].

These constraints have severely affected provision and/or quality of IT education in many RRR schools. Our recent study with Year-10 students from RRR schools in central Queensland found that

their general digital literacy seemed below the educational goals for Year-10 students required in the national digital technologies curriculum (DTC) [10,11]. As Australia does not have a mandatory national specialist DTC for students in Years 11 and 12, many RRR schools may not be willing to or not able to offer a specialist DTC for senior students in Years 11 and 12, which would lead many RRR students to missing out an opportunity of participating in tertiary IT education after graduating from high schools.

Our recent study was based on students' real-time responses during a designated hands-on workshop on social media apps for two groups of Year-10 students from three schools in or near Rockhampton, a regional city in Queensland, before the COVID-19 pandemic [10]. Statistical analyses of the students' responses also indicated that the hands-on activities were loved by the students, which saw more students express a strong desire and interest in learning more digital technologies. Inspired by the success of that hands-on workshop to engage Year-10 students from RRR schools with learning and using digital technologies, two more such workshops were organized two months later for Year-12 students from two different schools. These two groups of Year-12 students represented different types of RRR schools. The first group of students came from a school in Rockhampton city that has been the regional capital of the central Queensland region. With better infrastructure and human capital in Rockhampton, this school offered a specialist DTC for the students in Years 11 & 12 after completing the basic DTC in Year 10. The second group of students came from a remote school more than 50 km away from Rockhampton and the school did not offer any specialist DTC for the students in Years 11 & 12. The contrast between these two regional schools provides a unique opportunity to explore the difference between the responses to the same questions presented to the students during the hands-on workshop. The main facts to be explored in this current study are:

- Whether the availability of a specialist DTC for the students in Years 11 and 12 in regional schools influenced students' intent to participate in tertiary IT education.
- Whether the hands-on activities helped improving students' intent to participate in tertiary IT education should such opportunity be offered to the Year-12 students in regional schools.

To explore these two facts, two new interactive questions were presented to the students although the hands-on activities remained the same as in the previous workshop for the Year-10 students. Chi-square test was applied to analyse students' responses to the questions so as to find the key factors that may affect and more importantly improve the RRR students' participation in tertiary IT education in the future.

2. Background information about the workshop and the students

2.1. The workshop design

The workshop aimed at providing the Year-12 students (17 years of age) with hands-on practices in a university computer laboratory to taste possible university life in tertiary education should they be admitted to an IT program after completing Year 12. To inspire as many students as possible to choose an IT program leading to a future career in IT, this workshop on social media apps was related to their daily digital experiences and the hands-on activities were easy to follow and students could instantly see the output of their work. The workshop was centred around the client-server architecture behind all social media apps, for instance Facebook, Twitter, and Instagram, depicted by

the sketch in Figure 2. This is necessary because all hands-on activities were performed on ‘the server’ end even though the users were interacting with the app from ‘the client’ end. A simple demo chat app was especially created for the students to readily send plain text messages to each other or the whole group. However, the initial version of the app could be further improved by modifying the functionalities (or codes) on the ‘server’ guided by the instructor during the workshop.

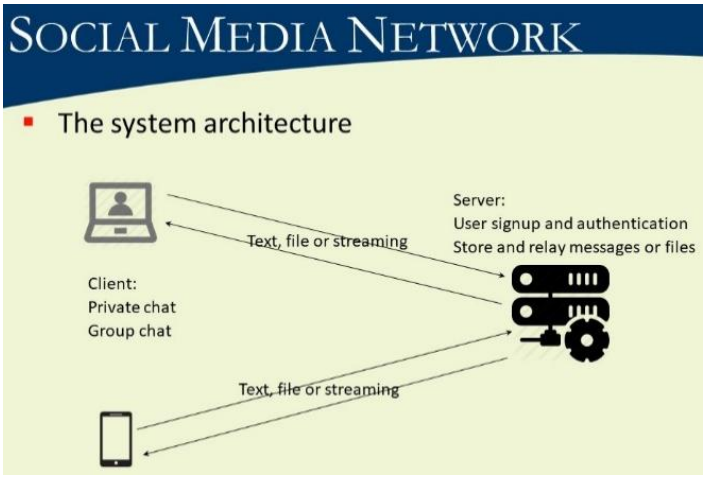

Figure 2. The skeleton of social media systems.

