

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

ARGUMENT MAPPING METHOD AND CRITICAL THINKING DISPOSITIONS
OF LEARNERS IN PHYSICS

A Thesis Presented to the
Faculty of the Graduate School
College of Education
West Visayas State University
La Paz, Iloilo City

In Partial Fulfilment
of the Requirements for the Degree
Master of Arts in Education
(Physics)

by

Shayne V. Esquillo

July 2021

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

APPROVAL SHEET

A Thesis for the Degree
Master of Arts in Education
(Physics)

by

Shayne V. Esquillo

Approved by the Research Committee:

GRACE A. MANAJERO, Ph.D., Chair

ANTONIETTE D. CORTEZ, Ph. D., Member

ELVIRA L. ARELLANO, Ph.D., Outside Expert

LOURDES N. MORANO, Ed.D., Outside Expert

CHIVE G. GABASA, Ph.D., Adviser

RICKY M. MAGNO, PhD
Dean

July 2021

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

Esquillo, Shayne V. "*Argument Mapping Method and Critical Thinking Dispositions of Learners in Physics*". Unpublished Master's Thesis, Master of Arts in Education (Physics), West Visayas State University, Iloilo City, July 2021

Abstract

The quasi-experimental study was conducted to determine the effect of argument mapping method of teaching to the critical thinking dispositions of learners in Physics. Argument mapping presents ideas in a verbal-diagrammatical representation through boxes and arrows. It includes arguments or premises and contentions. The subjects of the study were the 56 Grade 10 learners for the School Year 2020-2021. The subjects coming from the two (2) intact groups were determined using matching criteria limited to sex, Final Grade in Science 9 in the previous School Year, and First Quarter Grade in Science 10 in the current School Year. Random group assignment was done using toss-coin method. The Critical Thinking Dispositions of learners in Physics were determined using a researcher-made CTD Inventory which was given as pretest and posttest. The Self-Learning Modules (SLMs) in Science 10 for the Second Quarter was used for the controlled group. The same SLMs were modified to embed argument mapping activities and were used in teaching the experimental group. There were a total of seven (7) SLMs implemented for seven (7) weeks for both groups containing the Most Essential Learning Competencies for Grade 10 learners as prescribed by the DepEd. The learners in the AM group have a "very strong CTD". This is an indication of the learners' strength in overall CTDs. Also, they have "very strong CTDs" in intellectual honesty,

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

objectivity, methodical, logical, intellectual curiosity, and reflective thinking subcategories and a “strong CTD” in intellectual self-confidence CTD. This is an indication of strength in CTDs and a positive inclination to possess these CTDs. Learners in the non-AM group have a “strong CTD” in the posttest. They also have a “strong CTDs” for the subcategories of intellectual honesty, objectivity, methodical, logical, intellectual self-confidence, intellectual curiosity, and reflective thinking subcategories. Results implied that learners in the non-AM group have a positive inclination towards critical thinking dispositions. The mean gain scores of the learners in the AM Group is higher than that of the Non-AM Group. Results mean that there is a higher increase of mean scores from pretest to posttest in the AM group than the non-AM group. Moreover, results revealed that there is a significant difference between the posttest mean scores in CTDs of learners between the two groups favoring the experimental group. This indicates that learners in the experimental group scored higher in the posttest in critical thinking dispositions in Physics than those in the controlled group. Results also revealed that the difference in the mean gain score in critical thinking dispositions in Physics between the two groups is significant. This means that the learners exposed to argument mapping method of teaching scored higher from pretest to posttest than those in the non-argument mapping method group. The results of the study imply that argument mapping method has a positive effect to the critical thinking dispositions of learners. Moreover, argument mapping method of teaching can be used to increase the learners’ critical thinking dispositions. The researcher recommends that learners be exposed to critical thinking activities such

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

as constructing argument maps and be given opportunities to collaborative works and communicate their ideas. The critical thinking dispositions of learners can be promoted when they are constantly exposed to activities which require them to use critical thinking. Also, it is strongly recommended that further studies be conducted to develop better instruments to measure the critical thinking dispositions of learners.

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

TABLE OF CONTENTS

	Page
Title Page	i
Approval Sheet	ii
Acknowledgment	iii
Abstract	vi
Table of Contents	x
List of Figures	xii
List of Tables	xiii
List of Appendices	xv
Chapter	
1 INTRODUCTION TO THE STUDY	1
Background of the Study	2
Theoretical Framework of the Study	10
Statement of the Problem	16
Hypotheses	18
Significance of the Study	18
Definition of Terms	20
Delimitation of the Study	22

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

2	REVIEW OF RELATED LITRATURE	25
	Learning Theories Supporting Argument Mapping	25
	Argument Mapping	32
	Critical Thinking Dispositions	40
	Summary	56
3	RESEARCH DESIGN AND METHODOLOGY	61
	Research Design	61
	Subjects of the Study	62
	Data Collection Instruments	63
	Data Collection Procedure	74
	Data Analysis Procedure	88
4	RESULTS AND DISCUSSIONS	94
	Descriptive Data Analysis	94
	Inferential Data Analysis	106
5	SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS	140
	Summary of the Problems, Method, and Findings	140
	Conclusions	147
	Implications	149
	Recommendations	158
	REFERENCES	162
	APPENDICES	184

