International Journal of Biology Education Towards Sustainable Development
Vol.4, No.1, 2024, pp. 32-47
e-ISSN 2809-5073. DOI. 10.52889/ijbetsd.v4i1.436

An Introduction to the STRAMERS Model for Graduate Biology Education: Development and Acceptability for Sustainable Instruction

Submitted 24 June 2024 Revised 30 June 2024 Accepted 30 June 2024

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Abstract

Revision of the Policies, Standards, and Guidelines in the offering of graduate education in the Philippines necessitated curricular innovations particularly in integrating research in graduate courses. This study aimed to introduce and propose STRAMERS Model for utilization in science education by graduate schools in local colleges and state universities in the Philippines. The requirement via this model at the end of a semester is a systematic review output or SYRO which was content analyzed in two stages, i.e. first for its general features as an IMRAD article to evidence feasibility and to describe the raw skills of graduate students in writing a SYRO and second for its features relative to the PRISMA 2020 Updated Guidelines to evidence its adherence and to describe the opportunities for improvement in this and in succeeding SYROs. An acceptability test for both users and expert validators was conducted. Results showed that the SYROs have manifested the adherence to format of academic publications and its basic elements to adhere to latest review models which leads the researcher to the conclusion that the use of SYROs could be an alternative mechanism in integrating research in science graduate courses in response to curricular innovations brought about by CMO No. 15, s. 2019 and recommending the utilization of the STRAMERS Model in implementing this innovation. Further, prospective users rated the Model with 4.4 level of acceptability which means very highly acceptable. Furthermore, expert's insights on the Model reveals its novelty in the field of publication hence was recommended for adoption among graduate schools in the Philippines because of its unique features as well as ability for continuous syllabus refinement.

Keywords: Biology Education, Curriculum Enhancement, Higher Education Institution, Pedagogy, Systematic Review

INTRODUCTION

The graduate education plays a vital role in economic development and national competitiveness, so it has been a hot topic for international academic researchers and policy makers, and the discussion will continue for a long time (Liu & Fang, 2019). The goal is to develop and produce top-tier talent, enhance national innovation, and advance the higher education industry. This not only contributes to knowledge transfer but also facilitates independent research, innovative thinking, and interdisciplinary cooperation, all of which are vital for industry growth (Zhang, 2024). The effectiveness of educational resources, particularly in terms of input-output ratio, significantly impacts national competitiveness (Liu & Xu, 2017). Collaborative development of graduate education and high economic quality is crucial for the coordinated development of a country (Zhiqi et al., 2023).

Graduate students play a crucial role in enhancing a country's innovation system and industry development (Zhang, 2024). However, the relationship between the supply of graduate labor and organizational innovative capacity is intricate and influenced by various factors. Morais et al. (2022), Rahman et al. (2023) and Mahon (2022) emphasized the importance of

establishing a solid theoretical foundation and effectively measuring graduate attributes in higher education. Mahon further highlights how these attributes can enhance the educational value, particularly amidst current higher education challenges. Brauer (2021) adds to this discussion by exploring competence-oriented educational processes and the necessity for clearly defined competencies, crucial for implementing competence-based curricula successfully. This increasing emphasis on graduate attributes mirrors a global discourse on the essence and objectives of university education (Barnett, 1997; Barnett, 2000). According to Bowden et al. (2000), these attributes encompass qualities, skills, and understandings that transcend disciplinary knowledge, preparing graduates to contribute positively to an uncertain future. They serve as a foundational framework for educational outcomes that universities agree their graduates should achieve upon completing their studies.

Research consistently highlights the significance of research skills as crucial attributes for graduates. According to Hill et al. (2016), participating in undergraduate research conferences helps students develop intellectual autonomy, confidence, and self-authorship. Universities worldwide are increasingly incorporating research into teaching, especially in engineering, technology, and science education. Brenner & Adamovic (2020) emphasizes the benefits of involving students in European research projects across diverse programs. Zhan (2020) provides an example of this integration at Texas A&M University, where faculty integrated research into teaching through a control systems course and a capstone project using a custom drone platform for building safety inspection. Reyes (2023) delves into how primary research enhances chemical education by using scientific literature to reinforce chemistry concepts. Overall, these studies demonstrate the various approaches universities take to integrate research into instruction, benefiting both student learning and faculty research endeavors.

