



Evaluating Victorian Universities' STEM Outreach Programs

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THE STUDY

- » The study is situated within the research field of informal STEM education.
- » In particular, it investigates the effectiveness of the management and delivery of STEM education outreach, by Victorian universities.



BACKGROUND AND MOTIVATION

In recent years **informal education** has drawn much attention as a way of enhancing STEM education.



It may provide an alternative pathway for students who are otherwise deterred by the schools' STEM education.



STEM? Not for me



The United States Academic Competitiveness Council listed informal education as one of three integral pieces of the US education system (NRC, 2009).



The council stated that informal education is needed for ensuring ‘*U.S. economic competitiveness, particularly the future ability of the nation’s education institutions to produce citizens literate in STEM concepts and to produce future scientists, engineers, mathematicians, and technologists*’ (US Department of Education, 2007, p. 5).

BACKGROUND AND MOTIVATION



- » **Informal education** in the form of **outreach programs** can be found all over the world in various forms.
- » Some evidence suggests that universities are strongly positioned to play a major role in providing high quality STEM outreach programs.

(Eastwell & Renie, 2002; NRC, 2009)



BACKGROUND AND MOTIVATION



The high potential of universities to make a difference in the lives of young students suggests the existence of an extensive body of research regarding universities' STEM outreach.

Yet a search of the literature yields only scattered information and a sense of **un-treaded territory**.

There is lack in

- » Basic information regarding the management models of the programs, the delivery, and
- » the programs' impacts.



AIMS

To

- » develop a database of Victorian universities' STEM outreach programs delivered to school students;
- » analyze the data to characterize the main factors affecting management and delivery; and,
- » develop and apply a set of performance indicators to evaluate the effectiveness of university-led STEM outreach.

PART A: DATA-BASE DEVELOPMENT



Data was collected in regard to:

- » policies and sources of motivation driving the universities' operations;
- » how the programs are managed within the universities' framework;
- » the extent to which universities participate in outreach programs;
- » the extent to which school students participate in the outreach programs;
- » how the participation is distributed across year levels; and,
- » how the programs are conceived in terms of content and delivery.

METHODOLOGY

» Face to face interviews

Interviews with **16 program coordinators** in eight universities.

» Online questionnaires

Online questionnaires were sent to **3688 STEM researchers** working at the nine Victorian universities. The response rate was 5.3 per cent (N=196).

» Analysis of documents

Analysis of: universities' policy documents; the academic promotion packets; and, documents containing information about the outreach programs.



RESULTS

How many programs are delivered by Victorian universities?

University	Number of programs by questionnaires	Number of programs by coordinators	Total
Uni1	14	16	30
Uni2	21	8	29
Uni3	4	34	38
Uni4	7	3	10
Uni5	5	2	7
Uni6	1	3	4
Uni7	3	1	4
Uni8	0	3	3
Uni9	0	0	0
Total	55	46	125

A total of 125 programs delivered across nine universities



How long do programs prevail?