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

LIST OF FIGURES

Figure		Page
1	Schematic Diagram of the Study	16
2	Schematic Diagram of the Pretest-Posttest Design	62
3	Flow chart on the Processing of learners' constructed argument maps	83
4	Flow chart for gathering data on teacher's experiences using argument maps	85
5	Procedural design of the study	87
6	Flow Chart on Collecting and Interpreting Qualitative Data	90

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

LIST OF TABLES

Table		Page
1	Subjects of the Study According to Grouping/Section	63
2	Mean Scores, Verbal Interpretation, and Description of Critical Thinking Dispositions in Physics of Grade 10 Learners	68
3	Matrix of Activities for the Actual Implementation of the Intervention	71
4	Learners' level of competence in constructing argument map	81
5	Pretest and Posttest Scores in CTDI of Grade 10 Learners in the Argument Mapping Method of Teaching Group	96
6	Pretest and Posttest Scores in CTDI of Grade 10 Learners in the Non-AM Group	99
7	Mean Gain Scores in CTDI of Grade 10 Learners	104
8	The t Test for Independent Samples to Show the Significant Difference in the Pretest Results of Critical Thinking Dispositions (CTDs) of Grade 10 Learners Taught using Argument Mapping and Non-Argument Mapping Methods of Teaching	107
9	The t Test for Independent Samples to Show the Significant Difference in the Posttest Results of Critical Thinking Dispositions (CTDs) of Grade 10 Learners Taught using Argument Mapping and Non-Argument Mapping Methods of Teaching	110
10	t-test for Paired Samples to Show the Significant Difference in the Pretest and Posttest Results of Critical Thinking Dispositions of Grade 10 Learners Taught using Argument Mapping Methods of Teaching	114
11	The t-test for Paired Samples to Show the Significant Difference in the Pretest and Posttest Results of Critical Thinking Dispositions of Grade 10 Learners Taught using Non-Argument Mapping Methods of Teaching	117

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

12	The t-test for Independent Samples to Show the Significant Difference in the Mean Gain Scores of Critical Thinking Dispositions (CTDs) of Grade 10 Learners	120
----	---	-----

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

LIST OF APPENDICES

Appendix		Page
A	Letters	185
A1	Letter to the Superintendent of the Division of Roxas City	186
A2	Letter to the School Head	188
A3	Letter to the Assistant Principal, Senior High School Department	190
A4	Letter to the Validators of the Researcher-Made Inventory	192
A5	Letter to the Validators of the Argument Mapping– Embedded SLMs	194
B	Validation Tools	196
B1	Content Validation for Argument Mapping-Embedded Self-Learning Modules (SLMs) in Grade 10 Science	197
B2	Content Validation of Critical Thinking Disposition Inventory in Physics	200
B3	Content Validation of Guide Questions for Grade 10 Learners Taught Using Argument Mapping Method	202
C	Letter to the Participants and Parents' Consent	204
D	Research Instrument	207
E	Argument Mapping –Embedded Self-Learning Module	210
F	Weekly Home Learning Plan	222
G	Reliability Test Results	227

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

H	Statistical Data	229
I	An Excerpt from the Teacher's Journal	241
J	Rubric for Scoring the Constructed Argument Map	243
K	List of Topics/Lessons in the SLMs	246
L	Sample argument maps constructed by the learners	248

References

- Abrami, P.C., Bernard, R.M., Borokhovski, E., Waddington, D.I., Wade, C.A., & Persson, T. (2015). Strategies for teaching students to think critically: A meta-analysis. *Review of Educational Research, 85*(2), 275–314. doi: 10.3102/0034654314551063.
- Abrami, P.C., Bernard, R.M., Borokhovski, E., Wade, A., Surkes, M.A., Tamim, R., & Zhang, D. (2008). Instructional interventions affecting critical thinking skills and dispositions: A stage 1 meta-analysis. *Review of Educational Research, 78*(4), 1102-1134. doi: 10.3102/0034654308326084.
- Akkermans, F., Borst, R., van Groos, B., & Langerak, J. (2017). *Teaching critical thinking through argument mapping*. Retrieved from <https://repository.tudelft.nl/islandora/object/uuid:080ff88c-fdb4-4fe1-ae01-94bcee5e5e39/datastream/OBJ/download>
- Alvarez-Ortiz, M.C. (2007). Does philosophy improve critical thinking skills. Retrieved from <https://web.archive.org/web/20120708000509/http://images.austhink.com/pdf/Claudia-Alvarez-thesis.pdf>
- Alwahaishi, S. & Al-Mohair, H. (2020). Study on students' experiences about online teaching during COVID-19 Outbreak. Retrieved from https://www.researchgate.net/publication/342159786_Study_on_students'_experiences_about_online_teaching_during_COVID-19_Outbreak
DOI:10.47577/tssj.v8i1.701

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

164

Ameen, M. & Khan, M. (2010). Impact of counselling on self-confidence to academic achievement of underachievers. *Research Review Journals*, 4(3), 1707-1714.