Systematic review as a tool in integrating research in graduate school has also been studied. Baldassarre et al. (2008) and Iwazaki et al. (2022) underscore its importance in software engineering and computing, respectively. They emphasize the need for students to develop skills in evaluating and synthesizing empirical evidence, highlighting how such courses enhance research skills and deepen understanding of the research domain. McGowan et al. (2021) supports this with findings of increased student confidence in systematic review processes after completing a for-credit course. However, challenges such as time requirements, effort, and the lack of standardized frameworks for conducting systematic reviews persist (Barat et al., 2017 Alchokr et al., 2022). In response in particular to CMO No. 15, s. 2019, this study proposes STRAMERS Model (Syllabus 1 - Training - Mentoring - Evaluating - Reporting –

Syllabus 2) as an innovation in teaching systematic reviews and integrating research into graduate science education, to prepare graduate students on the challenge for academic publication requirement.

METHOD

Purpose and Research Design. The researcher aimed to propose an innovation in the teaching of specialization courses in graduate schools by integrating the teaching of Systematic Reviews and writing these in the form of an IMRAD. The idea of the researcher is that graduate students could be contributors to the content of the course syllabi. The students' contribution could be done by conducting a systematic review on unexplored science topics in the syllabi. Thus, the researcher thought of integrating the writing of systematic reviews in the form of IMRAD and recommending the article's citation as a component of the syllabus' references for supplementary readings. This study, therefore, utilized an exploratory sequential mixed method research design. Refer to Figure 1 for the process flow.

Unit of Analysis. Aside from the classroom guide of implementation the writing of systematic reviews for the qualitative data, the unit of analysis for quantitative data source included 17 SYROs submitted as course requirements in Cell and Molecular Biology and Advanced Genetics and Evolution at the School of Advanced Studies, Pangasinan State University. The study was conducted for two semesters, one in 2022 and another one in 2023 - both semesters were delivered in a hybrid teaching modality but the same faculty taught each class (i.e. the author). Thus, both the SYROs and the researcher's reflection during the 2-year implementation were analyzed.

Implementation. The researcher implemented the study from July 2022 up to August 2023 in two graduate courses (i.e. EDSC 312 Cell and Molecular Biology and EDSC 313 Advanced Genetics and Evolution). The Systematic Review Outputs (i.e. data corpora) or referred to in this study as 'SYROs' (n=17) were those submitted by students who were enrolled in the earlier-mentioned graduate courses in 2022 (n=9) and 2023 (n=8) respectively as a partial requirement of each course, and included those SYROs that passed the 20% cut off similarity check of a plagiarism software available in the University. Each graduate course was taught by the researcher for one semester within 54 hours during Saturdays in an in-person-to-online class alternative learning modality. The implementation of the SYROs was included in the researcher's syllabus and was approved by campus officials.

Analysis. Analysis of the corpora included two stages. The first stage involved quantitatively analyzing each corpus using a researcher-prepared list of features in order to determine the present attributes of the data corpora which manifests the students' raw ability in

writing their SYROs. The second stage involved quantitatively analyzing each corpus using *selected* indicators of the PRISMA 2020 Updated Guidelines (https://www.prisma-statement.org/prisma-2020-checklist) in order to determine the strengths and weaknesses of the SYROs in terms of academic publication at the national and international level.

Model Development. Both of these analyses provided bases in the crafting of a model on how to integrate the use of Systematic Reviews in the teaching of graduate courses using the beginning abilities of graduate students. It is hoped that the guideline would be implemented in Year 2 (2024) and Year 3 (2025) in order to refine the approach of integration. For both stages, frequency and percentage were reported for each feature. Finally, an approach to integrate SYROs in graduate courses is proposed for implementation after a thematic analysis.

Expert Evaluation and User Acceptability. The draft/initial model was emailed to three expert validators from Ghana, Malaysia, and Philippines who provided sound insights and recommendations to the draft model in September 2023. The researcher revised the model in November 2023 based on the evaluation of these experts. The final model was emailed to nine graduate students through Google form in February 2024. These students were not part of the 2022 and 2023 implementation. They assessed the model along indicators set by the researcher.

