IJED: International Journal of Educational Development
Vol. 1, No.3 July 2024
e-ISSN :3046-8159, p-ISSN :3047-1893 Page 69-86
DOI: https://doi.org/10.61132/ijed.v1i3.72

Interpretation of the Meaningfulness on Ecomathrigi Learning Model

Adun Priyanto
Universitas Islam Negeri Profesor Kiai Haji Saifuddin Zuhri Purwokerto, Indonesia
Corresponding author: adoncrush@gmail.com // https://orcid.org/0000-0003-4090-0372

Abstract: *Meaningful learning is analyzed through the interaction between learning subjects and the episteme framework of education. This research is to determine the interpretive activities of causality of the relationship between 3 (three) dimensions of the subject phenomenological analysis model (ethnographic context of learning) and determine the influence of the meaningful process of interaction between learning subjects. So that this approach model uses several observations of semiotic analysis variables, gestures, and interpersonal relationships. It also seeks to translate between interactions, semiotic resources, and meaning-making. Analysis using the theory of Meaningful Learning Ausubel model learning at Islamic Junior High School Al-Azhar 15 in Cilacap. To determine the meaningfulness of the interaction of learning the Mathematics Ecomathrigi model, data collection techniques use observation, documentation, and interviews. The results are there was a significant mutual influence between students-teachers-artifacts in the meaningfulness of mathematics learning; The significant influence is also due to the use of the Ecomathrigi model learning approach in building learning interaction; The consequences of the significant influence of cognitive structure on new students on alumni perspectives on mathematics learning, teachers and schools.*

Keywords: *Intepretation, Meaningfulness Learning, Ecomathrigi, Learning Model*

INTRODUCTION

Meaningful learning of mathematics (Darling-Hammond et al., 2015; Mendoza, 2020) becomes a problem when mathematics is specified in the competence of the domains of cognition, genetics, and cultural perspective social-economics the loss of dialectical-semiotic conditions of students is cultured very long so that mathematics learning looks more difficult, abstract, postulated-mathematical and considered uninteresting for students, then the concept of learning that does not touch realistic dynamics, and teachers are accustomed to using informative-doctrinal methods as well as the teacher's sense of crisis ability and classroom mastery (Priyanto, 2020) Experts say (Azra, 2014; Nanik Masruroh dan Umiarso, 2011; Umiarso dan Asnawan, 2017) teachers still experience classroom psycho-social problems such as interaction-communicative skills, understanding students' social problems, and the ability to adapt to the class through the suitability of the methods and strategies used, and teachers' lack of preparation of learning materials; Diversity of habits and character of students; Teachers have difficulty finding students' talents and interests; and Teachers lack concentration in teaching (Widodo, 2019). It has become a culture of stigmatization that mathematics learning is rigid and difficult, as well as a frightening stigma directed at teachers personally. This culture of stigma becomes folklore told by alumni as their experiences to new students, but in fact, it is as the excesses of the alumni's failure to understand mathematical concepts (Thompson & Carlson, 2017). This failure is caused by not reaching a semiotic-convergence meeting point between teachers and students in learning (Bormann, 1985) the factors: the teacher's

Received: May 30, 2024; Accepted: June 29, 2024; Published: July 31, 2024;
* Adun Priyanto, adoncrush@gmail.com

explanation is not easy to understand, the teacher lacks the patience to manage his emotional side, and the culture shock of students learning patterns from the previous level.

According to Ausubel, the meaningfulness of learning is measured through the initial assumptions of learning (D. Ausubel et al., 1978). Meaningfulness of learning means initial understanding refined through advanced understanding, reinforced by the relationship of subject dimensions—teacher, student, and media (artifacts)—at the core of learning into a comprehensive inductive learning experience that needs to be revealed patterns of meaning, as learning events as phenomenology (Edgar & Sedgwick, 1999; Karen & Littlejohn, 2010) according to theoretical assumptions and subjective perspectives that can be measured. Elaborative through the events of teacher-artifact-student interaction within the scope of simultaneous learning space and time as well as the context environment pedagogical, theoretical, and methodological implications. Researchers need to clarify through the concept map of interaction to understand each relationship of meaning between meaningful learning variables, and theoretical-integrative correlation as an analysis knife of all internal and external components of David Ausubel's theory-based learners (D. P. Ausubel, 1963, 1978, 2010; D. P. Ausubel & Fitzgerald, 1962).

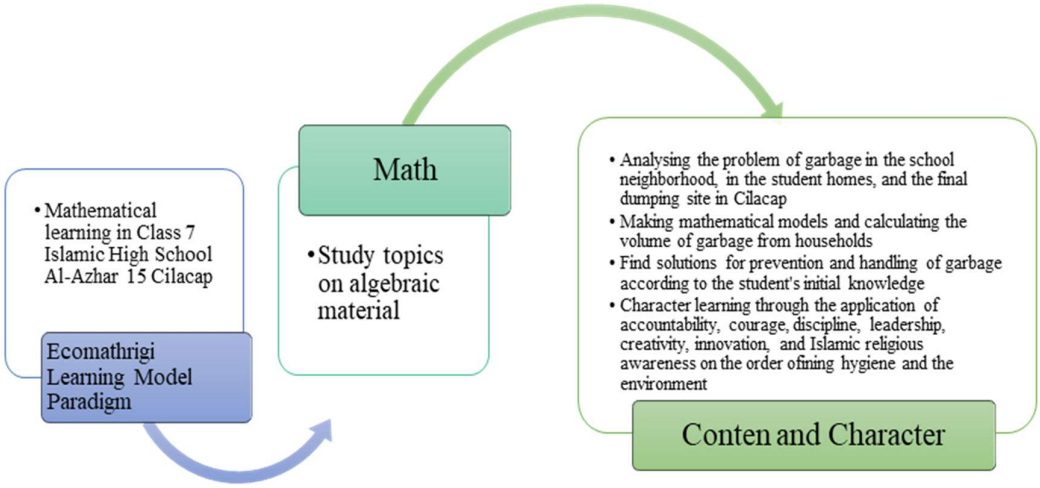
Based on mathematics learning problems, the urgency of learning about the process of meaningful interaction between learning objects is to reduce the stigma of mathematics learning. Evoke sense-making of different situations in each lesson by "calling" back the memory of students' initial knowledge through interaction-communicative actions of teachers and students to achieve the didactic goal of uncovering students' initial knowledge. Learning mathematics means essentially basing the management of learning on the phenomenon, then analyzing the interpretation of semiotic aspects (Fontdevila, 2010; Mehawesh, 2014; Midtgarden, 2010; Semetsky, 2010; Stables et al., 2018) gestures,(Pozzer-ardenghi & Roth, 2005; Roth & Roth, 2001), and interpersonal relationships of the class. According to phenomenological theory, the treatment of mathematical learning objects provides learning meaning through progressive ideas that students have as initial knowledge at each step in the learning process (D. Ausubel et al., 1978; D. P. Ausubel, 2012). For example, analyzing the volume of waste and the threat of waste to the sustainability of life, applying algebra material, and converting mathematical abstractions into real and more meaningful learning. Phenomenological point of view on meaningful-learning mathematics regarding the dimensional relationship of learning objects (teacher-artifact-student), so not only the verbalist realm (questions, explanations, and opinions) but also semiotic complexity (ways of