Retrieved from https://www.researchgate.net/publication/334363153_Impact_of_Counselling_on_Self-Confidence_and_Academic_Achievement_of_Underachievers

Amir, L.R., Tanti, I., Maharani, D.A., Wimardhani, Y.S., Julia, V., Sulijaya, B., & Puspitawati, R. (2020). Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. *BMC Med Educ* 20, 392. Retrieved from <https://doi.org/10.1186/s12909-020-02312-0>

Anderson, J. (2016). Objectivity and subjectivity. Retrieved from https://www.researchgate.net/publication/319332579_Objectivity_and_Subjectivity/citation/download. DOI:10.1002/9781118766804.wbiect016

Aristovnik, A., Keržič, D., Ravšelj D., Tomžević, D., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. Retrieved from <https://www.preprints.org/manuscript/202008.0246/v1/download>.

Ary, D., Jacobs, L.C., Sorensen, C., & Razavieh, A. (8th Ed). (2010). Introduction to research in education. *Wadsworth Cengage Learning*. Belmont, CA

Austin, M.W. (2014, April 3). Intellectual curiosity: Fifth in a series on intellectual character traits [Blog post]. Retrieved from <https://www.psychologytoday.com/intl/blog/ethics-everyone/201404/intellectual-curiosity>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

165

Australian Curriculum, Assessment and Reporting Authority. (2014). *Critical and*

Creative Thinking. Retrieved from <https://www.australiancurriculum.edu.au/f-10-curriculum/general-capabilities/critical-and-creative-thinking/?fbclid=IwAR2dxZSn0Gc6t7dvPXrtBwCwiFo17V0zYOrKeGYz1z1VcwRKEDCkaQagPOI>

Ausubel, D.G. (1960). The use of advanced organizers in the learning and retention of meaningful verbal material. *Journal of Educational Psychology*, *51*(5), 267–272. Retrieved from <https://doi.org/10.1037/h0046669>.

Bakir, S. (2015). Critical thinking dispositions of pre-service teachers. *Educational Research and Reviews*, *10*(2), 225-233. Retrieved from https://academicjournals.org/article/article1422282819_BAKIR.pdf

Beldiman, L. & Jascanu, V. (2020). Debate software tools used as pedagogical resources. Retrieved from <https://www.researchgate.net/publication/265244252>

Bell, R. & Loon, M. (2015). The impact of critical thinking disposition on learning using business simulations. *The International Journal of Management Education*, *13*(2), 119-127. doi: 10.1016/j.ijme.2015.01.002.

Billings, D.M. & Kowalski, K. (2008). *The Journal of Continuing Education in Nursing*, *37*(6), 246-247.

Branch, W.T. & Paranjape, A. (2002). Feedback and reflection: Teaching methods for clinical settings. *Academic Medicine*, *77*(12): 1185-8. Retrieved from https://journals.lww.com/academicmedicine/fulltext/2002/12000/feedback_and_reflection__teaching_methods_for.5.aspx

- Butchart, S., Forster, D., Gold, I., Bigelow, J., Korb, K., Oppy, G, & Serrenti, A. (2009). Improving critical thinking using web based argument mapping exercises with automated feedback. *Australasian Journal of Educational Technology, 25(2)*, 268-291. doi: 268-291. 10.14742/ajet.1154.
- Cakan Akkas, B. N., Sonmez, E., & Kabatas Memis, E. (2018). Step by step argument map in learning environments: An example of the subject of lenses. *Online Science Education Journal, 3(2)*, 15-25. Retrieved from <https://dergipark.org.tr/tr/download/article-file/598555>
- Calderon, M. T. (2014). A critique of K-12 philippine education system. *International Journal of Education and Research, 2(10)*, 541-550. Retrieved from <https://www.ijern.com/journal/2014/October-2014/42.pdf>
- Clark, J. & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review 3(3)*, 149-210. DOI:10.1007/BF01320076
- Coban, G. U. (2013). The effects of inquiry supported by argument maps on science process skills and epistemological views of prospective science teachers. *Journal of Baltic Science Education, 12(3)*, 271-288. Retrieved from <http://oaji.net/articles/2015/987-1425807916.pdf>
- Collins English dictionary online.* (2020). Retrieved from <https://www.collinsdictionary.com/dictionary/english>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

167

Davies, M. (2019). New directions in the teaching of critical thinking, change. *The Magazine of Higher Learning*, 51(5), 18-27. DOI: 10.1080/00091383.2019.1652063.

Davies, M. (2010). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?. *Higher Education*, 62, 279-301. doi: 10.1007/s10734-010-9387-6.