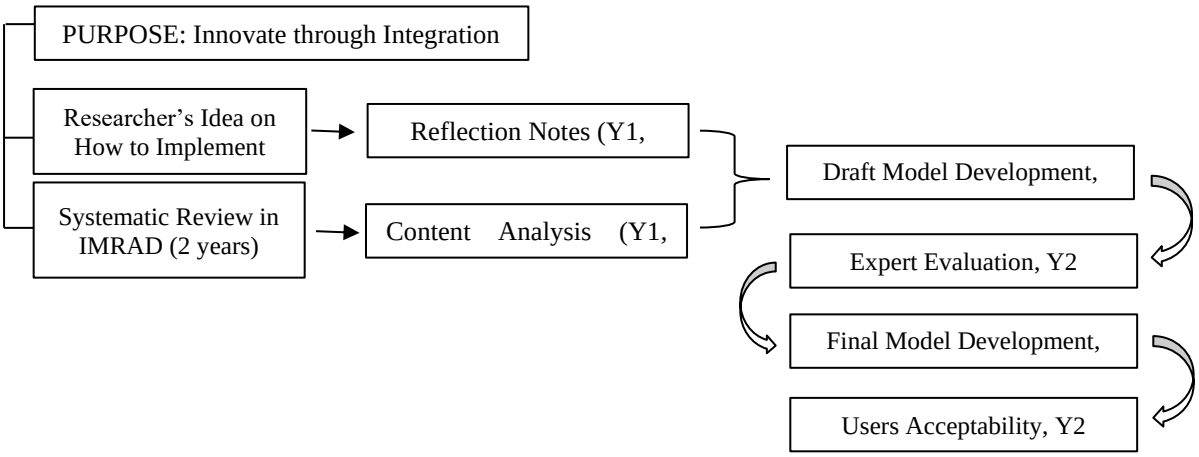

Figure 1. The Appropriate Process to Target the Purpose of the Study Using Exploratory Sequential Mixed Methods Research Design

RESULTS AND DISCUSSIONS

General Attributes of the SYROs

The general attributes of the SYROs submitted by graduate students with titles and codes presented in Table 1 as course requirements are presented in this section with the assumption that the quality of the SYROs is a manifestation of the students' ability to write a SYRO and therefore is also a manifestation of the feasibility to integrate this requirement in a graduate course. The assumption is that the SYROs will provide the basic and unprocessed skill level of

students which could be used in turn to draft a working model for graduate schools on how this level could be increased over time until outputs become publishable as SYROs. It should be noted that the numbers 1-17 in Table 1 do not match the numbers 1-17 in Table 2.

Table 1. *List of SyROs and initials of authors in their Unprocessed Form*

No	Title of Submitted SyRO	Researcher	Code
1	Human Embryonic Stem Cells: Developments and Challenges: A Systematic Review	JTA	22001
2	Chicken Egg Yolk Immunoglobulin Y (IgY) antibodies in response to Covid-19 virus: A Systematic Review	CAV	22001
3	Physiological, Pharmacological and Utilization of *Mimosa pudica* L.	WTA	22003
4	Motivational Learning Achievement of Gamification in Science Education: A Systematic Review	KIDB	22004
5	Systematic Review of Publications on Effects of Probiotics on Weight Loss	CMN	22005
6	A Systematic Review of the Human Microbiome's Impact on Determination of Postmortem Interval	RMN	22006
7	Teaching Molecular Biology among Filipino Junior High School and Senior High School in the Context of Education 4.0: A Systematic Review	LBRP	22007
8	Biomimicry as Nature-Inspired Innovation for a Classroom in the Philippines: A Systematic Review	JVS	22008
9	Impact of Biotechnology Application on Education: A Systematic Review	MNS	22009
10	Effective Strategies in Teaching Genetics Concepts: A Systematic Review	JTA et al.	23010
11	A Systematic Review on Gamification in Genetics and Evolution: Effects of Gamified Instructional Materials on the Students' Learning Motivation	KIDB	23011
12	Teaching Genetics with Multimedia: A Systematic Review	LSC	23012
13	Learners' Understanding and Acceptance on Evolution: A Systematic Review	BADF	23013
14	A Systematic Review on Understanding Resistance to Genetics and Evolution in Christian-dominated Schools: Innovative Approaches for Effective Teaching	SKJM	23014
15	Least Mastered Competencies in Genetics as Guide for Instructional Interventions: A Systematic Review	LBRP	23015
16	Spiral Progression Approach in Teaching Evolution on Junior High School: A Systematic Review	MNS	23016
17	Golden Rice in the Philippines: A Systematic Review of Acceptance and Potential Impact on Public Health	CAV	23017