2.2. The hand-on activities

Four hands-on activities were included in the workshop: customizing the initial interface, improving message transfer, adding more functions, and securing message transfer by encryption, as shown in Figure 3. Considering that most students might not have the required skills in Java programming, in the Java code on the server, all the hands-on programming tasks were already included in the code for relevant methods but initially disabled. Students were instructed to follow a designated process to make changes to a chosen item. For example, by making changes in Activity 1 illustrated in Figure 4 on the server, the modified app would have a new interface to send and receive messages.

Figure 3. The hands-on activities for the workshop.

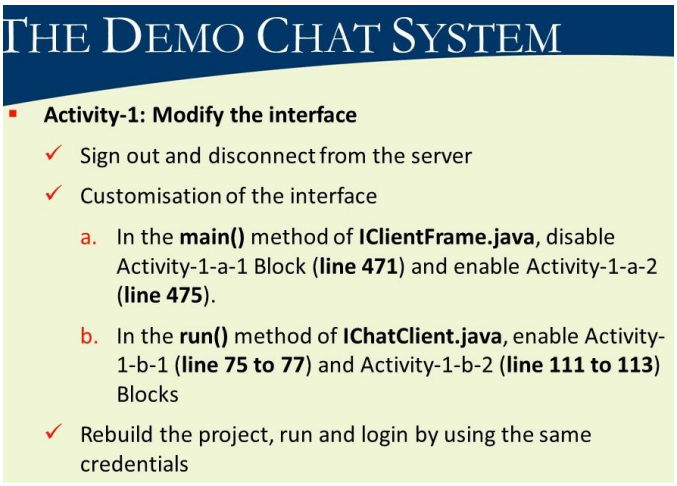

Figure 4. Instructions to Activity 1 to modify the initial interface.

2.3. The interactive questions and real-time responses

As this workshop was tailored for Year-12 students who would finish high school education soon, the interactive questions during the workshop targeted the student's desire or intent to participate in further IT education or pursue an IT career in the future. The questions were designed in a casual manner to avoid exerting any pressure to the students. The following two questions were pushed to students through the demo chat during the workshop.

Q1: How much do you know about the client-server ICT model?

1. Not at all
2. Very little
3. Somewhat
4. Well
5. Very well

Q2: Offered a chance to do an IT degree at a university, how likely would you take the opportunity?

1. Not at all
2. Reluctant
3. May consider
4. Likely to take
5. Certainly to take

Anonymous and voluntary informal responses to these questions from the students could be naturally collected through the embedded interactive activities with the demo chat app. Each question was pushed to individual students twice through the app, the first before the start of and the second after the completion of the hands-on activities for different purposes, and the students could immediately reply by typing either the number linked to the choice or the words associated with the number in the chat interface.

The initial responses to the first question were to probe whether a difference in IT knowledge

existed between the students from the two schools with and without offering a specialist DTC in Year 11 and Year 12. The final responses to the same question were to explore whether any improvement in understanding the basic IT system (hence general IT knowledge) achieved by the students after completing the hands-on activities. The responses may also be an indirect indicator on whether these students might have increased an interest in participating in tertiary IT education once finishing their Year 12.

The initial responses to the second question were to explore whether a difference in the intent to participate in tertiary IT education existed between the students from the two schools with and without offering a specialist DTC in Year 11 and Year 12. The final responses to the same question were to investigate whether such gap could be narrowed between the two groups after completing the hands-on activities.