interacting, gestures, and interpersonal relationships) so that analysis can be carried out on verbal-nonverbal, visual representation, mathematical, and artifacts.

The dynamism of meaningful learning is very interesting when it involves the physical environment and educational content, teacher and student backgrounds, and communication models and media. Encouraging learning interaction also strengthens the process of interpersonal interaction, stimulating the involvement of all learning objects in one scope of learning process interaction. It is also possible to have overall multi-modular interactions on internal factors (students' personality, background, and initial knowledge) or external factors (environment, media, and communication models within the scope of learning). Technology is used to support the interaction process and encourage the involvement of digital artifacts (Faggiano et al., 2018) to improve students' skills in interactive communication—meaning-making contexts, helping to understand mathematics through interesting topics that are discussed and relevant to students' daily experiences.

Ecomathrigi Model Learning

Ecomathrigi in this research is a paradigm of an integrative-realistic learning model based on students' initial knowledge that is elaborative and holistic towards understanding mathematical concepts (Priyanto, 2022), as well as a medium for building efficient learning semiotic communication. Ecomathrigi was developed as a medium for learning mathematics based on a realistic environment and also builds students' religious character. This means that Ecomathrigi has the role of connecting the cognitive side and affective-spiritualism, the motor side based on understanding the socio-cultural environment of students (the experiences they experience). The spiritual side of Ecomathrigi about the teaching of wisdom to awaken the religious basic elements of students in the bond of transcendent knowledge in which there are elements of "origin" and "return", namely the awareness of the origin of identity as a human being and its relationship with nature. Ecomathrigi also means precision (mathematical) in analyzing problems, through kinetic and motor efforts to solve problems to achieve their life goals while remaining grounded in spiritual awareness. Ecomathrigi offers an analytic-realistic model of mathematical learning, involving all multi-dimensional students as a whole in cognitive building processes (Edwards, 2005; Priyanto, 2022), This study uses an experimental class (grade 7) of Islamic Junior High School Al-Azhar 16 Cilacap on algebra material in Semester 1 of 2022/2023.



Picture 1. Ecomathrigi Learning Paradigm

The author provides views on a *multi-dimensional* learning approach using the entire process of sensory and functional-transcendence analysis to understand the concept of beings in the world in a timeline and build meaningful cognitive values, restore the function of science-humanistic and science that preserves living things. *Multi-dimensionality* connects every sense—*touch, sight, hearing, sense of taste, feeling (emotional attachment)*—as well as the nature of meaning, culture, language, background, and environment as capital to analytical-problem-process in building critical cognitive trained in learning activities. Social contact *of multi-dimensional* learning in students is interpreted from interaction-communicative, gesture, semiotic*, verbal, eye-contac*t, and symbol artifacts—*written, verbal, and drawing*. As a medium to communicate concepts, ideas, ideas and theories between students and teachers, through *learning settings* and learning themes (Fowler & Boylan, 2010; Taguchi, 2010). This explains the dynamic relationship of excellence, when the teacher as a class manager can orchestrate the beautiful classroom with the entire network of action-reaction and contact connectedness that is built, into meaningful interactions of mathematics learning. According to McNeill (2000; 1993): (a) *deictic* refers to the concrete or abstract; (b) *iconic or* representational*, the movement of the arm strongly represents the perceptual* concrete object; (c) metaphor*, pointing to an abstract object; and* (d) tapping *or stomping movements.*

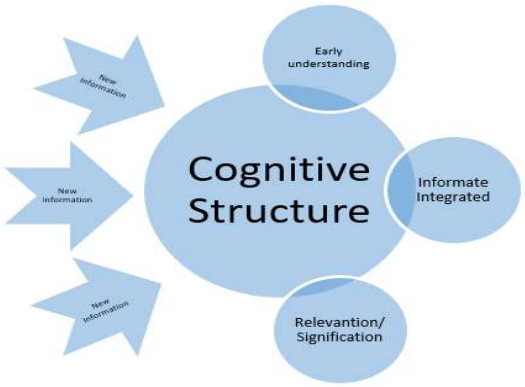
Body movement essentially supports verbal dimensions (a) *interactive* when gestures are used to coordinate the twists and turns of speech, setting the rhythm of speech, seeking, asking for responses, or acknowledging understanding; (b) *narrative* metaphorically describing an object produced by hand movements or overall body movements; (c) *grounding*, linking verbal and narrative dimensions to objects, such as the gesture of pointing at something with an explanation. In addition to movement, there is an important element in the semiotic dimension, which is the dimension of *interpersonal-relationship* through sensory contact. For

example, *gaze* (Radford, 2010) in the context of face-to-face interaction has the meaning: (a) the function of sensing is to obtain information from the environment; (b) Signaling function, namely the occurrence of experimentation of interaction to continue.