Thompson (2007), and Thompson et al. (2008) emphasizes the importance of integrating educational theory and research in design education, especially for developing graduate attributes. Treleaven & Voola (2008) further highlights the need to align these attributes with learning outcomes and assessment criteria, stressing the importance of students understanding their relevance. Iwazaki (2022) supports the integration of graduate attributes in the Systematic Literature Review (SLR) course, noting its benefits in enhancing research skills and academic achievement. Additionally, Mullen (2001) underscore the significance of equipping graduate students with essential writing skills for scholarly work through their Writing Process and

Feedback (WPF) model, which includes structured assignments, student editorial review boards, and feedback from faculty and peers.

Table 2. *General Features of the SYROs*

No	T	K	I	M	Rs	D	Im	Li	Rf	wAb	wAr	arId	arSr	arRe	arEl	arIn
1	1	1	1	1	1	1	1	1	1	y	y	1983	261	96	46	14
2	1	1	1	1	1	1	1	1	1	y	y	1200	254	204	54	9
3	1	1	1	1	1	1	1	1	1	y	y	1580	50	40	30	5
4	1	1	1	1	1	1	1	1	1	y	y	365	55	46	31	11
5	1	1	1	1	1	1	1	1	1	y	y	126	87	39	77	10
6	1	1	1	1	1	1	1	1	1	y	y	1603	95	50	15	8
7	1	1	1	1	1	1	1	1	1	y	y	1318	687	109	53	5
8	1	1	1	1	1	1	1	1	1	y	y	11200	78	68	58	8
9	1	1	1	1	1	1	1	1	1	y	y	1390	355	90	30	5
10	1	1	1	1	1	1	1	1	1	y	y	435	155	57	42	7
11	1	1	1	1	1	1	1	1	1	y	y	1983	261	96	46	14
12	1	1	1	1	1	1	1	1	1	y	y	4729	349	85	53	10
13	1	1	1	1	1	1	1	1	1	y	y	542	50	40	25	5
14	1	1	1	1	1	1	1	1	1	y	y	1216	625	85	24	8
15	1	1	1	1	1	1	1	1	1	y	y	17200	1004	456	121	11
16	1	1	1	1	1	1	1	1	1	y	y	1242	386	83	22	11
17	1	1	1	1	1	1	1	1	1	y	y	1040	567	220	14	7

Legend: *[T]* Title, *[K]* Keywords, *[I]* Introduction, *[M]* Methodology, *[Rs]* Results, *[D]* Discussions, *[Im]* Implications, *[Li]* Limitations, *[Rf]* References, *[wAb]* words in the Abstract, *[wAr]* words in the Article, *[arId]* No of articles Identified, *[arSr]* No of articles screened, *[arRe]* No of articles Retrieved, *[arEl]* No of articles eligible, *[arIn]* No of articles Included.

Summary of General Features of the SYROs

Generally, the key elements for a systematic review were contained in the SYROs as presented in Table 2, which according to Bigby (2014), the key elements of a high-quality systematic review include clear clinical objectives, a thorough literature search, explicit inclusion criteria, critical appraisal of study quality, and structured reporting of results. Analysis of Table 2 would reveal that 100% of the 17 SYROs contained the following sections: Title, Keywords, Introduction, Methodology, Results, Discussions, Implications, Limitations, and

References. This finding showed the reflective practice of the course faculty who taught the subjects (i.e. the researcher) by lecturing on these basic and add-on sections in academic writing using the IMRAD. Further, Table 2 shows that the number of words in the Abstract (wAb) is considered acceptable (i.e. 'Y' means Yes, acceptable). Similar observation was found in the number of words in the entire article (wAr) which is considered acceptable.