2.4. The workshop venue and participants

The workshop was hosted in a computer laboratory that is also used for undergraduate IT students in Rockhampton campus of Central Queensland University. The venue was deliberately chosen for the school students to have a taste of real university experience. As the hands-on activities required a secure client-server development environment, all participants were granted a special permission to 'legally' log into the computing system in the computer laboratory as a 'system developer'. This also allowed any inappropriate action with the system to be monitored and swiftly fixed by the facilitator should such action occur during the workshop.

There were fifteen students in the first workshop who came from a school located in Rockhampton but only ten completed all hands-on activities. This school offered students in Year 11 and Year 12 a specialist DTC and the ten students who completed all hands-on activities had been enrolled in this DTC since Year 11. Among the ten students, eight were boys and two were girls. Thirteen students in the second workshop came from a remote school outside of Rockhampton, among whom eight students completed all hands-on activities. This remote school did not provide any specialist DTC to the students in Year 11 and Year 12. Hence, the students from this remote school only had knowledge of digital technologies gained from the basic DTC learnt up to their Year 10 in the school. Among the eight students who completed the workshop, five were girls and three were boys.

3. Students' responses and analyses

3.1. Students' responses

The responses are the ordinal Likert-type data for each of the questions [12,13]. The frequencies and medians of the initial and final responses to Question 1 are summarised in Table 1 and that to Question 2 are showed in Table 2, respectively.

For the simple statistics of responses to Question 1, a noticeable improvement in understanding the basic IT client-server model before and after completing the hands-on activities can be seen for both student cohorts. The median for the regional city group moved to 4 from 3 whereas that for the remote group was increased to 3 from 2. However, the improvement within a group before and after completing the hands-on activities does not reach a sound level of statistical significance as indicated by the chi-square test results shown in Table 3, in which at the significance level of $\alpha = 0.05$, both

chi-square values (6.0 and 7.20) are below the critical chi-square values respectively. It should be especially noted that the regional city group seemed more active in sharing their feelings during the hands-on activities. For example, one girl shared "*The password is encrypted. IT is so cool*.", and one boy shared "*I can see what (the interface) was changed*." However, there was no any extra message shared from any student in the remote group throughout the workshop.

Table 1. Frequencies and medians of the responses to Question 1 from the two groups.

Group 1 (Regional city)	*n*	Frequency 1	2	3	4	5	Median	Group 2 (Remote)	*n*	Frequency 1	2	3	4	5	Median
Initial	10	0	3	4	3	0	3	Initial	8	3	3	0	0	2	2
Final		0	0	4	3	3	4	Final		0	2	3	1	2	3

Table 2. Frequencies and medians of the responses to Question 2 from the two groups.

Group 1	*n*	Frequency 1	2	3	4	5	Median	Group 2	*n*	Frequency 1	2	3	4	5	Median
Initial	10	0	0	0	2	8	5	Initial	8	1	1	3	3	0	3
Final		0	0	0	2	8	5	Final		0	2	2	2	2	3.5

Table 3. Pairwise statistics of responses to Question 1 from both groups.

Q1 (initial) vs Q1 (final)		
	Group 1 (n = 10)	Group 2 (n = 8)
chi-square value	6.0 (df = 3, a = 0.05, χ^2 = 7.815)	7.200 (df = 4, a = 0.05, χ^2 = 9.488)

For the simple statistics of responses to Question 2 in Table 2, the students from the regional city seem so determined to advance to IT study in a university even prior to the start of the hands-on activities, which is indicated by the same median of 5 to the question before and after completing the hands-on activities. One boy wrote an extra text "*I would take any opportunity that is given to me by the University*" in his final response. Another boy responded to the repeating question with "*My knowledge has increased but I am still wanting to learn more in the future*". There is a slight increase in the median for the remote group, moved to 3.5 from 3 (Table 2). However, this improvement within the group does not have statistical significance. Given the small number of participants, it is noticeable that after completing the hands-on activities two students (one girl and one boy) from the remote group had a stronger desire to take the opportunity of studying an IT degree should the university offer them the chance. The boy even responded to the repeating question with 6 for more than '*certainly to take*'.