Artifacts (Peppler et al., 2023) play a role in encouraging the synergy of symbiotic complementation of learning and its contribution to the dimension of learning subjects through a variety *of setting-learning* in the process of forming advanced knowledge as individual learners. But it may also become contradictory when yield power is ineffective, for example, the use of the same artifact in different situations or vice versa. Artifacts in mathematical learning provide interactive semiotic symbolization of socio-constructivist approaches to interpret teacher and student social interactions. While mathematics itself provides a realistic perspective, coordinating every understanding of the material simultaneously through the discovery of ideas and adaptation according to learning objectives. Then learning interactions play a role in building the knowledge process and providing a variety of meanings of mathematical abstractions to be realistic. The semiotician nodes become the relevance of the media to photograph classroom activities as a whole in learning activities. This occurs implicitly or explicitly as the relationship between semiotic variables and the process of making mathematics learning meaningful.

Meaningful learning theory

According David Ausubel*, "People acquire knowledge primarily by direct exposure rather than by discovery".*(D. P. Ausubel, 2012) This means *that making meaningful learning* is a learning strategy of a social-psychological approach that relies on important values in managing *expository learning*. The initial understanding of students is revealed if there is interaction with their knowledge in perceiving objects sensibly and especially, interpreting them functionally according to the context and situation that occurs.(Eichler et al., 2015) This means that there are simultaneous processes that students go through in interpreting the causality of actions-reactions to the *contextual making-meaning* of an event in mathematics learning, for example with pre-tests or opening questions for learning activities. This can be done dynamically, simultaneously, or continuously, the dependence of cultural values and internal habitus of students, student experience, student association, and cognition-genetics into a *semiotic setting and* pattern of combination of interaction with habitus and rules of the social environment in the school.



Picture 2. Ausubel's Early Understanding Concept

Some of the main elements of Ausubel's theory of early understanding: a) gaining meaningful understanding through the interaction of new information with the knowledge the individual already possesses so that the learner relates the concepts to everyday life and makes practical use of them; b) The structure of knowledge, ideas, and experiences that a person has is very influential in learning, regarding the understanding of new concepts that must be integrated into existing cognitive structures. If new information can be connected to existing concepts, then learning will be more meaningful and understanding will be better; c) teach each concept in a hierarchical manner of deduction; d) The teacher's role is to facilitate and manage learning and presentation of material relevant to students' initial knowledge; e) Motivate and encourage interaction-communicative learning through questioning, discussing, and conveying ideas and ideas learned from other sources.

An effective cognitive learning model does not eliminate its old concepts of knowledge but ties together new concepts to reinforce one's knowledge structure. According to Ausebel, the meaningfulness of learning depends on behavioral, social, and socio-humanistic conceptions as a space for the interpretation of every incoming information. (D. Ausubel et al., 1978; D. P. Ausubel, 1963, 2012) For example, for children aged 0-7 years information obtained from the closest person regarding the name of objects, language, semiotics, how to do something, and even understanding environmental conditions greatly affects memory and mechanical patterns of behavior. At this age, children usually have prepared the realm of symbolic interpretation to respond to every piece of information heard, seen, experienced, touched, and felt according to the period of emotional growth and development (sulking, crying, laughing, and choosing something). Later it becomes a behaviorist, if not confirmed positively-normatively about what is good and what is not done, and may also become an automatic response *(spontaneity) as an emotional solution that imprints on the subconscious memory and touches its emotional side.*

Symbolic interpretations fill cognitive spaces and are then stored as initial information (concepts) that are used as references in acting, thinking, and responding to the environment or verbalist contact (exposure to the knowledge of others) either intentionally (taught) or observing and imitating. New information that is known is not immediately received, but first goes through the process of assimilating information to be elaborated and confirmed. So, when a student asks the teacher, he or she is experiencing an upheaval of thinking over new information with previously received information that could have corroborated or replaced it. Then the cognitive system explores the information through additional information in written media, asking experts, or through other media such as the internet for example to find answers to big questions that arise from the students' elaborative process and then connect the two pieces of information.

If it leads to social spaces students will look for examples in their cultural environment of informed events or behaviors, the results can be accepted as truth, motivation, or warning signs or rejected as lies, threats, or psychological distress. So once again the exposure of people around students determines the validation of the process of new information received, usually related to exposure to alumni information. Socio-humanistic attitude is a transcendent value of understanding positive information and is realized through the assimilation of knowledge in situations natural responses to the emotional side of events around him whether verbalist, gesture, or semiotic. (Seeger, 2011) So the essence of student habits is born from the complementation of various auto-response attitudes to environmental conditions that affect assimilative or *selectively elaboratively*, then decisions are made rationally by considering the benefits obtained and the risks of these decisions (political-pedagogical individuals).

Periodically political-pedagogical knowledge is taught to others as a life experience, this process is said to be the didactic process of alumni exposure. This can affect the way new students learn in habituation learning at the school where they learn. Exposure to alumni information determines the meaning of freedom for new students in interacting and relating to teachers in learning based on their knowledge and knowledge of the teaching styles and methods of teachers from alumni. (Snyder et al., 2023) This freedom is related to the expressive, knowledge, democratic, and positive development of self-potential. If there is a relationship that runs well and smoothly, students respect the rules, are easily disciplined, and imitate the positive character of teachers and other students, but if they fail to achieve interactive relationships and tend to curb freedom, there is dis-harmony in learning and the impact of cognitive achievement is not achieved and negative student behavior is born. For this reason, researchers measure the interpretation of the meaningfulness of mathematics

learning(Parikh, 2000; Willems, 2011) on the dimensions of teacher and student relationships and all media-product interactions (artifacts) produced in learning with David Ausubel's theoretical analysis. That is, mathematics learning research with a phenomenological analysis of meaningful learning on the interaction of students, teachers, and learning artifacts in the semiotic realm with the Ecomathrigi learning model.

