

## Supplementary Material – The List of Studies Reviewed and Coding Schemes (Tables S1 – S4)

### The role of Mathematics in STEM classrooms: a literature review

#### The List of Reviewed Studies

1. Bautista, N., Diekman, A. y Fuesting, M. (2018). Why Not STEM? Communal experiences motivate students to pursue STEM careers. *The Science Teacher*, 86(3), 46–52. <https://www.jstor.org/stable/26611966>
2. Chuasontia, I. y Sirirat, T. (2021). Designing an instructional module to teach light diffraction by a grating to secondary students applying a STEM-integrated approach. *Physics Education*, 56(4), 45011. <https://doi.org/10.1088/1361-6552/abf69a>
3. Daman Huri, N. H. y Karpudewan, M. (2019). Evaluating the effectiveness of Integrated STEM-lab activities in improving secondary school students' understanding of electrolysis. *Chemistry Education Research and Practice*, 20(3), 495–508. <https://doi.org/10.1039/C9RP00021F>
4. Dasgupta, C., Magana, A. J. y Vieira, C. (2019). Investigating the affordances of a CAD enabled learning environment for promoting integrated STEM learning. *Computers & Education*, 129, 122–142. <https://doi.org/10.1016/j.compedu.2018.10.014>
5. Duygu Sönmez y S. Asli Özgün-Koca (2020). An Integrated Biology & Mathematics Activity to Investigate Photosynthesis & Linear Relationships. *The American Biology Teacher*, 82(7), 488–493. <https://doi.org/10.1525/abt.2020.82.7.488>
6. Goovaerts, L., Cock, M. de, Struyven, K. y Dehaene, W. (2019). Developing a Module to Teach Thermodynamics in an Integrated Way to 16 Year Old Pupils. *European Journal of STEM Education*, 4(1). <https://doi.org/10.20897/ejsteme/3964>
7. Hacıoğlu, Y. y Dönmez Usta, N. (2020). Digital game design-based STEM activity: Biodiversity example. *Science Activities*, 57(1), 1–15. <https://doi.org/10.1080/00368121.2020.1764468>
8. Khozali, N. B. y Karpudewan, M. (2020). An Interdisciplinary Facebook Incorporated STEM Education Strategy in Teaching and Learning of Dynamic Ecosystems. *Eurasia Journal of Mathematics, Science and Technology Education*, 16(11), em1902. <https://doi.org/10.29333/ejmste/8704>
9. Lawrimore, C. y Surber, E. (2018). Graph It Out! Create Graphing Manipulatives to Explore Evolutionary Selection: A Lesson for High School Biology Students. *Proceedings of the Interdisciplinary STEM Teaching and Learning Conference*, 2(1). <https://doi.org/10.20429/stem.2018.020111>
10. Ng, O.-L. y Chan, T. (2019). Learning as Making: Using 3D computer-aided design to enhance the learning of shape and space in STEM-integrated ways. *British Journal of Educational Technology*, 50(1), 294–308. <https://doi.org/10.1111/bjet.12643>
11. Pérez, A., Braaten, B. y MacConnell, R. (2019). Closing the Circuit on Function Concepts. *The Mathematics Teacher*, 112(5), 366–373. <https://doi.org/10.5951/mathteacher.112.5.0366>
12. Wan, A. y Ivy, J. (2021). It's a Wrap: A New Dimension for Sinusoids. *The Mathematics Teacher*, 114(6), 473–476. <https://doi.org/10.5951/MTLT.2020.0217>

13. Wang, L. y Chiang, F.-K. (2020). Integrating novel engineering strategies into STEM education: APP design and an assessment of engineering-related attitudes. *British Journal of Educational Technology*, 51(6), 1938–1959. <https://doi.org/10.1111/bjet.13031>
14. Yasin, A. I., Prima, E. C. y Sholihin, H. (2018). Learning Electricity using Arduino-Android based Game to Improve STEM Literacy. *Journal of Science Learning*, 1(3), 77. <https://doi.org/10.17509/jsl.v1>