3.2. The chi-square test on students' responses across the two groups

The differences in the initial responses to Questions 1 and 2 across the two groups of students are assessed by chi-square test and the test results are presented in Table 4.

For both questions, significant differences in the initial responses from the two groups exist as both chi-square values are greater than the critical value. This indicates that statistically students who

had engaged in a specialist DTC in the school located in the regional city are likely to have a higher level of IT knowledge and more determined to advance to tertiary IT education than the students who did not have a chance to study a specialist DTC in the school located in a remote area, before practicing the hands-on activities. Hence, the availability of a specialist DTC for Year-11 and Year-12 students is likely to have an impact on student's IT knowledge and skill development and their attitude towards advancing to tertiary IT education.

Table 4. Pairwise statistics of the initial responses to Questions 1 & 2 from both groups (n = 18).

Group 1 (initial) vs Group 2 (initial)		
Chi-square value	Q1	Q2
	11.925	13.140

Critical chi-square value = 9.488 (df = 4, α = 0.05)

However, after completing the hands-on activities, although the gaps were still there, the differences in the final responses from the two groups are no longer significant statistically at level α = 0.05 (Table 5), particularly in understanding the IT system model related to the responses to Question 1. This means that hands-on activities can better engage students in IT knowledge acquisition than by pure theoretical learning. As the responses to Question 2 from the students from the regional city remained the same in both rounds (Table 2), this weaker significance indicates that the hands-on activities indeed inspired the students from the remote school to advance to tertiary IT studies, but this result may be influenced by only a couple of willing students. The lack of a specialist DTC for the remote students to continue knowledge building in ICT in Years 11 & 12 may have damped the confidence of many students in choosing tertiary IT education and in turn missing out a career in IT industries.

Table 5. Pairwise statistics of the final responses to Questions 1 & 2 from both groups (n = 18).

Group 1 (final) vs Group 2 (final)		
Chi-square value	Q1	Q2
	3.160	7.470

Critical chi-square value = 7.815 (df = 3, α = 0.05)

4. Discussion

4.1. Impact of hand-on activities on student's choice for pursuing tertiary IT education

Both groups of students showed some improvement in gaining general IT knowledge and increasing a desire for participating in tertiary IT education, particularly for a few students from the remote school after completing the hand-on activities. The IT discipline is a mixture of theories of digital communication technologies and algorithms and practices of installation, maintenance, reparation, and utilization of digital devices and systems, but the practical aspects are regarded as the daily interface seen by the general public. Hence, hands-on practices associated with a popular app (like the demo chat app used in the workshop) are more likely to attract teenage students' attention to and stimulate their interests in participating in IT education and in turn leading to a future career in IT industries, which is also evidenced by the responses of Year-10 students reported in our previous

study [10]. Once the students are channelled into the continuing DTC in Years 11 & 12, most of these students would be determined to advance to tertiary IT education, which is demonstrated by the responses of all the students from the regional city in this study.

Therefore, an engaging and practical digital technology curriculum for students in Years 11 & 12 in ALL schools should be included in the national curriculum in the future.

4.2. Impact of socioeconomic disparities on IT education participation in regional areas

In terms of engaging with future IT education and choosing IT as a potential career, the difference between the students from the regional city and from the remote community is statistically significant. Many factors may have contributed to such difference, but in a broad sense, the inequity created by socioeconomic disparities among the major cities (MC), regional cities (RC), and remote and rural (RR) communities may be a key cause leading to such imbalance. The RR communities, mostly classified as low SES in Australia, are usually scattered over a vast territory with a small population in each community. The telecommunication infrastructure and services provided by either the governments or private businesses are often more expensive or of degraded quality in these communities [9,14–16]. Frequently upgrading the infrastructure, as a result of rapid advancement of ICT technologies seemingly every year, may be even more expensive for the RR communities [9]. Such effect of high cost in telecommunication and inferior quality of services in the low SES communities would have a great negative impact on people's career choices.