METHOD

This phenomenological research was carried out at SMP Islam Al-Azhar 15 Cilacap. The interest of researchers is based on the learning culture system, individual religious-based religious cultural patterns, and the development of eco-social-based student characters, thus affecting teacher-student-learning interaction learning artifacts. Researchers used a sample of respondents 1 Mathematics teacher and grade 7 students in 4 classes totaling 128 children located in urban areas at the beginning of the 2022/2023 academic year. The analytical tool uses Ausubel's theory of *multi-dimensional* theoretical perspective to explain didactic situations in the interweaving of densities between subject variables, and to analyze as a whole: a*) the oral speech* of teachers and students in the learning process; b) body *gestures* include deictic, iconic, metaphoric, *and beat dimensions*; (McNeill, 2000; McNeill & Levy, 1993) and c) *inscriptions/artifacts* Learning products: sketches, writings/notes, work/works, all changes in the atmosphere and appearance of the class due to the learning process, all planned or incidental learning events, or dramatized events. Then the researcher symbolizes the elements of interaction are: reaction; proactive; response; Intrapersonal movements; Gaze; oral interactions (questions and revisions of speech); Student-teacher interaction with artifacts.

RESULTS

Please use 10-point font size. Please margin the text to the justified. Manuscripts should be 1.5 times spaced. A paragraph should have at least 3 sentences. Footnotes and endnotes are not accepted. All relevant information should be included in main text. Do not indent paragraphs; leave a 1.5 times space of one line between consecutive paragraphs. Do not underline words for emphasis. Use italics instead. Both numbered lists and bulleted lists can be used if necessary. Before submitting your manuscript, please ensure that every in-text citation has a corresponding reference in the reference list. Conversely, ensure that every entry in the reference list has a corresponding in-text citation.

Data Collection and Analysis

The data collected is specific to the interpersonal meaningfulness of teachers, students, and artifacts, meaning that it is related to the overall mathematics learning activities in grade 7

algebra material at SMP Islam Al-Azhar 15 Cilacap with video and audio recording tools, observation and recording of every event, and interviews. All data is analyzed quantitatively, to obtain meaning, so the whole analysis can describe the situation of connection between semiotic components in mathematics learning. Then synchronization is carried out on the analysis of the object symbiose, to give meaning to each final result of the analysis. The layer of meaningfulness is a result of decomposing analytical data into data interpretation using the theory of interaction causality and elaboration theory. A product readability analysis of interactions on *non-verbal interactive contacts* such as gaze, direction tendencies, and intensity of interaction through nominal record transcripts written in the form of tables of direct or indirect class observation notes (through recordings). So, the focus of specific analysis on the *semiotic product of* students and teachers then from the table is outlined in the flowchart of student-teacher-product interaction as a real picture of dialectical events between teacher and student and response to media, artifacts, and situations.

Interaction data are presented in row and column tables in a general and processive manner, researchers analyze powerful and complex data to describe in detail the overall variables of analysts, such as specific aspects of teacher and student semiotics and their interaction with the media as artifacts. (Kuzu, 2016) The meaning of each event in the field (A) will be correlated with the sponge of the learning subject (B) as a relationship, thus allowing the readability of the meaning properly and correctly.

Table 1. Defining the Relationship Between Elements of Meaning

Variable	Possible relationships	Defining
Interaction	Attribute	A with more than one attribute B
Pronunciation	Contingency	A with the word corresponding to B
Gestures	Function	A as a tool that affects B
Artifact	Operational	A by considering action B as the recipient's target
Meaning	Comparison	A as similar or even different events B
	Analogical	A by quoting event B
	Synonymous	A as B equivalent
	Antonym	A as negation B
	Source	A by looking at the origin of B
	Levels	A to place it in a circuit that also includes B
	Circular	A as B

The following is the form of interaction in the observation table simultaneously in learning (average face-to-face hours 40 minutes) x 2 Lesson Hours = 80 Minutes. Researchers calculated the average of each interaction that occurred directly in mathematics learning in 3 different classes with the same teacher (scale in percentage: 1-100). Describe the relationships that occur in each variable, and carefully analyze each event in learning:

1. Describe complex interactions between learners or teachers and students, represented in diagrams on interaction variables, causality, and exploration in mathematics learning;

2. The interaction between subject dimensions (teacher-student) and artifacts characterizes an exploration of mathematical concepts through class discussion or other communicative forms over time;
3. The role of *multi-dimensional* interaction in the context of contributions in the learning process in uncovering new layers of meaning.

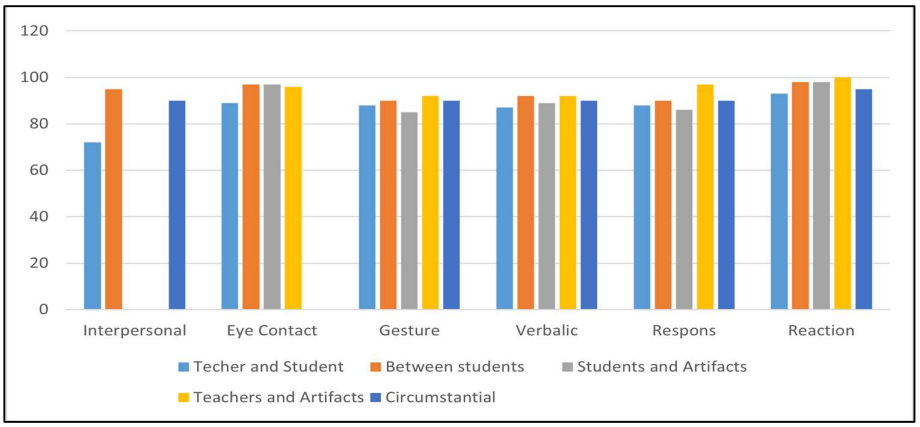


Figure 1. Sensory Observation data

Object variable interactions are measured based on simultaneous or frequentative student-teacher involvement, meaning that observations focus on student-teacher-artifact interpersonal relationships from a multidimensional side. Expressed in numbers then poured into graphs. Second, read the correlation of learning media and learning products or artifacts with student-teacher interaction expressions, which are also measured in symbolic relationship graphs. Third, the relationship of learning subjects with the Ecomathrigi model is measured in the causality of interaction with media and learning situations. To catalyze the final data of the whole research (context: learning interactions or events) that are considered to greatly influence the processes of meaning in learning phenomena.

