p-ISSN: 2184-044X e-ISSN: 2184-1489 ISBN: 978-989-54815-2-1 © 2020
DOI: 10.36315/2020end021

SOUTH AFRICAN AT-RISK UNDERGRADUATE ENGINEERING STUDENTS' PERCEPTIONS OF THE REMEDIAL INTERVENTION DESIGNED TO ENHANCE THEIR ACADEMIC PERFORMANCE IN MATHEMATICS AS A KEY KNOWLEDGE DOMAIN

Sam Ramaila[1], & Philemon Seloane[2]
[1]*Department of Science and Technology Education, University of Johannesburg (South Africa)*
[2]*Department of Pure and Applied Mathematics, University of Johannesburg (South Africa)*

Abstract

The complexity of the articulation gap between school and higher education poses enormous challenges to institutions of higher learning in South Africa. In response to this predicament, various strategic interventions were adopted with a view to adequately address student under-preparedness for tertiary studies. As a gateway knowledge domain, mathematics forms an integral part of various curriculum programs geared towards the cultivation of skills required by the mainstream economy. However, inadequate student academic performance in mathematics remains a pervasive pedagogic challenge afflicting meaningful enhancement of human capital development through inculcation of critical skills. In recognition of this fundamental challenge, this study explored at-risk undergraduate engineering students' perceptions of the remedial intervention which was implemented to enhance their academic performance in mathematics at a South African university. Additional critical academic support was provided to this cohort of students as mathematics repeat students in order to maximise opportunities for success with a view to subsequently ensure their survival of academic exclusion on the basis of sustained inadequate academic performance. The students expressed positive sentiments about the efficacy of the remedial intervention implemented as it provided meaningful opportunities to improve their academic performance in mathematics as a key knowledge domain. The students indicated that the implementation of remedial interventions of this nature serves to safeguard future prospects for under-prepared students while boosting the throughput rates of higher education institutions. Furthermore, the students provided contextually appropriate recommendations for strengthening remedial interventions of this nature to ensure the academic survival of at-risk students in particular. Implications for meaningful enhancement of human capital development are discussed.

Keywords: *Articulation gap, remedial interventions, human capital development.*

1. Introduction

Student under-preparedness for tertiary studies remains a fundamental challenge facing higher education institutions in South Africa. This fundamental challenge is intrinsically linked to the complexity of the articulation gap between school and higher education. Higher education institutions in South Africa responded in a variety of ways to this predicament. Some of the key measures adopted included the implementation of extended curriculum programs which essentially provided additional critical academic support for under-prepared students. Admissions policies provide tertiary education access to diverse student populations and this renders higher education institutions agents of social mobility for at-risk students in particular (Skidmore *et al*., 2014). There is a need to scaffold mathematics instruction to cater for the needs of at-risk students. Wass, Harland, and Mercer (2011) posit that teaching practices that scaffold instruction should be more widely applied within tertiary instructional settings. It is for this reason that this study explored South African at-risk undergraduate engineering students' perceptions of the remedial intervention which was designed to enhance their academic performance in mathematics as a key knowledge domain.

2. Research design and methodology

A remedial intervention was implemented to enhance academic performance of at-risk undergraduate engineering students in mathematics at a South African university. Additional critical academic support was provided to this cohort of students as mathematics repeat students in order to maximise opportunities for success with a view to subsequently ensure their survival of academic exclusion on the basis of sustained inadequate academic performance. An evaluation questionnaire was subsequently administered to unearth students' perceptions about the efficacy of the remedial intervention implemented.

3. Findings

Table 1 below provides distribution of students' responses to the evaluation questionnaire. The students demonstrated fundamental appreciation of the structural nature and efficacy of the remedial intervention. Evaluation areas included workshop content, workshop design, efficacy of the workshop as well as self-paced delivery.

Table 1. Distribution of students' responses to the evaluation questionnaire.

	WORKSHOP CONTENT				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
I was well informed about the objectives	4	3	12	40	32
This workshop lived up to my expectations	3	7	24	40	17
The content is relevant to my studies	2	1	12	40	37
	WORKSHOP DESIGN				
The workshop objectives were clear to me	3	4	17	45	21
The workshop activities stimulated my learning	1	5	19	40	24
The activities in this workshop gave me sufficient practice and feedback	2	14	16	38	19
The pace of this workshop was appropriate	6	9	23	39	13
I had a fair opportunity to participate and contribute	2	7	22	41	20
	WORKSHOP EFFICACY				
The workshop prepared me well for tests	4	6	17	37	24
I am able to use what I learnt in the workshop and beyond	1	2	24	37	28
	SELF-PACED DELIVERY				
The workshop was a good way for me to learn mathematics content	2	3	21	43	21

Contextually appropriate recommendations advanced by the students on the improvement of the remedial intervention are provided in Table 2 below. The nature of the recommendations provided reflected the extent to which the students benefited from the key concomitant activities that characterized the remedial intervention.