Davies, M. & Barnett, R. (Eds). (2015). The palgrave handbook of critical thinking in higher education. *Palgrave MacMillan. St. Martin's Press, LLC*. NY, USA.

Demirhan, E. and Koklukaya, A.N. (2013). The critical thinking dispositions of prospective science teachers. *Procedia - Social and Behavioral Sciences*, 116, 1551 – 1555. doi: 10.1016/j.sbspro.2014.01.433.

Department of Education. (2013, September 24). *Implementing Rules and Regulations (IRR) of Republic Act No. 10533 Otherwise Known As The Enhanced Basic Education Act of 2013*. Retrieved from <https://www.deped.gov.ph/2013/09/24/do-43-s-2013-implementing-rules-and-regulations-irr-of-republic-act-no-10533-otherwise-known-as-the-enhanced-basic-education-act-of-2013/>

Department of Education. (2016, June 17). *DepEd Order No. 042, s. 2016. Policy guidelines on daily lesson preparation for the K to 12 basic education program*. Retrieved from <https://www.deped.gov.ph/2016/06/17/do-42-s-2016-policy-guidelines-on-daily-lesson-preparation-for-the-k-to-12-basic-education-program/>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

168

Department of Education. (2019, August 22). *DepEd Order No. 021, s. 2019: Policy guidelines on the K to 12 basic education program*. Retrieved from

https://www.deped.gov.ph/wp-content/uploads/2019/08/DO_s2019_021.pdf

DepEd Press Releases. (2019, October 8). *DepEd chief: teachers still at the forefront in 21st century learning*. Retrieved from

<https://www.deped.gov.ph/2019/10/08/deped-chief-teachers-still-at-the-forefront-in-21st-century-learning/>

DepEd Press Releases. (2018, September 3). *Education chief underscores importance of 21st century learning, expresses gratitude to partners*. Retrieved from

<https://www.deped.gov.ph/2018/09/03/education-chief-underscores-importance-of-21st-century-learning-expresses-gratitude-to-partners/>

Deslandes-Martineau, M., Charland, P., Arvisais, O., & Vinuesa, V. (2020). Education and COVID-19: challenges and opportunities. Retrieved from

<https://en.ccunesco.ca/idealab/education-and-covid-19-challenges-and-opportunities>

Dwyer, C., Michael, J., Hogan, M., Stewart, I., & Hdippsych, B. (2020). *The evaluation of argument mapping as a learning tool*. Retrieved from

<https://www.researchgate.net/publication/265244252>

Dwyer, C.P. (2019, April 5). 12 important dispositions for critical thinking. [Blog post].

Retrieved from <https://www.psychologytoday.com/us/blog/thoughts-thinking/201904/12-important-dispositions-critical-thinking>

Dwyer, C.P. (2018, November 9). Improving critical thinking through argument mapping: dual coding, gestalt grouping, and hierarchical organization. [Blog post]. Retrieved from <https://www.psychologytoday.com/us/blog/thoughts-thinking/201811/improving-critical-thinking-through-argument-mapping>

Dwyer, C., Hogan, M., & Stewart, I. (2015). The effects of argument mapping-infused critical thinking instruction on reflective judgement performance. *Thinking Skills and Creativity, 16*, 11-26. Retrieved from <https://www.sciencedirect.com/science/article/pii/S1871187114000777>

Dwyer, C.P., Hogan, M.J., & Stewart, I. (2012). An evaluation of argument mapping as a method of enhancing critical thinking performance in e-learning environments. *Metacognition and Learning, 7*(3). doi: 10.1007/s11409-012-9092-1.

Dwyer, C. P., Hogan, M. J., & Stewart I. (2011). The promotion of critical thinking skills through argument mapping. Retrieved from <https://pdfs.semanticscholar.org/a8fa/5720f7e534da9adbffdb90c47e6067e49cfe.pdf>

Dwyer, C. P., Hogan, M. J., & Stewart, I. (2010). The evaluation of argument mapping as a learning tool: Comparing the effects of map reading versus text reading on comprehension and recall of arguments. *Thinking Skills and Creativity, 5*(1), 16-22. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S1871187109000224>

Emiliannur, E., Hamidah, I., Zainul, A., & Wulan, A. (2017). Using performance assessment model in physics laboratory to increase students' critical thinking disposition. *Journal of Physics: Conference Series* 895(1), 1-6. doi: 10.1088/1742-6596/895/1/012143.