DISCUSSION

Section 1: Meaningful Learning

Table 2. Step Learning Ecomathrigi Model

Step Learning	Event Description
First	Before learning, students pray and are given some studies related to the learning steps of grade 7 algebra material and then enter the explanation of learning objectives and pre-learning activities.
Second	Observing video shows and some pictures of humans producing garbage and how the journey of waste from homes to landfills (TPA) in Cilacap.
Third	Students record the series and then record the types of hazardous waste and potentially recycled waste.
Fourth	Students model in mathematical sentences using an algebraic concept of the volume of waste in a landfill if each household contributes a certain amount of waste each day
Fifth	Students create problem-solving concepts from mathematical models that have been created by other students/other groups that allow different variations of problems from each group. Then model other problems related to waste handling costs, and also the cost of making trash can handcraft utilizing recycled waste such as old tires, wooden boards, and woven plastic bags.
Sixth	Students elaborate on the types of waste, explaining its dangers, as well as negative impacts on the environment and health. Analyzing the aspects of processing and utilization (recycling) into useful goods also shows a process of gratitude for life by fostering a sense of responsibility for the environment and human functions as *khalifatu fii al-ard*.
Seventh	Students discuss data by first amplifying data from internet media, asking fellow students and teachers about learning topic problems. Students analyze each note made and make a solution to the problem, then democratically presented

	the recorded data. Students in the other group confirmed and questioned every data record found and also the results of calculations according to theoretical algebra on modeling into mathematical sentences. At the end of the discussion session, the results of the student discussion were delivered, and the teacher provided important points, making corrections to misconceptions and calculation results.

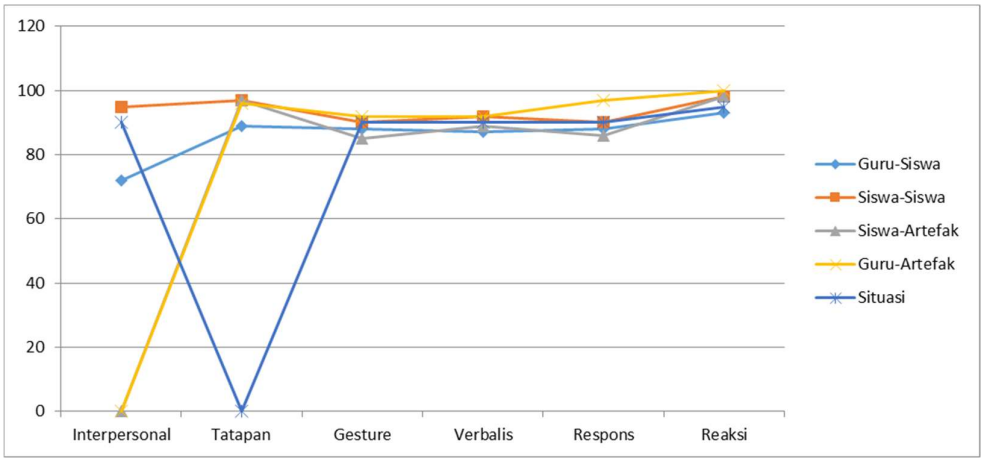
Learning as a complex activity generally presents abstract concepts, then brought by the teacher into a real event experienced by students every day, which is an effective step to help orient students in developing their learning potential. Students actively think cognitively and assimilative manage old and new knowledge, teachers use learning scenarios with the Ecomathrigi model motivating students to be actively involved in *meaning-verbalistic* as expository learning practices. First*,* the teacher creates a classroom atmosphere that encourages students to take the initiative to explore events, assume and verify, communicate through discussion to discover the experience of beauty of knowledge and love the values of knowledge, and increase self-discipline. *Second*, teachers create content of actual events experienced by students into a concern of mathematical events, presented in audio-visual, image, and *animated courseware*, or present direct and touchable objects. To arouse interest in learning, stimulate students' curiosity, and problem-solving.

Third, content-based learning implications: (a) timely learning; (b) Helping students understand abstract concepts quickly through the presence of objects according to abstractor images so that they are easier to analogize in realistic concepts; (c) Readiness to receive new information depends on students' critical-verbalist abilities and defines themselves; (d) The teacher's pedagogical technical ability depends on defining concepts practically, precisely, clearly, accurately, inductively, and relevantly to provide different perspectives on the understanding of single/rigid concepts in student memory; (e) Special training in simulating analytical thinking-synthesizing abstract concepts encourages students to think operatively at a higher level of abstraction. For students to be able to retain new information obtained longer in their cognitive memory and usher in the basic structure of building new concepts (advance organizer); (f) Use sufficient quantity and quality teaching language (describing the concepts discussed, and by the nature of the lesson); (g) Students with mathematical-verbalist abilities are given *expository-verbal* method *treatment*, to improve critical, reasoning, imaginary, problem-solving and conjecture skills; (h) Students' verbalist abilities and movements reflect their behavior, for example, that students actively ask material, students try to solve each problem, students succeed in concluding the learning process and finding solutions to problems (problems or events).

Section 2: Recording Interaction Flows

The researcher observes and records in such a way that each interaction flows according to the category set according to the theoretical concept of semiotic expression flow in this study

(teacher and student behavior in the context of reaction, response, interpersonal communication, gaze, verbalist, and gesture). To obtain data that has data density and frequency data solicitation of contacts and interactions that occur according to teacher-student-artifact-situation variables to photograph ongoing semiotic relationships. The flow of communication allows to be an independent variety that can affect directly and indirectly the quantity and quality of interactions that occur because in every learning there must be direct and indirect contact events, verbal-gesture communication interactions, or action-reaction contacts that occur both in the delivery of initial rules to the implementation of discussions *(Table 3.)* researchers provide Note the issue that occurs. For example, errors in the use and understanding of language, gestures, and vagueness of information are major emphasis factors because they have the potential to affect calculations into tables made. All calculation results are depicted in a variable relationship graph (*Picture. 2.*), finding the meaning of the maximum/minimum point of the graph also determines the intersection/intersection of each variable and is then interpreted narratively according to the theoretical analytical knife of this study.