Furthermore, the 5 steps in including articles to be reviewed revealed that the SYROs contained generally thousands of articles Identified (arId) and this became progressively smaller after being screened (arSr), retrieved (arRe), made eligible for review (arEl), and finally being included (arIn) in the review.

Quantitative Content Analysis

Table 3. *Adherence of the SYROs to the PRISMA 2020 Updated Guidelines*

Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	**f1**	**f2**
Title*	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*16*	*1*
Abstract	1	2	2	2	2	1	2	2	2	1	1	1	2	1	1	1	2	*8*	*9*
Rationale*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*17*	*0*
Objectives*	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*16*	*1*
Eligibility Criteria*	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*16*	*1*
Information Sources*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*17*	*0*
Search Strategy*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*17*	*0*
Selection Process*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*17*	*0*
Data Collection Process	2	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	1	*4*	*13*
Data Items (Outcomes)	2	2	2	2	2	1	2	1	2	2	2	2	1	2	2	2	2	*3*	*14*
Study Risk of Bias Assessment	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*
Effect Measures	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*
Synthesis Methods (Eligibility)*	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	2	*14*	*3*
SM- (Tabulation and Graphical)*	1	1	1	1	1	1	2	2	2	1	1	1	1	2	2	2	2	*10*	*7*
SM - (Stat. Synthesis Methods)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*
SM - (To explore heterogeneity)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*
Study Selection (Flow of Studies)	2	1	2	2	1	1	1	2	2	2	1	2	1	2	2	1	1	*8*	*9*

Indicator	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	**f1**	**f2**
Study Characteristics	2	1	2	2	1	1	2	2	2	2	2	2	2	2	2	2	2	*3*	*14*
Results of Individual Studies	2	2	2	2	2	2	2	2	2	1	2	2	1	2	2	2	2	*2*	*15*
RS - (Char. of Contributing Studies)	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*1*	*16*
RS - (Statistical Syntheses)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*
Reporting Biases	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	*1*	*16*
Discussion (Interpretation)*	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	*16*	*1*
Discussion (Limitation of Evidence)*	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1	1	*14*	*3*
Discussion (Limitation of Process)*	1	1	1	1	2	2	1	1	1	2	1	1	1	1	1	1	1	*14*	*3*
Discussion (Implications)*	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	*16*	*1*
Support	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	*0*	*17*

Note: 1 – Evident [E]; 2- Not Evident [NE]*

As mentioned, the SYROs represented the beginning characteristics of the participants and after being taught the basic processes on conducting a systematic review using the reflective practice of the researcher. Further, during the implementation the participants were asked to refer to published systematic reviews as guides.

The outputs for 2022 cohort and 2023 cohort of the participants were analyzed each year if the write ups adhered or not to the basic requirement of the PRISMA 2020 Expanded Checklist. The results are displayed in Table 2. Table 2, by analysis, showed that 21 of 27 (77.78%) indicators were at least found evident in the outputs while 6 of 27 (22.22%) were totally not evident. Of the 21 evidenced indicators, there were 13 (61.90%) which have been evidenced by more than half of the SYROs, and are marked with an asterisk (*), suggesting that beginning researchers found it manageable to do these indicators. Further, this implies that are not evidenced at all and those which have been evidenced by less than half of the number of participants would require further training, and in fact, a greater focus in Year 3, Year 4, and so on. However, it should be noted that Table 2 only reported selected indicators from the PRISMA 2020 Expanded Checklist.

This finding is consistent with other studies where a review of systematic review and meta-analysis articles in the Korean Journal of Radiology found that many did not fully adhere

to the PRISMA 2020 guidelines, particularly in the reporting of eligibility assessment, risk of bias, and study limitations (Park et al., 2022). Similarly, a study on systematic review protocols found that adherence to the PRISMA-P 2015 reporting guideline was inadequate, with many protocols failing to fully report key items (Frost et al., 2022). The PRISMA 2020 guidelines, which aim to improve the transparency and completeness of systematic review reporting, have been updated to reflect recent advances in methodology and terminology (Page et al., 2020). These studies highlight the need for greater adherence to the PRISMA guidelines in systematic review and meta-analysis reporting.