This combined effect may raise people's doubts about the usefulness of IT professionals in the RR communities, which in turn makes the parents reluctant to support their children to choose IT as a career [3,4,7,8,17]. For example, when a local resident or business owner was not satisfied with the IT services provided, the IT service professionals who were called up to 'fix the perceived IT problems' might not be able to make any noticeable improvement on the IT services due to the constraints with the underlying inferior ICT infrastructure. To the local resident or the business owner, the costly IT 'repairing job' provided by the IT professionals would be less useful or useless at all, thus leading them to the perception that the IT profession was less useful and hence not worthy for their children to consider. This disconnection of ICT (and STEM in general) with RR communities may partly explain why the students from the RR communities were less interested in undertaking an IT degree at a university should they be offered the opportunity, compared to the students from the regional city.

Therefore, promoting STEM education to the whole community in RR areas, not only in the RR schools, is the top priority in terms of improving the awareness of career prospective in STEM, particularly the IT profession, for the RR students. In the meantime, IT programs in tertiary institutions must have a focus on training the students towards employment ready and even better on locking in a job before their graduation [18]. In turn, such IT graduates from the RRR schools would set an exemplar to inspire more future students living in the RRR communities into the IT profession or STEM professions in general.

4.3. Stimulating more interested students into tertiary IT education

The statistics of students' responses from the school in the regional city showed a strong desire to undertake a tertiary IT degree should such opportunity be presented to them. This desire was

irrelevant to the influence of participating in the hand-on workshop. However, for the students living in the RR communities, many unseeable factors with a family or the extended families may derail their dream of future career, for instance, financial constraints, a change of interest influenced by the choice of their close friends, availability of jobs that do not require much training and advanced knowledge, early engagement and marriage as a custom of the RR communities.

Therefore, the tertiary institutions who want to attract young talents to IT studies need to provide incentives to the students to constantly stimulate them towards realizing their dream gradually and tangibly as early as it is appropriate. This could include offering these students free enrolment to the foundation units of a tertiary IT program from as early as Year 10. All units a student passed could be credited to their formal study of the IT program with the institution later. Of course, the institution may need to slightly adjust the way of the unit delivery to better fit to the school student's learning planner. To further ease the financial pressure on the students from low SES families for their tertiary education, those students who have already carried the credits from successfully completing the foundation units in school may be offered further scholarships by subsiding their tuition, for example, during completing the rest of the IT program. Once advanced to the second year of their university study, the students could be appointed as the university ambassador to promote university life and career opportunities through their personal experiences with the RRR communities where they came, which should be more influential in changing the misunderstanding of IT education and IT profession possessed by the local residents. Of course, the most powerful promotion of IT education and IT profession would be the student visiting the home community with the offer of a secured job in the ICT industry even before the graduation.

Some of these may have been provided by many universities already to the future students but new and creative tactics must be brought into the existing operations regularly to meet the advancement in information and communication technologies, the change in professional standards and regulations, the shift in industry demands, and the adoption of modern educational technologies, etc.

4.4. The key role of regional universities to bridge the RC and RR communities

In Australia, all regional universities are located in one or more regional cities (RC). Hence, the regional universities are closer to the RR communities compared to the universities in the capital and major cities. On the other hand, due to the financial constraints of many low SES families in the RRR communities, the regional universities become the most cost-effective choice for their children to engage in tertiary education if such is the choice of their children. As major ICT projects in the RRR areas are likely to be carried out by the governments and/or large enterprises, the RRR residents are likely to regard an IT professional in a local community as an "IT allrounder" who is able to resolve most trivial to intermediate IT issues encountered commonly in their daily life, rather than developing large-scale enterprise-level software systems or establishing regional-scale ICT infrastructure for the community. This would require the local IT professionals to have not only sufficient knowledge to explain to and convince the local residents what can be done locally and why other things must be outsourced for a solution, but also the technical skills to fix those IT issues resolvable locally.