Picture. 1. Interactive expression flow on average learning activities

1. Interaction between teachers and students in each variable always increases, this proves that the teacher-student relationship reaches high meaningfulness of 85% of all interactions (reactive, response, interpersonal, gaze, verbalist, and gesture). That is, every feed in mathematics learning given by the teacher can be well received. However, it is very dependent on differences in class entities, because it affects the way of communication, understanding, and interpretation of teachers in the initial understanding of the previous school level. For example, the learning model does not fully work if applied to classes with ordinary cognitive structures, thus affecting the teacher's intensive way of communicating which is not yet acceptable.

2. Teacher-Artifact interaction is the highest because the teacher makes artifacts as the main learning medium (slides/video-audio).
3. Teacher-student interpersonal interaction shows that teachers build good learning situations, through the creation of pre-learning conditions, suitability of media, materials, methods, and learning models. However, it is not enough to pay attention to the concentration power of students so that learning seems rigid, but when doing elaborative discussions students tend to be fluid and enjoy the process.
4. The response becomes a high teacher-student meaningful interaction, a response to the difficulty of students understanding mathematical steps or concepts and the teacher repeats explanations using analogies of data and student daily events that lead to new knowledge that students have not obtained through realistic solutions to problems. When students are interested in paying attention to the teacher's explanation, there are communication-verbalist-question-answer gestures (iconic movements accompanied by repeated narratives). Auditorily students will continue to listen so that it is embedded in memory, and strengthened by the act of finding and feeling/seeing directly / touching objects through students' daily experiences in learning elaboration.
5. There is an increase in contact intensity ± ≥ 90% indicates meaningful interaction in learning because every movement/response/reaction of students and teachers has the potential to be a semiotic reaction *(Picture. 2.)* As reinforcement, the intensity of contact shows meaningfulness that leads to new knowledge of the theory and also occurs because the teacher is cooperative.
6. Artifacts bridge the meeting point of the student's initial knowledge and the teacher's confirmatory knowledge when students can uncover and be able to explain other problems that may occur in the topic of the lesson using their initial knowledge analytically-logically based on theory. Able to bring up argumentative statements of the problem as a form of interaction-reactive measurable and logical data.
7. Students demonstrate problem-solving from the teacher through cognitive-interaction problem associations with teachers and other students (theoretical, field findings, and discussion results) and visualized as a presentation of problem-solving findings. The teacher triggers every interaction that occurs while providing interaction initiation through simulating gesture-verbalist communicative situations to catalyze each interaction that occurs, as a new experience, and simulate the side of storing in his subconscious.
8. The teacher-artifact-student symbiotic interaction occurs differently because it is influenced by the learning environment situation, eventually giving rise to different layers

of meaning. The results of this study strongly influenced the multidimensional interaction of contexts: (1) oral communication, gestures, gazes, and artifact interactions; (2) integration to describe semiotic components in detail of properties and functions; (3) The disclosure of layers of meaning is carried out because of the interaction between subjects with semiotics-multidimensionality, and is analytical to answer research questions.

Section 3: Learning Media and Resulting learning products.

1. Learning media and learning products as artifacts help researchers reveal every event that occurs in the context of multidimensional interactions. The background of the interaction-dimensioned learning media reveals each implied purpose, use, and selection of media by the teacher's learning strategy. Media provide layers of meaning but are influenced by differences in multidimensional interactions, producing confirmed meaningfulness of the truth of the meaning of learning, as information on teacher learning success and to interpret each learning event coherently.
2. The meaningfulness of learning interactions in a semiotic, *multi-dimensional* manner follows the process of making meaning in the interaction itself. Both iconic and metaphorical movements are juxtaposed narratively to support the function of movement description, gazes of great relevance, interacting signals, and synergistic use of artifacts as media contributors for meaning expression.

Section 4: Effects of Alumni Exposure

1. New students at the junior high school level with knowledge about previous learning in elementary school, try to find information about the character of teachers in the new school. This certainly affects the learning process of students, especially if the teacher is indicated to have a bad communication relationship with previous students and alumni.
2. In the process of education at a school, some students usually show this behavior known as negative verbal persuasion even though they have been attending the school for a long time. This is due to: incompatibility in getting the school as desired, dissatisfaction with educational services at school, the social conditions of students at school, and the negative mind of the students themselves.

CONCLUSION

This research provides a new perspective on the importance of meaning in interaction before, during, and after meaningful mathematics learning. Teachers in learning act habituation so it is important to bring up new perspectives on the meaning of learning with a multi-dimensional semiotic approach. Every event in learning has the potential to cause serious excesses if teachers do not handle it properly through direct evaluation of methods and

strategies when conducting learning in class. This is done to avoid the failure of the cognitive-assimilative process of students who are influenced by the management of learning, artifacts, classroom environmental conditions, and cultural backgrounds of students, as well as student associations that allow negative exposure to alumni. This phenomenon researchers call the failure of communication in learning or apotynchano (ancient Greek) which means failure; to no avail; or failure to achieve goals. As an expression to describe the teacher-student inability to carry out interaction-communicative learning, this refers to the teacher's efforts to deliver learning material to students, and after didactic evaluation, the results are not per the set learning objectives. This research may still be refined from several other perspectives to produce further comprehensive research. In general, the results of this study prove a multidimensional semiotic interaction analysis model, but the measurement tool for finding meaningful interaction relationships needs to be tested for stability to obtain better meaningfulness.

Recommendations

The study reveals that the Ecomathrigi learning model significantly influences students' meaningful interaction and understanding of mathematics. This highlights the need to further develop and expand this model in education, provide teachers with proper training, and assess student achievements for ongoing improvement.