The STRAMERS Model in Integrating SYROs

In the field of science education, various models have been developed also to enhance educational delivery such as the STREAM model by Godsk (2013), which is notable for its flexibility and comprehensive nature, transforming science education through blended and online learning methods that emphasize active and collaborative learning. Imaduddin & Zuhaida (2019) extends this further with the STREAMIN model, integrating technology, religion, engineering, arts, mathematics, indigenous culture, and nationalism into science education. Markowitz & DuPre (2007) focuses on a course tailored for biomedical science graduate students, emphasizing practical teaching and communication skills, while Canary et al. (2012) explores instructional models integrating micro and macroethics in graduate education for scientists and engineers.integrate micro and macroethics in graduate education for scientists and engineers.

The STRAMERS Model is a refinement of the classroom-based strategy used by the researcher in delivering the lesson on writing a systematic review. The old approach could be summarized with Syllabus-Training-Submit or STS. In this old approach, the students were presented with the topics in the syllabus. Then, they were asked to identify which of these topics would they want to research on. Further, the Training involved two stages (1st on systematic review, 2nd on IMRAD Writing). Then, 'Submit' just referred to the submission by the students with both the softcopy and hardcopy each semester.

The STRAMERS Model on the other hand, which stands for Syllabus 1 - Training - Mentoring - Evaluating - Reporting – Syllabus 2, represents an innovative approach to teaching systematic reviews in graduate studies. Barat (2017) proposed a model-based approach to systematic review production, which could potentially reduce the time and effort required. The approach uses a domain-specific language expressed as a meta-model to represent research literature, a meta-model to specify SR constructs in a uniform manner, and an associated development process all of which can benefit from computer-based support. During the

evaluation of the model by the experts through email corresponce, a most-sought publons reviewer commented that '*he personnaly, throughout his career, did not encounter yet an existing sustainable model that consciously aims at nurturing the academic writing skills of students through carefully developed cyclical model'*. Further, according to him *the STRAMERS Model is novel and certainly would heighten the development of the academic writing potentials of graduate students in systematic review which he said is the foundation of all academic writing.* With his comments and the two other evaluators, the initial draft of the model was finalized, and the Final Model is shown in Figure 2. The pedagogical description is in Table 4.