Such IT needs in most RRR communities make regional universities play a unique role in training and educating the young talents from RRR communities to become new generational IT

professionals to better serve the RRR society. Those regional institutions with an arm in technical training and vocational education, such as TAFE (Technical and Further Education) in Australia, could streamline the TAFE IT courses and bachelor IT courses as a package and work with the RRR schools and governmental authorities to offer such package to school students as early as in Year 10. This could partly resolve the issue of unavailability of a specialist DTC in most RR schools so that the Year-10 students would be able to continue the TAFE IT courses in Years 11 & 12. The technical skills gained in TAFE courses enable the students to not only serve the basic IT needs for a local community as early as during their senior high school, but also set up a solid foundation for their future tertiary IT education after graduating from high school. These students could also fill in causal or part-time jobs in IT service industries while completing a tertiary IT degree, hence, to reduce the financial burden for their tertiary education.

Of course, most RRR students are associated with low SES families who may not be able to support their children to engage in early TAFE training from Year 10. The governments and tertiary institutions should consider adopting tailored policies to offer the students free or affordable opportunities of early TAFE training. As many TAFE IT courses are currently delivered face to face in physical laboratories where most RR students cannot attend in person, institutions also need to transform most of the training courses by adopting contemporary ICT innovations so that RR students could complete most of the training components virtually from their local community.

5. Conclusions

In summary, the analyses of the Year-12 students' responses from the workshops indicated that the hands-on activities improved all students' general IT knowledge and increased the desire of some students from the remote school to participate in tertiary IT education. The Year-12 students from the regional city that offered the students a specialist DTC were determined to undertake tertiary IT education should such an opportunity be offered to them, even before the start of the hands-on activities. Hence, the most significant influence in Year-12 student's intent to advance to tertiary IT education seems likely the availability of a specialist DTC to the students in Years 11 & 12. Therefore, a mandatory specialist DTC for students in Years 11 & 12 in ALL schools is recommended to be included in the national curriculum in the future.

Comparably, the Year-12 students from the remote school seemed less interested in choosing IT as a potential career through engaging in tertiary IT education, perhaps partly due to the unavailability of a specialist DTC to the students in Years 11 & 12. Another potential influence might be the overall attitude of the residents in remote and rural communities towards the usefulness and hence the value of the IT profession for their communities, considering the financial burden on supporting their children's higher education from many low SES families. Therefore, producing "allrounder" type of IT professionals by tertiary institutions to serve the needs of RRR communities would be able to not only change the local residents' attitude to the IT profession, but also effectively improve IT education participation of the regional students with the support of the whole RRR community.

To improve participation in post-secondary education of the students in RRR communities, collective and persistent efforts to support the RRR communities must be committed by all levels of governments, industry and business sectors, educational and training institutions, and the goodwill and determination of the local residents by different ways all together. Governments need to consider

leading the design and implementation of a national mandatory DTC for students in Years 11 & 12 in all schools, adjusting policies to better support effective delivery of educational programs by secondary schools and tertiary institutions, reducing financial burden to low SES families to encourage their children to participate in tertiary education. Tertiary institutions need to offer students streamlined programs to engage school students as early as in Year 10 towards a smoother transition from secondary education to tertiary education. Industries and businesses need to offer more employment opportunities, casual or part-time jobs or more internships, to increase enthusiasm of both the students and their families for a prosperous future, which in turn would encourage more low SES families to make their best possible effort to support their children's participation in tertiary education.