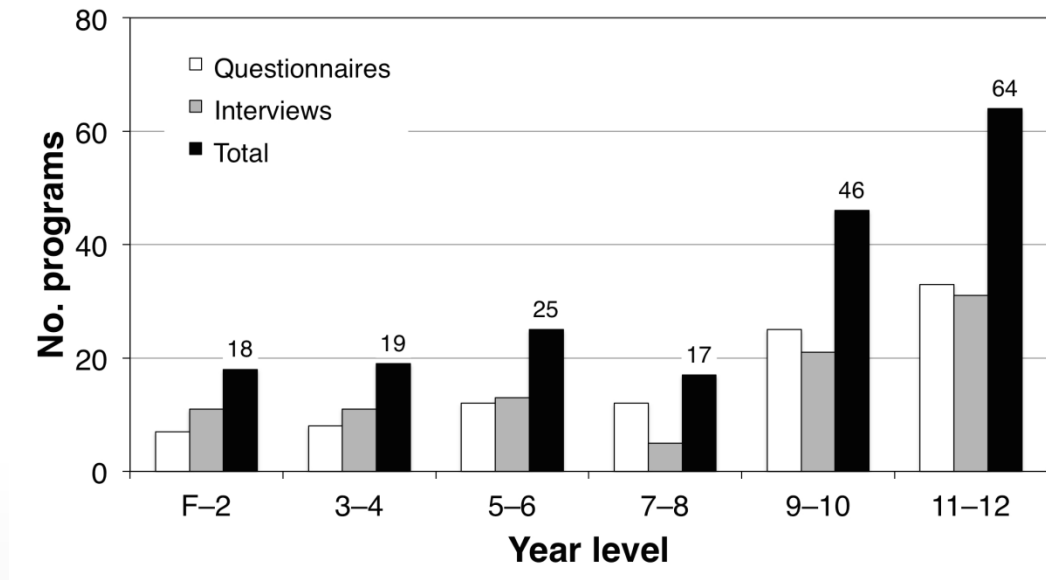


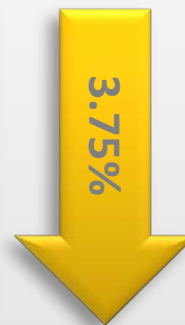
Figure 1. Number of Outreach Programs Offered by Australian Universities in the State of Victoria by Longevity as Determined From: (i) Interviews and (ii) Questionnaire Data sources

The longevity of 88% of the programs is less than five years



How many students participate in the programs?

- The yearly participation rate of school students is 34,325 participants.
- Only 3.75% of F-12 student population participates in university-led STEM outreach



STEM
OUTREACH

How are the programs distributed across year levels?

- » Programs for primary schools – 33%
- » Programs for secondary schools – 67%
- » The main contribution is made by 34% of programs delivered to Years 11-12

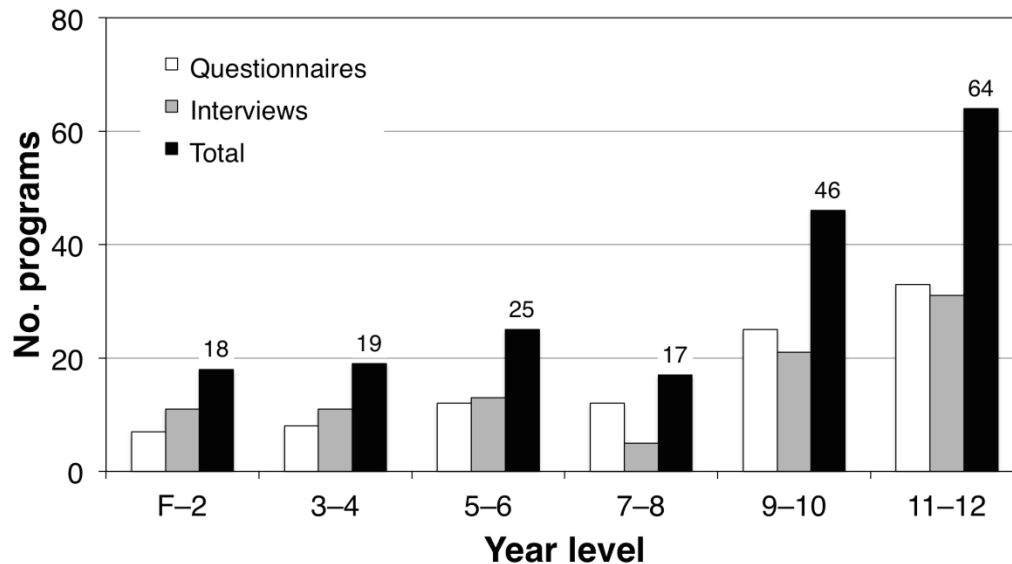


Figure 2. Number of Outreach Programs Offered by Australian Universities in the State of Victoria at the Various Year Levels as Determined From: (i) Interviews and (ii) Questionnaire Data Sources

Most of the programs are delivered to secondary students who have already chosen STEM



How are the programs publicized?