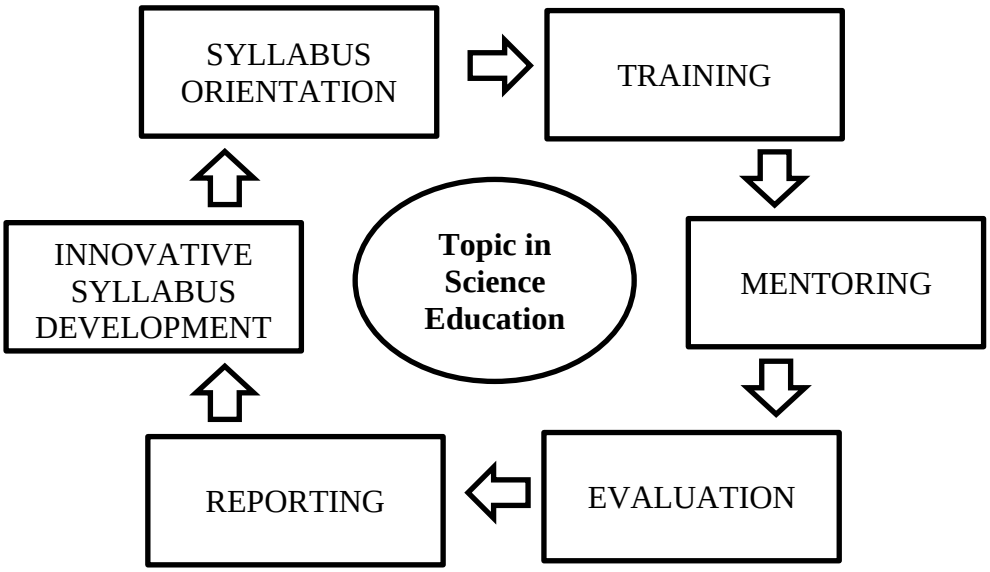

Figure 2. The (cyclical) STRAMERS Model in Graduate Science Education

Table 4. *The STRAMERS Model for Conducting SYROs in Graduate Science Education*

Area	Pedagogical Description
Syllabus 1 (Syllabus Orientation)	This step refers to the orientation of the professor on the contents of the course via a syllabus. The syllabus contains the chapters/topics and a brief description on what will be tacked per chapter/topic. This will provide an idea to the learners which components of a topic will not be covered in the course (which in turn could be a potential source of research question for SYRO).
Training	This refers to a basic virtual or in-person trainings on [1] Basics of IMRAD Template [2] Basics of Writing Systematic Reviews. For IMRAD Training, this can be discussed by the course professor to properly situate his or her personal specifications as long as the format is IMRAD. For Systematic Review Training, this can be discussed by an external speaker (i.e. national or international) as long as his or her expertise and publications is any type of SYR in local or international journal, and regardless of its type of indexing (For Year 1). For succeeding years of implementation, the graduate school shall specify the indexing

like SCOPUS, WOS, ACI, and the like.

Mentoring	This refers to a series of coordination between the professor and student within the 54-hour course time and which could be done during consultation time. Topics during mentoring may include: 1, justification on exclusion and inclusion criteria; 2, refinement of the research question; 3, controlling bias in the collection process. This step will not involve scoring of outputs because in this step the student is not yet finished writing the paper. Further, mentoring shall not involve any lecture about the conclusions to be arrived at by the student, it is the student who must see for himself or herself what information is new about his or her SYRO after conducting such.
Evaluating	This step refers to the submission of the student to his or her professor a GDrive containing the outputs for evaluation prior reporting to class. The professor shall issue the following score, after a careful analysis of the reviewed studies using an evaluation rubric: A - For Acceptance with Reporting; B - For Acceptance without Reporting; C - For Revision. This step includes AI checkpoint.
Syllabus 2 (Innovative Syllabus Development)	This refers to the step where the professor decides to integrate the new information from the students' SYROs in his or her Course Syllabus for the next subject offering. Refinement may include adding the new information as a context, as an example, as a reference, or the professor may include a DOI or link to the SyROs archives as a form of reading. Approval of the relevant committee for Curriculum is of course sought. Publication of output is recommended after 2 years of implementation (Year 3 and 4).

Note: Only pedagogical description is shown. Full Model is submitted for copyright.

Table 5. *Acceptability of the STRAMERS Model by Prospective Users*

Feature	**Weighted Mean**	**Descriptive Equivalent**
Sequence of the Steps	4.4	Very Highly Acceptable
Pedagogical Description	4.6	Very Highly Acceptable
Course Placement	4.4	Very Highly Acceptable
Time Requirement	4.2	Very Highly Acceptable
Success Indicator	4.4	Very Highly Acceptable
General Acceptability	**4.4**	**Very Highly Acceptable**

Table 5 reports that prospective users (i.e. presently enrolled graduate students in the doctoral program, sampled from science majors) rated the Model with a weighted mean of 4.4 and is interpreted as Very Highly Acceptable. The pedagogical description had the highest mean of 4.6 and time requirement having the lowest with 4.2 - both were interpreted as Very Highly Acceptable. When inquired during informal interviews why time requirement had the lowest mean, a prospective user shared that she preferred a longer time for the trainings on IMRAD and Systematic Review. However, the author did not increase the time requirement in the final Model because of the restrictions in the Instructional Academic Time (or IAT) in the graduate schools' courses, the SYRO is a final requirement and not a course content which should be given a time mandatorily. Further, since the Model will be used for graduate and postgraduate level, a 1-hour training coupled with independent studies would be enough. Studies by McGowan et al. (2021), Himelhoch et al. (2015), Acosta et al. (2020), and Krainovich-Miller et al. (2009) collectively stress the significance of systematic review training for graduate students, enhancing confidence, research literacy, methodological assessment skills, and critical appraisal essential for evidence-based practice in clinical settings.