Enciso, O.L.U., Enciso, D.S.U., & Daza, M.D.V. (2017). Critical thinking and its importance in education: Some reflections. Retrieved from <https://doi.org/10.16925/ra.v19i34.2144>

Ennis, R. (1996). Critical thinking dispositions: Their nature and assessability. *Informal Logic*, 18 (2), 165-182. Retrieved from https://education.illinois.edu/docs/default-source/faculty-documents/robert-ennis/thenatureofcriticalthinking_51711_000.pdf

Facione, P.A. (2015). Critical thinking: What it is and why it counts. Retrieved from https://www.researchgate.net/publication/251303244_Critical_Thinking_What_It_Is_and_Why_It_Counts

Facione, P.A., & Gittens, C.A. (2016). *Cultivating a critical thinking mindset*. Retrieved from https://www.academia.edu/28435344/Cultivating_A_Critical_Thinking_Mindset

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

171

Facione, N.C., Facione, P., and Giancarlo, C.A. (1994). Critical thinking disposition as a measure of competent clinical judgment: The development of the California critical thinking disposition inventory. *Journal of Nursing Education, 33(8):345-350*. DOI: 10.3928/0148-4834-19941001-05.

Facione, P.A., Sánchez, (Giancarlo) C.A., Facione, N.C. & Gainen, J., (1995). The disposition toward critical thinking. *Journal of General Education, 44, (1). 1-25*. Retrieved on https://www.insightassessment.com/var/ezflow_site/storage/pdf/Disposition_to_CT_1995_JGE.pdf?fbclid=IwAR10zzDhKht5_E0IfnQExKybWFTY8jaota6jsytn5bHC8ELHAqTizeuZzOs

Facione, P.A. (1990). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. "The Delphi Report". *The California Academic Press*. Millbrae, CA. Retrieved from https://www.researchgate.net/publication/242279575_Critical_Thinking_A_Statement_of_Expert_Consensus_for_Purposes_of_Educational_Assessment_and_Instruction

Feng, R.C., Chen, M.J., Chen, M.C., & Pai, Y.C. (2010). Critical thinking competence and disposition of clinical nurses in a medical center. *Journal of Nursing Research, 18(2), 77-87*. doi: 10.1097/JNR.0b013e3181dda6f6.

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

172

- Fitriani, H., Asy'ari, M, Zubaidah, S, & Mahanal, S. (2018). Critical thinking disposition of prospective science teachers at IKIP mataram, indonesia. Retrieved from <https://iopscience.iop.org/article/10.1088/1742-6596/1108/1/012091/pdf>
- Fraenkel, J.R., Wallen, N.E., & Hyun, H.H. (2012). *How to design and evaluate research in education*. (8th ed). McGraw-Hill. The McGraw-Hill Companies, Inc., NY, USA
- Fosnot, C.W. (2005). *Constructivism: Theory, perspectives, and practice*. (2nd ed.). Teachers College Press, Colombia University, 1234 Amsterdam Avenue, NY, USA
- Garcia, D.G. (2019, December 24). Developing higher-order thinking skills among pupils. *The Philippine Star, Letters to the Editor*. Retrieved from <https://www.philstar.com/other-sections/letters-to-the-editor/2019/12/24/1979361/developing-higher-order-thinking-skills-among-pupils>
- Ghadi, I.N., Bakar, K.A., & Njie, B. (2015). Influences of critical thinking dispositions on critical thinking skills of undergraduate students at a Malaysian Public University. *Journal of Educational Research and Reviews*, 3(2), 23-31. doi: 10.13140/RG.2.1.2648.4328.
- Govier, T. (2010). *A practical study of argument*. Retrieved from <https://pdfs.semanticscholar.org/8a9b/67f4d4d1283b711fce2095b4f3afcf61daa2.pdf?fbclid=IwAR0u2qRNWHBLPguip2NgcJhPGbElkjwSAy86KO6FaxP6ad80geZuuaQvqbs>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

173

- Gurbin, T. (2015). Enlivening the machinist perspective: Humanising the information processing theory with social and cultural influences. *Procedia - Social and Behavioral Sciences, 197*, 2331-2338. doi: 10.1016/j.sbspro.2015.07.263.
- Haber, J. (2020, March 2). *It's Time to Get Serious About Teaching Critical Thinking*. [Blogpost]. Inside Higher Ed. Retrieved from https://www.insidehighered.com/views/2020/03/02/teaching-students-think-critically-opinion?fbclid=IwAR1TvRabTPxscdGIcSKz2uRZYyz7cdgW-h_o2KrFiD1SunNibB_FQxedMI
- Hakim, N.W.A, & Talib, C.A. (2018). Measuring critical thinking in science: systematic review. *Canadian Center of Science and Education - Asian Social Science, 14(11)*, 9-15. doi: 10.5539/ass.v14n11p9.
- Hatague, A. & Nabua, E. (2019). Information processing theory: Implication to mathematics education. Retrieved from https://www.researchgate.net/publication/338132660_INFORMATION-PROCESSING_THEORY_IMPLIATION_TO_MATHEMATICS_EDUCATION
- Hendrix, B. E. (1999). Critical thinking dispositions: The need for a balanced curriculum in collegiate critical thinking courses. *Critical and Creative Thinking Capstones Collection, 144*. Retrieved from http://scholarworks.umb.edu/cct_capstone/144