Acknowledgements or Notes

The author expresses profound gratitude to all parties who have participated in this research, including the students, mathematics teachers, school administrators, and all those who granted permission and supported the research process.

REFERENCES

Achyani, M. N., & Kusumawati, E. (2023). Pengaruh profitability, leverage, liquidity, dan good corporate governance terhadap financial distress. Jurnal Maneksi, 12(4), 899–908.

Adzroo, N. U., & Suryaningrum, D. H. (2023). Pengaruh leverage, likuiditas, profitabilitas, sales growth, good corporate governance, dan corporate social responsibility terhadap financial distress pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia periode 2015-2019. Jurnal Ilmiah Wahana Akuntansi, 18, 128–150.

Alexandra, C., Jennefer, S., Meiden, C., Bisnis, I., Kwik, I., & Gie, K. (2022). Studi literatur: Pengaruh faktor good corporate governance terhadap financial distress. Owner: Riset & Jurnal Akuntansi, 6(1), 111–122. https://doi.org/10.33395/owner.v6i1.536

Anistasya, V., & Setyawan, I. R. (2022). Pengaruh profitabilitas, likuiditas dan leverage terhadap financial distress. Jurnal Manajerial Dan Akuntansi, 4(3), 786–795.

Ayem, S., Cahyaning, E. K., Sari, P. R., & Hayoina, A. (2023). Faktor-faktor yang mempengaruhi terjadinya financial distress: Sebuah review. Reslaj: Religion Education Social Laa Roiba Journal, 5, 2957–2976. https://doi.org/10.47476/reslaj.v6i1.2971

Cahyani, A. D., Putri, S. M., Naka, O. A., Nupita, T., Surabaya, U. N., Bengkulu, U. M., Masalah, L. B., & Indonesia, D. (2024). Literature review: Implementasi etika bisnis dengan good corporate governance (GCG) terhadap kinerja. Journal of Management and Innovation Entrepreneurship (JMIE), 1(2), 76–88.

Damayanty, P., & Masrin, R. (2022). Pengaruh struktur kepemilikan manajerial, leverage, financial distress dan risiko litigasi terhadap konservatisme akuntansi. Jurnal Manajemen Dan Bisnis, 2(2), 111–127. https://doi.org/10.32509/jmb.v2i2.2347

Dita Maretha, L. A. (2021). Pengaruh likuiditas, profitabilitas, financial leverage, dan arus kas operasi dalam memprediksi kondisi financial distress. Jurnal Akuntansi Dan Manajemen, 16(2), 68–86. https://akuntansi.pnp.ac.id/jam

Erayanti, R. (2019). Pengaruh likuiditas, profitabilitas dan leverage terhadap prediksi financial distress. Jurnal Riset Akuntansi & Perpajakan (JRAP), 6(1), 38–51. https://doi.org/10.35838/jrap.v6i01.393

Fania, E., & NR, E. (2023). Pengaruh good corporate governance dan kinerja keuangan terhadap financial distress: Studi empiris pada perusahaan subsektor jasa konsumen yang terdaftar di Bursa Efek Indonesia tahun 2017-2021. Jurnal Eksplorasi Akuntansi, 5(3), 886–900. https://doi.org/10.24036/jea.v5i3.732

Felsiana, B., Sri, A., & Lestari YP, S. (2022). Pengaruh likuiditas, profitabilitas dan ukuran perusahaan terhadap risiko financial distress pada perusahaan manufaktur. Jurnal Ilmiah Akuntansi, 13(Agustus), 1–19.

Fikri, Divri, Hesty, I. (2022). Pengaruh kepemilikan manajerial, leverage, finansial distress, dan ukuran perusahaan. Digital Bisnis: Jurnal Publikasi Ilmu Manajemen Dan E-Commerce, 1(3), 87–107.

Fitri, A., Rimbano, D., Zafina, A., Fransiska, F., Kholifah, S. Y., Fitri, A., Rimbano, D., Zafina, A., Fransiska, F., Manajemen, P. S., Insan, U. B., & Laba, M. (2022). Pengaruh good corporate governance terhadap manajemen laba dengan financial distress sebagai intervening. Escaf 1st Journal, 208–217.

Fitri, R. A., & Syamwil, S. (2020). Pengaruh likuiditas, aktivitas, profitabilitas dan leverage terhadap financial distress (studi kasus pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia periode 2014-2018). Jurnal Ecogen, 3(1), 134. https://doi.org/10.24036/jmpe.v3i1.8532

Handayani, H., Maulani Iskandar, I., & Pratiwi, M. W. (2019). Pengaruh kinerja keuangan dan kepemilikan manajerial terhadap financial distress. Media Riset Akuntansi, 9(2), 201–220.

Inten, D. (2019). Pengaruh likuiditas, leverage, dan kepemilikan institusional terhadap financial distress pada perusahaan property dan real estate. E-Jurnal Manajemen, 8(5), 3110–3137.

Irving, S., Purba, M., & Muslih, M. (2019). Pengaruh kepemilikan institusional, intellectual capital, dan leverage terhadap financial distress (studi kasus pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia tahun 2014-2017). Journal Accounting and Finance Telkom, 2(2), 27–40.

Khairiyah, & Affan. (2023). Pengaruh likuiditas dan leverage terhadap kondisi financial distress pada perusahaan manufaktur yang terdaftar di bursa efek Indonesia. Kinerja: Jurnal Ekonomi Dan Manajemen, 20(2), 266–273.