CONCLUSION

The researcher concluded that the 6-step cyclical STRAMERS Model is a Very Highly Acceptable pedagogical innovation in the teaching of specialization courses in graduate science education in the Philippines, and by extension, to respond to the challenge posed by CMO No. 15, s. 2019 which stipulates the requirement for an academic publication by graduating students in graduate schools in the Philippines.

SUGGESTIONS

The finding that the STRAMERS Model was rated as very highly acceptable by prospective users imply that the model could serve as an input in graduate level instruction practices. Further, this could serve as a model in other non-science degree programs in their class instruction. The Commission on Higher Education may consider assessing the model relative to relevant indicators in capacitating state universities and colleges in their research productivity. Graduate schools could integrate the Model in their program as a support curriculum.

The finding that most of the selected indicators of the PRISMA 2020 Expanded Checklist were evidenced by the SYROs of the cohort 1 and cohort 2 beginning researchers imply that Filipino graduate students are flexible in their learning and maintain a remarkable self-efficacy in research instruction. Thus, a potential area of research interest is the level of research literacy in the master's level that is received by Filipino professionals. Learning this level of literacy

would provide guidance on how to increase their competence so that the 6 (22.22%) not evidenced PRISMA areas in SYROs would be resolved.

The research gap on the non-existence of a formal instructional model to integrate SYROs in graduate science education and the finding that the proposed STRAMERS Model is found novel by experts and are rated as very highly acceptable by prospective users could target SDG No 4 which is on Quality Education. The attribute of the STRAMERS Model as cyclical provides for a sustainable mechanism to nurture beginning researchers in order for them to be contributors of either or both local and global knowledge.

While the STRAMERS Model provides a formal protocol on how to innovate on graduate level syllabi by collecting SYROs of graduate students at the end of the semester, the quality of the SYROs could potentially weaken the syllabus content if the SYROs are not evaluated thoroughly per institutional standards and other quality mechanisms. While findings of SYROs of future users could be integrated in the graduate level syllabi, the course faculty is given a pivotal role as 'checkpoint'. This means that course faculty teaching is expected to have possessed the requisite technical competence in conducting SYROs and writing scientific reports in IMRAD Form. Absence of this will weaken the Model.

The study on future skills of Filipino graduate science students by Camara & Adom (2024) showed that the science graduates possessed very high competence in four areas, namely, communication, reflective, initiative and performance competence, and cooperation competence, which according to them implies that the science program of the University (i.e. PSU) has satisfactorily incorporated all the future skills, empowering its graduates to perform well in the industry. In this particular study on STRAMERS Model, the combination of very high competence and a formal protocol in research instruction could pave the way for more synergistic effect, like developing a Training Plan on how to similarly execute the STRAMERS Model in other non-science degree specialization courses in order for course faculty to require a SYRO for each course, making their field updated and contextualized.

ACKNOWLEDGEMENTS

This study is funded by Pangasinan State University led by President Prof. Dr. Elbert M. Galas under BOR No. 43, s. 2023 (Study 10: Analysis of Systematic Review in Graduate School, Proj. RAISE – Researching Academic Innovations in Science Education). The researcher expresses his sincerest thanks to Dr. Dickson Adom of Kwame Nkrumah University of Science and Technology, Ghana; Dr. Lim Seong Pek of Universiti Selangor, Malaysia; and Dr. Thelma D. Palaoag, Director for Innovation, of University of the Cordilleras, Philippines, for their sound suggestions and insights to the initial and final model as expert-validators.

Further, the researcher is indebted to the expertise shared by Asst. Prof. R. Ahmad Zaky El Islami as resource person in Year 1 and Year 2 IMRAD (virtual) Training in the School of Advanced Studies, Pangasinan State University. Mr. John Rommel T. Retuya, Mr. John V. Bernardo, and Mr. James Bernardo Fronda are also acknowledged for their technical assistance in data analysis. The 2022 Cohort 1 and 2023 Cohort 2 graduate science students are also acknowledged.

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