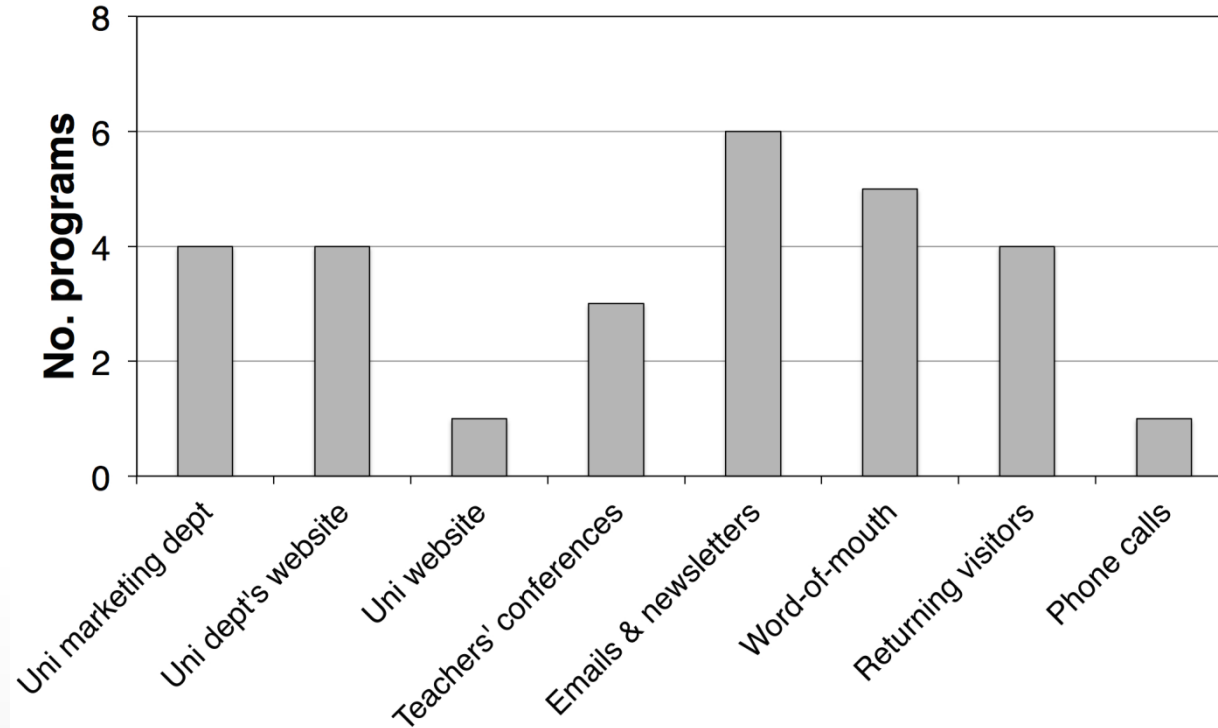


Figure 3. Number of Outreach Programs Offered by Australian Universities in the State of Victoria That Utilize the Various Modes of Publicity

Most programs are not openly publicized, for the public to access.



TYPOLOGY OF DELIVERY

- » **Intra-curricular *versus* extra-curricular** programs;
- » **short-term participation *versus* long-term participation**;
and,
- » **excursions *versus* incursions**



How are the programs related to the curriculum?

- » The data reveal that 81% of programs were intra-curricular.
- » The school curriculum is the most influential driving force in shaping the programs' delivery.

The programs are SCHOOL-CENTERED rather than STUDENT-CENTERED

The program developers perceive schools as their clients, rather than the students.

WHY?



What is the time-length of students' participation in the programs?

- » Most programs (80.5%) involve short-term participation, mainly one-lesson long.

The delivery does not provide opportunities for developing deep learning of STEM





**EVALUATION METHODOLOGY:
DEVELOPMENT AND APPLICATION**

- Data was grouped into five factors covering the scope of outreach
- For each factor appropriate Performance Indicators were developed

TABLE 3

The Effectiveness of Australian universities in the State of Victoria Management and Delivery of STEM Outreach by Factors, PIs and, Level of Performance

The factors	Performance indicators	Level of performance (%)
1. Institutional drivers and conceptualization	1.1. Social service motivated	0
	1.2. Student-as-client focus	11.4
	1.3. Accessible publicity	0
2. Policy	2.4. Uni outreach policies	12.5
	2.5. Equal uni/govt ownership	0
3. Coordinated management	3.6. Central coordination	12.5
4. Programs' delivery	4.7. Programs' stability (> 5 y)	11.8
	4.8. Extended students' participation	19.58
	4.9. Per cent of students' reach	3.8
	4.10. Year-level distribution	40.28
5. Self-initiated leverages	5.11. Uni participation	88.9
	5.12. Academic participation	63.0