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

174

Hitchcock, D. (2018). Critical thinking. *Stanford Encyclopedia of Philosophy*. Stanford University, USA. The Metaphysics Research Lab, Center for the Study of Language and Information. Retrieved from <https://plato.stanford.edu/entries/critical-thinking/?fbclid=IwAR04mk7aXbmLYrvNOLwywEbUc6StE0jmbJhTdkOTy0k5ThO Ou3bIMY7c-ME>

Hung, M., Cheng, M., & Wan, Z.H. (2017). Exploring the effects of classroom learning environment on critical thinking skills and disposition: A study of Hong Kong 12th graders in Liberal Studies. *Thinking Skills and Creativity*, 24, 152-163. Retrieved from <https://www.sciencedirect.com/science/article/pii/S1871187117300639>

Huspeni, T., Warren, D., & Spaulding, C. (2018). Using argument mapping to teach critical thinking across the curriculum. Retrieved from <https://www.uwsp.edu/acadaff/2018%20Quality%20Initiative%20Report%20Appendix/Appendix%2023%20-%20Presentation%20at%20the%20HLC%20Convention,%202017.pdf>.

Indrawatiningsih, N., Purwanto, P., As'ari, A.R., & Sa'dijah, C. (2020). Argument mapping to improve student's mathematical argumentation skills. Retrieved from https://www.temjournal.com/content/93/TEMJournalAugust_1208_1212.pdf

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

175

- Jonhson, E.J. (2010). Improving positive self-confidence. *Journal of school social work, 1(1-13)*. Retrieved from https://www.researchgate.net/publication/233741934_Improving_positive_self-confidence
- Karami, M., Pakmehr, H., & Aghili, A. (2012). Another view to importance of teaching methods in curriculum: collaborative learning and students' critical thinking disposition. *Procedia - Social and Behavioral Sciences, 46, 3266 – 3270*. doi: 10.1016/j.sbspro.2012.06.048
- Kanellopoulou, C., Kermanidis, & Giannakouloupoulos, A. (2019). The dual-coding and multimedia learning theories: film subtitles as a vocabulary teaching tool. *Education Sciences 9(3):210*. DOI:10.3390/educsci9030210
- Kusumawati, D. & Rachmawati, Y. (2017). Optimizing storytelling through dual coding theory. *Advances in Social Science, Education and Humanities Research (ASSEHR), 58, 131-135*. Atlantis Press. doi: 10.2991/icece-16.2017.22.
- Laird, T.F. N. (2005). The California critical thinking disposition inventory (CCTDI). Wabash Avenue, Crawfordsville, IN 47933. *Indiana University Center for Postsecondary Research, 301 W*. Retrieved from https://www.wabash.edu/news/displaystory.cfm?news_ID=2935&fbclid=IwAR2EOWqR1ukYycPLYLINTwEuTliw3c3myglwMmFc-wxBza3Sqayrf4cxr8I

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

176

Lidaker, T. (2018). *The potential of argument mapping as a tool for teaching critical thinking in secondary school*. Retrieved from <http://liu.diva-portal.org/smash/get/diva2:1229406/FULLTEXT01.pdf>

Lucas, M.R.D. & Corpuz, B.B. (2014). 4th Ed. *Facilitating learning: A metacognitive process*. Metro Manila. Lorimar Publishing Inc.

Luele, S.A. (2018). Effects of problem-based English writing instruction on students' critical thinking dispositions and argumentative writing skills. *The Internet Journal Language, Culture and Society*, 46, 60-71. Retrieved from <http://aaref.com.au/en/publications/journal/>

Lunenborg, Fred. (2012). Teachers' use of theoretical frames for instructional planning: critical thinking, cognitive, and constructivist theories. *International Journal of Scholarly Academic Intellectual Diversity*, 14 (1), 1-9. Retrieved from <http://www.nationalforum.com/Electronic%20Journal%20Volumes/Lunenborg,%20Fred%20C.%20Teachers%20Use%20of%20Theoretical%20Frames%20for%20Instructional%20Planning%20-%20Critical%20Thinking%20IJSID%20V14%20N1%2020.pdf>

Malipot, M.H. (2019, December 24). Year-end report: DepEd in 2019: the quest for quality education continues. *Manila Bulletin*. Retrieved from <https://news.mb.com.ph/2019/12/29/year-end-report-deped-in-2019-the-quest-for-quality-education-continues/>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