This case study is based on a small number of Year-12 students from two schools, one in a remote community and the other in a regional city. Although the findings of this study seem having general implications with respect to the circumstances in different RRR communities, a more generalised conclusion on the findings requires further investigations involving more participants who can adequately represent schools from as many types of RRR communities as possible. This may consist of a series of experiments with purposeful research questions supported by a proper set of measurement scales and well-suited formal research methods.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

References

1. Regional Education Expert Advisory Group (REEAG), *National Regional, Rural and Remote Tertiary Education Strategy—Final Report*. 2019, Canberra, Australia: Commonwealth of Australia.
2. Guo, W., Exploratory case study on solving word problems involving triangles by pre-service mathematics teachers in a regional university in Australia. *Mathematics*, 2022, 10: 3786. https://doi.org/10.3390/math10203786
3. Wilson, S., Lyons, T. and Quinn, F., Should I stay or should I go? Rural and remote students in first year university stem courses. *Australian and International Journal of Rural Education*, 2013, 23(2): 77–88.
4. Fraser, S., Beswick, K. and Crowley, S., Responding to the demands of the STEM education agenda: The experiences of primary and secondary teachers from rural, regional and remote Australia. *Journal of Research in STEM Education*, 2019, 5(1): 40–59.
5. Murphy, S., Science education success in a rural Australian school: Practices and arrangements contributing to high senior science enrolments and achievement in an isolated

rural school. *Research in Science Education*, 2020, 52: 325–337. https://doi.org/10.1007/s11165-020-09947-5

6. Allen, K.A., Cordoba, B.G., Parks, A., Arslan, G., Does socioeconomic status moderate the relationship between school belonging and school-related factors in Australia? *Child Indicators Research*, 2022, 15: 1741–1759. https://doi.org/10.1007/s12187-022-09927-3
7. Courtney, L., Anderson, N., Do rural and regional students in Queensland experience an ICT 'turn-off' in the early high school years? *Australian Educational Computing*, 2010, 25(2): 7–11.
8. Vichie, K., Higher education and digital media in regional Australia: The current situation for youth. *Australian and International Journal of Rural Education*, 2017, 27(1): 29–42.
9. Flack, C.B., Walker, L., Bickerstaff, A., Margetts, C., *Socioeconomic disparities in Australian schooling during the COVID-19 pandemic*. 2020, Melbourne, Australia: Pivot Professional Learning.
10. Guo, W., Li, W., A workshop on social media apps for Year-10 students: An exploratory case study on digital technology education in regional Australia. *Online Journal of Communication and Media Technologies*, 2022, 12: e202222. https://doi.org/10.30935/ojcmt/12237
11. ACARA., *The Australian curriculum: Digital technologies* (v 8.4) *for Years 9 &10*. Australian Curriculum, Assessment and Reporting Authority. Available from: https://www.australiancurriculum.edu.au/f-10-curriculum/technologies/digital-technologies/
12. Boone, H.N., Boone, D.A., Analyzing Likert data. *Journal of Extension*, 2012, 50(2): Article 2TOT2.
13. Joshi, A., Kale, S., Chandel, S., Pal, D.K., Likert scale: Explored and explained. British *Journal of Applied Science & Technology*, 2015, 7(4): 396–403.
14. Duncan-Howell, J., Digital mismatch: Expectations and realities of digital competency amongst pre-service education students. *Australasian Journal of Educational Technology*, 2012, 28(5): 827–840.
15. Considine, G., Zappalà, G., The influence of social and economic disadvantage in the academic performance of school students in Australia. *Journal of Sociology*, 2002, 38(2): 129–148. https://doi.org/10.1177/144078302128756543.
16. Queensland Audit Office, *Enabling Digital Learning* (*Report* 1: 2021-22). 2021, Brisbane, Australia: The State of Queensland
17. Gibson, S., Patfield, S., Gore, J.M., Fray, L., Aspiring to higher education in regional and remote Australia: the diverse emotional and material realities shaping young people's futures. *Australian Educational Researcher*, 2022, 49: 1105–1124. https://doi.org/10.1007/s13384-021-00463-7
18. Guo, W., Li, W., Dodd, R., Gide, E., The trifecta for curriculum sustainability in Australian universities. *STEM Education*, 2021, 1(1): 1–16. https://doi.org/10.3934/steme.2021001

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