Table 2. Students' recommendations on the improvement of the remedial intervention implemented.

FREQUENCIES DEPICTING STUDENTS' PREFERRED RECOMMENDATIONS ON THE IMPROVEMENT OF THE WORKSHOP IMPLEMENTED	
Provide better information before the workshop	45
Clarify the workshop objectives	34
Reduce the content covered in the workshop	9
Increase the content covered in the workshop	54
Update the content covered in the workshop	36
Improve the instructional methods	36
Make workshop activities more stimulating	45
Improve workshop organization	35
Make the workshop less difficult	4
Make the workshop more difficult	56
Slow down the pace of the workshop	43
Speed up the pace of the workshop	13
Allocate more time for the workshop	53
Shorten the time for the workshop	4
Improve the tutorials used in the workshop	52
Improve student active involvement and participation	43

4. Discussion

The students expressed positive sentiments about the efficacy of the remedial intervention implemented as it provided meaningful opportunities to improve their subject matter knowledge in mathematics as a key knowledge domain. The students indicated that the implementation of remedial interventions of this nature serves to safeguard future prospects for under-prepared students while boosting the throughput rates of higher education institutions. Furthermore, the students provided contextually appropriate recommendations for strengthening remedial interventions of this nature to ensure the academic survival of at-risk students in particular. This implies that every effort must be made to provide additional critical academic support to at-risk students to ensure their academic success. This requires critical understanding of the profile of at-risk students. Bulger and Watson (2006) postulate that many academically at-risk students come from under-privileged backgrounds. In addition, many at-risk students attended failing, low-performing, or under-resourced high schools (Glazerman & Max, 2014). According to Woods and Domina (2014), students coming from affluent schools are poised to succeed in their tertiary studies.

Scaffolding mathematics instruction may serve as a panacea for student under-preparedness. Affordances associated with scaffolding of mathematics instruction ought to be harnessed in order to maximize the academic experience of at-risk students in particular. Scaffolding can support a variety of learning objectives including absorbing course content and concepts, increasing self-awareness, providing motivational support, understanding how to use learning and teaching tools such as computerized learning platforms, and learning techniques to adapt to different instructional contexts (Azevedo & Hadwin, 2005). Context-specific remedial interventions can be used as meaningful platforms for providing at-risk students with opportunities to gain important information about institutional resources and courses, develop study skills, form relationships, and gain knowledge of available resources (O'Gara, Karp, & Hughes, 2009).

5. Conclusion

The adoption of innovative remedial interventions can serve as a panacea for student under-preparedness which is a consequence of the complexity of the articulation gap between school and higher education within the broader South African context. Scaffolding mathematics instruction to cater for the needs of at-risk students can provide immense benefits for meaningful enhancement of human capital development.

References

Azevedo, R., & Hadwin, A. F. (2005). Scaffolding self-regulated learning and metacognition–Implications for the design of computer-based scaffolds. *Instructional Science*, 33(5), 367–379.

Bulger, S., & Watson, D. (2006). Broadening the definition of at-risk students. *The Community College Enterprise*, 12 (2), 23-32.

Glazerman, S., & Max, J. (2014). Do disadvantaged students get less effective teaching? Key findings from recent Institute of Education Sciences studies (Report No. NCEE 2014-4010). Washington, DC: National Center for Education Evaluation and Regional Assistance.

O'Gara, L., Karp, M. M., & Hughes, K. L. (2009). Student success courses in the community college an exploratory study of student perspectives. *Community College Review*, 36(3), 195–218.

Skidmore, S. T., Zientek, L. R., Combs, J. P., Fuller, M. B., Hirai, M., Price, D. P., & Moore, G. W. (2014). Empirical reporting practices in community college journal of research and practice and journal of developmental education from 2002 to 2011: A systematic review. *Community College Journal of Research and Practice*, 38(10), 927–946.

Wass, R., Harland, T., & Mercer, A. (2011). Scaffolding critical thinking in the zone of proximal development. *Higher Education Research & Development*, 30(3), 317–328.

Woods, C. S., & Domina, T. (2014). The student–counselor ratio and the high school-to-college pipeline. *Teachers College Record*, 116(10), 1–30.