Kristiana, L. W., & Annisa, D. (2022). Pengaruh kepemilikan institusional, auditor switching, dan financial distress terhadap audit delay. Jurnal Revenue: Jurnal Ilmiah Akuntansi, 3(1), 267–278. https://doi.org/10.46306/rev.v3i1.118

Kustiana, N., & Halim, S. (2022). Pengaruh likuiditas, leverage, dan aktivitas terhadap financial distress (studi empiris pada perusahaan sektor transportasi yang terdaftar di BEI periode 2016-2019). Jurnal Ilmu Ekonomi Dan Sosial, 11(3), 243–257. https://doi.org/10.22441/jies.v11i3.17546

Lausiri, N., & Nahda, K. (2022). Pengaruh rasio likuiditas, leverage dan profitabilitas terhadap kondisi financial distress dengan kepemilikan manajerial sebagai variabel moderasi. Selekta Manajemen: Jurnal Mahasiswa Bisnis & Manajemen, 1(5), 219–234. https://journal.uii.ac.id/selma

Lewa, D. H., Mukoffi, A., & Sulistyowati, Y. (2024). Pengaruh financial distress, good corporate governance, audit report lag dan opini audit terhadap ketepatan waktu publikasi laporan keuangan. Owner Riset & Jurnal Akuntansi, 8(2), 1956–1967. https://doi.org/10.33395/owner.v8i2.1962

Mahera, A. V., & Hartono, U. (2022). Analisis pengaruh ukuran perusahaan dan kepemilikan institusional terhadap financial distress pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia (BEI). Edukatif: Jurnal Ilmu Pendidikan, 4(4), 5461–5471. https://doi.org/10.31004/edukatif.v4i4.3153

Masita, A., & Purwohandoko, P. (2020). Analisis pengaruh rasio keuangan, kepemilikan manajerial, dan kepemilikan institusional terhadap financial distress pada perusahaan sektor perdagangan, jasa, dan investasi yang terdaftar di BEI tahun 2015-2018. Jurnal Ilmu Manajemen, 8(3), 894. https://doi.org/10.26740/jim.v8n3.p894-908

Ninda, F., & Oktavi, S. (2023). Good corporate governance dan financial distress pada perusahaan manufaktur di Indonesia. Jurnal Ekonomi E-JE, 28(2), 274–291. http://dx.doi.org/10.24912/je.v28i2.1625

Novianda, W., & Irdhayanti, E. (2023). Analisis financial distress pada perusahaan sub sektor penerbangan (studi kasus pada PT. Garuda Indonesia (Persero) Tbk periode 2016-2020). Jurnal Ilmiah Akuntansi Dan Bisnis, 13(1), 27–41. https://doi.org/10.24843/JIAB.2023.v13.i01.p03

Nurmalitasari, P. Y. (2022). Pengaruh kinerja keuangan dan ukuran perusahaan terhadap financial distress. Jurnal Keuangan Dan Bisnis, 12(2), 185–199.

Putri, N. P. A. D. A., & Dewi, P. S. (2022). Pengaruh likuiditas, leverage, dan profitabilitas terhadap financial distress dengan ukuran perusahaan sebagai variabel moderasi pada perusahaan manufaktur yang terdaftar di BEI. E-Jurnal Akuntansi, 32(9), 2322. https://doi.org/10.24843/EJA.2022.v32.i09.p14

Putri, S. M. (2023). Pengaruh ukuran perusahaan, financial distress dan good corporate governance terhadap penghindaran pajak (tax avoidance). JI-AK, 4, 162–175.

Sani, S. H., & Dewi, I. K. (2021). Pengaruh good corporate governance, leverage dan likuiditas terhadap financial distress. Jurnal Riset Akuntansi Dan Keuangan, 9(2), 271–280. https://doi.org/10.17509/jrak.v9i2.36207

Santoso, N., & Pratama, A. (2021). Pengaruh likuiditas, leverage dan profitabilitas terhadap financial distress. Jurnal Riset Akuntansi Kontemporer, 12(2), 116–126. https://doi.org/10.23969/jrak.v12i2.4363

Saputri, A. N., & Budi, I. (2020). Pengaruh kinerja keuangan terhadap financial distress. Jurnal Manajemen Bisnis, 9(2), 203–213.

Shiddiq, A., Randa, F. P., & Indriani, D. (2022). Pengaruh good corporate governance dan rasio keuangan terhadap financial distress pada perusahaan manufaktur di Indonesia. E-Jurnal Akuntansi, 32(6), 1537. https://doi.org/10.24843/EJA.2022.v32.i06.p06

Silva, A., & Kania, P. (2023). Pengaruh likuiditas dan leverage terhadap kondisi financial distress pada perusahaan manufaktur yang terdaftar di Bursa Efek Indonesia. Jurnal Ekonomi Dan Bisnis, 20(2), 1–8.

Siregar, S., & Amanda, A. (2023). Pengaruh ukuran perusahaan dan leverage terhadap financial distress dengan good corporate governance sebagai variabel moderasi. Jurnal Akuntansi Dan Keuangan, 18(1), 46–58.

Siswanti, M. I., & Hermawan, H. (2021). Pengaruh likuiditas, leverage, profitabilitas dan ukuran perusahaan terhadap financial distress. Jurnal Ilmiah Akuntansi, 6(1), 12–22.

Sukiniarti, A. (2020). Pengaruh rasio likuiditas, rasio leverage, dan profitabilitas terhadap financial distress pada perusahaan manufaktur yang terdaftar di BEI. Jurnal Ilmu Manajemen, 8(1), 27. https://doi.org/10.26740/jim.v8n1.p27-39

Sumanti, S. (2023). Pengaruh likuiditas, leverage dan good corporate governance terhadap financial distress. Jurnal Akuntansi Dan Keuangan, 18(2), 59–72. https://doi.org/10.24246/jak.v18i2.59-72

Surjaatmadja, M. E., Chandra, R. W., & Kosasih, W. (2023). Pengaruh leverage dan likuiditas terhadap financial distress dengan good corporate governance sebagai variabel moderasi. Jurnal Manajemen Dan Bisnis, 12(2), 101–120.

Utami, W. N., & Surya, R. (2022). Pengaruh leverage, likuiditas dan kepemilikan institusional terhadap financial distress pada perusahaan manufaktur yang terdaftar di BEI. Jurnal Eksplorasi Akuntansi, 4(1), 204–217.

Yusuf, M., & Permata, P. (2023). Pengaruh likuiditas, leverage dan ukuran perusahaan terhadap financial distress pada perusahaan pertambangan. Jurnal Manajemen Dan Bisnis, 20(2), 21–35.