177

- Mahmood, S. (2016). Effectiveness of an instructional intervention in developing critical thinking skills – role of argument mapping in facilitating learning of critical thinking skills. *8th International Conference on Computer Supported Education (CSEDU 2016), 1, 330-336*. Retrieved from https://www.academia.edu/28199370/Role_of_Argument_Mapping_in_Facilitating_Learning_of_Critical_Thinking_Skills
- Marquez, L.P. (2017). Critical thinking in philippine education: What we have and what we need. Retrieved from <http://www.jceps.com/wp-content/uploads/2017/10/15-2-10.pdf>
- Merriam-Webster Online Dictionary. (2021). Retrieved from <https://www.merriam-webster.com/>
- Mohanty, A. (2015). Information processing and creative thinking abilities of residential and non-residential school children: A pilot study. *Sage Open Publication, 1-12*. doi: 10.1177/2158244015611452.
- Naber, J. & Wyath, T.H. (2014). The effect of reflective writing interventions on the critical thinking skills and dispositions of baccalaureate nursing students. *Nurse Education Today, 34 (1), 67-72*. Retrieved from <https://www.sciencedirect.com/science/article/abs/pii/S0260691713001251>
- Ng, C.S.L. (2020). *Approaches to evaluate critical thinking dispositions*. Retrieved from <https://www.researchgate.net/publication/267429881>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

178

Nieto, A.M. & Saiz, C. (2011). Skills and dispositions of critical thinking: Are they sufficient?. *Anales de Psicología, 27, 202-209*. Retrieved from https://www.researchgate.net/publication/233793489_Skills_and_dispositions_of_critical_thinking_Are_they_sufficient/citation/download

Nurudin, M. (*n.d.*). Integrating argument-based science inquiry with argument mapping in physics learning: A literature study. *The Faculty of Mathematics and Natural Sciences*. Retrieved from http://seminar.uny.ac.id/icriems/sites/seminar.uny.ac.id/icriems/files/prosiding2017/PE09_mohnurudin.pdf

Official Gazette. (2013, September 4). *Implementing Rules and Regulations of Enhanced Basic Education Act of 2013*. Retrieved from <https://www.officialgazette.gov.ph/2013/09/04/irr-republic-act-no-10533/>

O'Hare, L. (2004). *Measuring critical thinking skills and dispositions in undergraduate students*. doi: 10.13140/RG.2.1.5113.3527.

Osborne, J., Erduran, S., & Simon, S. (2004). Enhancing the quality of argumentation in school science. *Journal of research in science teaching, 41 (10), 994-1020*. Wiley Subscription Services, Inc., A Wiley Company. doi.org/10.1002/tea.20035

Paivio, A. (2006). Dual coding theory and education. Pathways to literacy achievement for high poverty children. *The University of Michigan School of Education*. Retrieved from <https://neuropedagogie.com/images/pdf/paivio.pdf>.

Paivio, A. & Clark J. (1991). Dual coding theory and education. *Educational Psychology Review, 3(3)*, 149-210. doi: 10.1007/BF01320076.

Palavan, A. (2020). The effect of critical thinking education on the critical thinking skills and the critical thinking dispositions of preservice teachers. *Educational Research and Reviews, 15(10)*, 606-627. doi.org/10.5897/ERR2020.4035

Pappas, C. (2014). Instructional design models and theories: Information processing theory. *E-learning Industry*. Retrieved from <https://elearningindustry.com/information-processing-theory>

Perkins, D.N., Jay, E., & Tishman, S. (1993). Beyond abilities: A dispositional theory of thinking. *Merrill-Palmer Quarterly, 39(1)*, 1-21. Retrieved from <https://psycnet.apa.org/record/1993-20281-001?fbclid=IwAR1CVqo6U6nqKYAVRgiigC2TnqXKAmXHdRgzkMpjQqpECwZTVd3oVm4Z2U>

Profetto-McGrath, J. (1999). Critical thinking skills and critical thinking dispositions of baccalaureate nursing students. *National Library of Canada*. 395 Wellington Street 395, Ottawa ON K1A ON4, Canada. Retrieved from https://www.collectionscanada.gc.ca/obj/s4/f2/dsk1/tape9/PQDD_0025/NQ39582.pdf?fbclid=IwAR2xGLYQiE9p9Pj7yc6EnDr1XxeuARqIUuRgahy2xFekcgJ04bIB3TO_xik

Pu, D., Ni, J., Song, D. Zhang, W., Wang, Y., Wu, L., Wang, X., & Wang, Y. (2019).

Influence of critical thinking disposition on the learning efficiency of problem-based learning in undergraduate medical students. *BMC Medical Education, 19(1)*. Retrieved from

<https://bmcmmededuc.biomedcentral.com/articles/10.1186/s12909-018-1418-5>

Redhana, I. W., Karyasa, I. W., & Atrisa, N.P.F. (2017). Development of critical thinking disposition inventory. *Atlantis Press, 195 – 198*. 2nd International Conference on Innovative Research Across Disciplines (ICIRAD 2017).

doi.org/10.2991/icirad-17.2017.37

Ricketts, J.C. & Rudd, R. (2004). The relationship between critical thinking dispositions and critical thinking skills of selected youth leaders in the national FFA organization. *Journal of Southern Agricultural Education Research, 54 (1)*.