### **Coding Schemes**

**Table S1.** Coding scheme for study characteristics and research methodologies of the studies reviewed.

Category	Codes	Short Description, if necessary
Number	-	Articles in alphabetical order (from 1 to 14)
Publication details	-	Names of author and co-authors
Publication year	-	Year of publication
Country of authors	-	Country of the institutions or universities the author(s) are affiliated
Publication type	J	Paper in journal
	C	Paper in monograph
	N	Paper out of a journal
Type of Journal	1	Journal that can be assigned primarily to mathematical education
	2	Journal that can be assigned primarily to science education
	3	Journal that can be assigned primarily to technology education
	4	Journal that can be assigned primarily to engineering education
	5	Journal that can be assigned primarily to STEM education
	M	Journal that can be assigned primarily to mixed education
	0	Journal that does not fit in one of the upper categories
Target group of the journal	T	The primary target group of the Journal are teacher
	R	The primary target group of the Journal are researchers
Empirical approach	Qualitative	Usage of qualitative methods reported by authors
	Quantitative	Usage of quantitative methods reported by authors
	Usage of both qualitative and quantitative methods	Usage of qualitative and quantitative methods jointly, but not called mixed-methods study

	Design-based research or research design	Usage of design-based research or research design reported by authors
	Experimental research	Usage of experimental research reported by authors
	Not mentioned	No information about methods provided by authors
Sample/participants	-	Grade in Number
Grade	0	No information provided
Sample size	-	participants of the study
	Not mentioned	No information provided

**Table S2.** Coding scheme for educational settings and approaches.

Category	Codes	Short Description, if necessary
Setting of the implementation	1	Implementation of the STEM unit as Project e.g. (Field, trip, project week, ...)
	2	Implementation of the STEM unit in regular classroom setting
	0	No information provided
Setting of the topic	1	Implementation as a project-based unit
	2	Implementation of the STEM unit in regular classroom setting
	0	No information provided
Approaches according to Hobbs	1	Implementation of the STEM unit in an integrated approach
	2	Implementation of the STEM unit in a separated approach
	3	Implementation of the STEM unit while emphasizing on or two disciplines
	4	Implementation of the STEM unit by Integrate one into others without Lining the others [3.M]
	5	Implementation of the STEM that is divided by subjects

**Table S3.** Coding scheme for the application of mathematics.

Category	Code	Short Description, if necessary
Application of mathematics	O	Focus of the application of mathematics is on handling the language, constructs, and tools of mathematics
	P	Focus of the application of mathematics is on posing and answering questions in and by means of mathematics

Opportunities in the application of mathematics after small adjustment of material and task	O	Focus of the application of mathematics is on handling the language, constructs, and tools of mathematics
	P	Focus of the application of mathematics is on posing and answering questions in and by means of mathematics
Necessity of mathematics	1	Mathematics is used in the sense of nature of mathematics
	2	Mathematics is used as an ancillary discipline
Necessity of mathematics in the authors depiction	1	Mathematics is seen in the sense of nature of mathematics in the authors depiction
	2	Mathematics is seen as an ancillary discipline in the authors depiction

**Table S4.** Sample coding. *Note.* Except for coding “year”, the codes indicate “yes” (1), “no” (0).

Category	Codes	Exemplary Coding	
Number	-	13	12
Publication details	-	Yasin, Alifa Irna; Prima, Eka Cahya; Sholihin, Hayat	Ng, Oi-Lam; Chan, To
Publication year	-	2018	2019
Country of authors	-	Indonesia	Hong Kong
Publication type	J	J	J
	C		
	N		
Type of Journal	1	2	3
	2		
	3		
	4		
	5		
	M		
	0		
Target group of the journal	T	R	R
	R		
Empirical approach	Qualitative	Design-based research or research design	
	Quantitative		
	Usage of both qualitative and quantitative methods		

	Design-based research or research design		
	Experimental research		
	Not mentioned		
Sample/participants	-	8	8
Grade	0		
Category	Codes	Exemplary Coding	
Sample size	-	16	50
	Not mentioned		
Setting of the implementation	1	2	2
	2		
	0		
Setting of the topic	1	0	2
	2		
	0		
Approaches according to Hobbs	1	1	3
	2		
	3		
	4		
	5		
Application of mathematics	O	O	P
	P		
Apply opportunities in the application of mathematics after small adjustment of material and task	O	P	P
	P		
Necessity of mathematics	1	1	1
	2		
Necessity of mathematics in the authors depiction	1	2	1
	2		