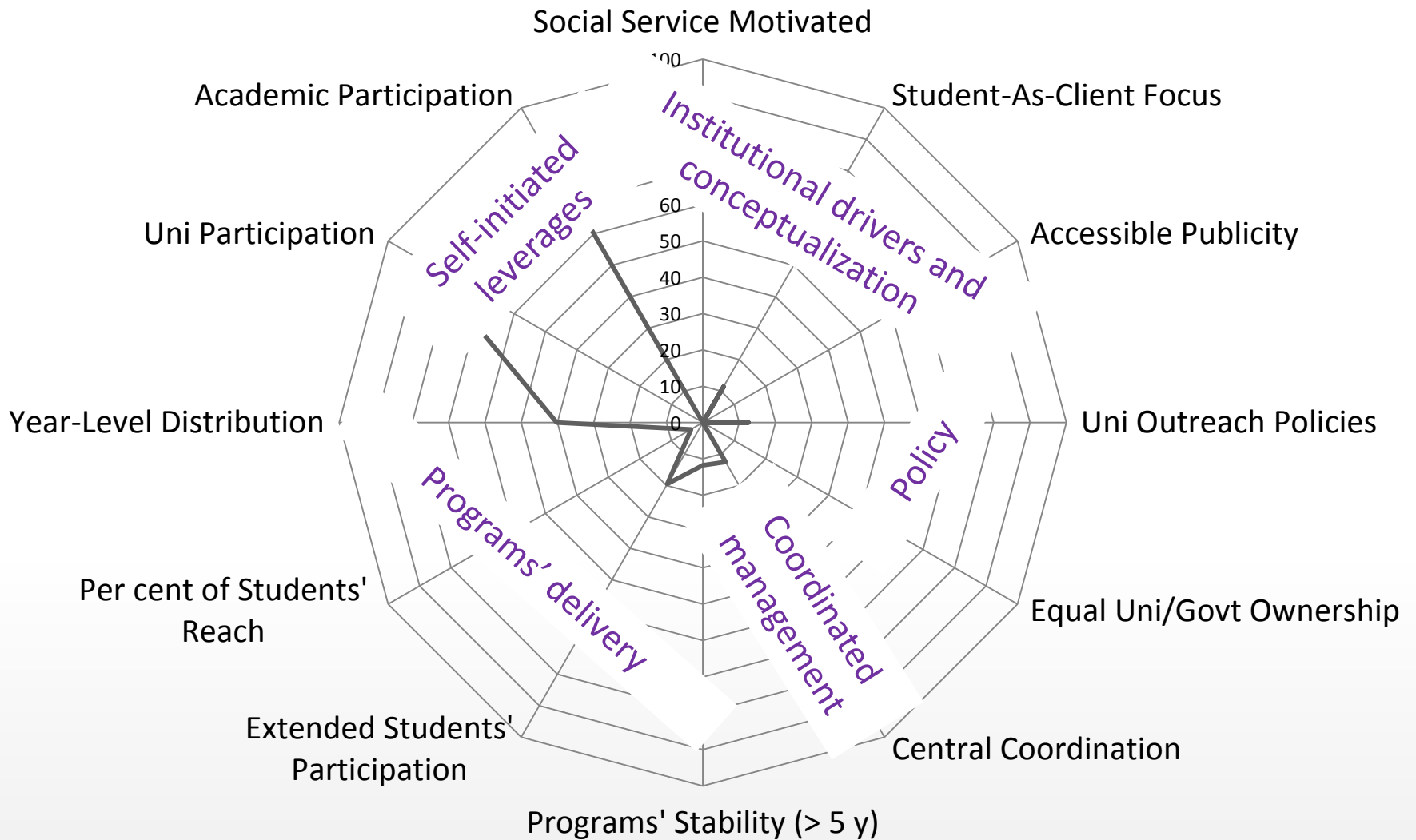


Figure 4. The University-Led STEM Outreach Performance in Management and Delivery: The PI Scores

CONCLUSIONS

- » The overall STEM outreach performance is low and skewed towards the 'Self-initiated leverages' factor.
- » The programs lack in conceptualization; policy; and central management.
- » They rely heavily on voluntary, dis-organized, bottom-up initiatives, by individual academics or departments in the institutions.
- » The delivery is pedagogically ineffective in enhancing STEM literacy and recruitment of students to STEM.



Victorian university-led STEM outreach landscape may be portrayed as fragile and unsustainable.