Retrieved from <https://www.researchgate.net/publication/266160642>

[_The_Relationship_between_Critical_Thinking_Dispositions_and_Critical_Thinking_Skills_of_Selected_Youth_Leaders_in_the_National_FFA_Organization/link/558c5fde08aee43bf6ae2e50/download](https://www.researchgate.net/publication/266160642/_The_Relationship_between_Critical_Thinking_Dispositions_and_Critical_Thinking_Skills_of_Selected_Youth_Leaders_in_the_National_FFA_Organization/link/558c5fde08aee43bf6ae2e50/download)

[5fde08aee43bf6ae2e50/download](https://www.researchgate.net/publication/266160642/_The_Relationship_between_Critical_Thinking_Dispositions_and_Critical_Thinking_Skills_of_Selected_Youth_Leaders_in_the_National_FFA_Organization/link/558c5fde08aee43bf6ae2e50/download)

Rimiene, V. (2002). Assessing and developing students' critical thinking. *Psychology Learning and Teaching, 2(1)*, 17-22 17. doi/pdf/10.2304/plat.2002.2.1.17

Rodrigues, A. & Oliveira, M. (2008). *The role of critical thinking in physics learning*.

Retrieved from <http://core.ac.uk/display/38301359>

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

181

Seel N.M. (2012) Assimilation theory of learning. DOI: https://doi.org/10.1007/978-1-4419-1428-6_358. Retrieved from https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1428-6_358#howtocite

Shattuck-St. Mary's School. (2018). Critical Thinking in the 21st Century. Retrieved from <https://www.ssm-fc.org/articles/2018/critical-thinking-in-the-21st-century>

Slate, J.R., & Charlesworth, J.R. (1988). Information processing Theory: Classroom applications. Retrieved from <https://files.eric.ed.gov/fulltext/ED293792.pdf>.

Sulaiman, T., Kuppusamy, S.K., Ayub,A.F.M. & Rahim, S.S.A. (2017). Relationship between critical thinking disposition and teaching efficacy among special education integration program teachers in Malaysia. Retrieved from <https://doi.org/10.1063/1.4972171>

Tamimi, A. R. (2017). The effect of using Ausubel's assimilation theory and the metacognitive strategy (K.W.L) in teaching probabilities and statistics unit for first grade middle school students' achievement and mathematical communication. *European Scientific Journal*, 13(1), 276-303. doi: 10.19044/esj.2017.v13n1p276.

Tavakol, M. & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*. 2, 53-55. DOI: 10.5116/ijme.4dfb.8dfd.

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

182

Taylor, L.L. (1997). The cultivation of critical thinking dispositions in grades three and four. *Critical and Creative Thinking Capstones Collection (296)*. Retrieved from http://scholarworks.umb.edu/cct_capstone/296

Temel, S. (2014). The effects of problem-based learning on pre-service teachers' critical thinking dispositions and perceptions of problem-solving ability. *South African Journal of Education, 34(1)*. Retrieved from <http://www.sajournalofeducation.co.za>. DOI: 10.15700/201412120936

The California Academic Press (2016). *California Critical Thinking Skills Test User Manual and Resource Guide*. Retrieved from https://www.elcentrocollege.edu/aboutecc/curriculum-assessment-and-accreditation-office/quality-enhancement-plan/Documents/cctst_cctst-n_cct-g835_user_manual_216.pdf

The New Webster's Dictionary of the English Language, International Edition. (2004).
Lexicon Publications, Inc. USA.

Toledo-Pereyra, L. (2009). Intellectual honesty. *Journal of investigative surgery: The official journal of the academy of surgical research, 15(113-4)*.
DOI:10.1080/08941930290085868. Retrieved from https://www.researchgate.net/publication/11241783_Intellectual_Honesty

WEST VISAYAS STATE UNIVERSITY
COLLEGE OF EDUCATION
GRADUATE SCHOOL
Iloilo City

183

Toulmin, S. (2003). *The Uses of Argument (Updated Ed.)*. Cambridge University Press, Cambridge UK. Retrieved from <https://canvas.uw.edu/courses/1055289/files/35865253/download?verifier=mTj3T65sdfngBSX5vyHfBhO4R35clLofu4bIIMvA&wrap=1>.

Twardy, C. (2004). Argument maps improve critical thinking. *Teaching Philosophy*, 27(2). doi: 10.5840/teachphil200427213.

Viyanti. (2015). The profile of argumentation skill using Toulmin Argumentation Pattern "analysis in the Archimedes principal on the students of SMA Kota Bandar Lampung. *Indonesian Journal of Science Education*, 4 (1), 86-89. DOI: 10.15294/jpii.v4i1.3506.

Worthington, P. (2016). The science of improved language comprehension: Brain connectivity and autism spectrum disorder. Retrieved from https://lindamoodbell.com/wp-content/uploads/2016/04/Whitepaper-LindamoodBell2-8-16GK_with-graphic-1-1.docx.

Yu, D., Zhang, Y., Xu, Y., Wu, J., & Wang, C. (2013). Improvement in critical thinking dispositions of undergraduate nursing students through problem-based learning: A crossover-experimental study. *Home Journal of Nursing Education*, 52 (10). Retrieved from <https://doi.org/10.3928/01484834-20130924-02>