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Sustainability Education and Critical Thinking in Outcomes-Based Teaching and Learning

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Abstract

Education and critical thinking are integral in the achievement of Sustainable Development Goals (SDGs). However, its integration in the curriculum is seemingly reduced to content-based teaching which causes unclear and misaligned learning outcomes and pedagogy. Thus, this study aims to examine the extent of alignment to sustainability education (SE) and critical thinking (CT) in the General Education (GE) Outcomes-Based Teaching and Learning (OBTL). The study employed convergent parallel research design. Curriculum mapping method was employed to analyze the alignment of the course plans of three participating colleges and interviews were done to examine the teaching-learning beliefs held by the participants. Deductive content and thematic analysis were used to analyze the alignment of course components and teaching-learning beliefs of participants respectively. The findings of the study suggest that most of GE's intended learning outcomes align with social and cultural concepts while environmental and economic concepts are underemphasized. In terms of critical thinking, most of the GE course components align with foundational and higher-level skills and less with complex and metacognitive skills. Notably, most of the sustainable development competencies are found to be underemphasized. While constructive alignment may be observed in some of the course plans, results suggest that a high number of teaching-learning activities and assessment tasks were not aligned with the intended learning outcomes. Thus, the nature and focus of the activities and assessments do not match the target skills and competencies of the learning outcomes. Seemingly, this misalignment is rooted in the participants' belief about the aim of teaching and the function of content. While integration is observed to some extent, overall results suggest a need for improvement in constructively aligning course instructional design to sustainability education as well as to its paradigm. This study hopes to contribute to the development of an SE-CT-OBTL integrated framework and principles as policy guidelines.

Keywords: Critical thinking; curriculum mapping; outcomes-based education; sustainability education

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1. Introduction

1.1. Sustainability Education

Sustainable development aims to maintain and improve quality of life (Cusack, 2019; Vogt et al., 2020), which meets the current needs of societies without compromising the needs of the future generations. Applying the lens of quality education to the goal of sustainable development paved the way for sustainability education, integrating sustainability into curriculum and instruction by promoting critical thinking, decision making, and collaboration skills. This education model trains students to make decisions and propose solutions (Boojh & Ishwaran, 2022) because they are equipped with the competencies to address sustainability challenges and issues.

Sustainability education is an "interdisciplinary, collaborative, experiential, and potentially transformative process of creating a space for inquiry, dialogue, reflection, and action about the values and goals of sustainability" (Moore, 2005, p. 78). Sustainability education integrates sustainability into curriculum and instruction by promoting critical thinking, decision making, collaboration, and imagining the future through transformative education. This framework exposes learners to progressive knowledge, skills, values and attitudes so that they can make decisions and take action aligned with sustainable development principles (Boojh & Ishwaran, 2022). By doing so, learners are equipped with competencies to address challenges and issues pertaining to sustainability.

Several related research and studies have pointed out different issues in its practice and implementation. As summarized by Abera (2023), these issues include: (1) curricular and instructional alignment of education with sustainable development, (2) unclear sustainability outcomes of curriculum and teaching (UNESCO, n.d.), (3) mismatch in teaching-learning approaches, (4) limited positive impact of educational strategies, (5) lack of interest of learners and teachers, (6) overwhelming content for teachers and students, and (7) indoctrination instead of promotion of critical skills like reflection (Carew et al, 2008). Central to these issues is the curriculum and instruction structure where the integration and alignment of sustainability education operates. The findings of Khadim, Qureshi, and Khan (2022) on the problem of sustainability education points out how sustainability content is integrated into narrow-focused courses. Similarly, the study of Ssossé, Wagner, and Hopper (2021) discusses how transmission of knowledge is prioritized rather than the development of sustainable development competencies.

This study aims to examine the alignment of Sustainability Education (SE), and critical thinking (CT) as its foundation, in the General Education (GE) Outcomes-Based Teaching and Learning (OBTL) course plans. Specifically, this study attempts to answer the following questions:

1. What course curriculum components align to sustainability education and critical thinking components?

2. How is constructive alignment observed in the course plans to reflect sustainability education and critical thinking?

3. What teaching-learning beliefs are held in facilitating learning of sustainability education and critical thinking?

By exploring these research questions, the study hopes to contribute to existing theory, research, and practice through development of a curriculum policy framework and guidelines for sustainability education and critical thinking integration and alignment.

1.2. Challenges in Sustainability Education

Education about sustainability is different from education for sustainability. While the former implies learning sustainability content, the latter suggests a deeper form of understanding that will transcend knowledge of sustainability issues to actions, practices, and decision making. Boyes and Stanisstreet (as cited in Violanda & Madrigal, 2021) emphasized that deep learning of sustainability requires students to shift paradigms, which may become difficult due to existing social norms and influences.

Attempts for teaching and learning models to infuse sustainability have been made explicit through the Education for Sustainable Development (ESD) framework. Many learning institutions have integrated ESD into their curriculum and instructional design, and each has a fair share of contributed insights and challenges in doing so. For example, the Southeast Asia Ministers of Education Organization (SEAMEO) (2010) mentioned the following challenges in integrating ESD in the social studies curriculum of secondary Southeast Asian regions:

- Lack of awareness and understanding of ESD by educators,
- Minimal involvement and superficial knowledge of curriculum developers about ESD integration,
- Overloaded curriculum,
- Weak integration of environmental education,
- Disciplinal approach to ESD, and
- Lack of trained teachers.

On the other hand, Munasi and Msezane (2025) cited that there is a significant disparity between teachers' theoretical understanding and ESD practical application along with deficiency in resources definite curriculum guidelines to accommodate teachers' needs to integrate sustainability into their teaching.

Culala and De Leon (2020) remarked that one of the main challenges in sustainability education is allegiance to the existing structure of the school curriculum. Culala and De Leon emphasized that the current structure of schools' curriculum is organized in traditional ways with high tendency to manifest traditional disciplines and practices in teaching. Scartascini, Curiel, and Melchor (2017) emphasized the atomistic structure of the school curriculum in terms of approaching content.

1.3. Critical Thinking as a Foundation in Sustainability Education

Central to the paradigm of sustainability education is the facilitation of students' learning in building and practicing critical thinking skills. This puts learners in a position to co-construct knowledge and make meaning of their experiences. This implies that teaching and learning approaches should be supporting the attainment and progress of such higher order skills. For Thomas (2009), the uncertainty of sustainability issues and decision-making requires society to have individuals who can critically think and assess processes and options while addressing issues and examining alternatives towards sustainability. Additionally, shifting paradigms from education about sustainability to education for sustainability requires awareness and critical examinations of existing structures and understanding from which current teaching and learning practices operate (Atibuni, et al., 2022). This reinforces the claim of Sterling and Thomas (2006) that critical thinking is the foundation of sustainability education.

Critical thinking is one of the key competencies identified as essential in sustainable development (Shafieieh et al., 2024). Though it is defined and applied in different disciplines (Thonney & Montgomery, 2019), this study adheres to the definition by UNESCO (2017) in the context of Education for Sustainable Development (ESD). UNESCO states that critical thinking is "the ability to question norms, practices and opinions; to reflect on own one's values, perceptions and actions; and to take a position in the sustainability discourse" (p. 10). This same definition is consistent with what Sterling (2004, as cited in Culala & De Leon, 2019) described in Level 2 Learning (Education for Sustainability). They frame critical thinking as a purposeful and metacognitive process (Dwyer, Hogan, & Stewart, 2014) and may refer to the quality of making inquiries, evaluations, reflections, decisions, and solving problems.

1.4. Outcomes-Based Teaching and Learning for Sustainability Education

Outcomes-Based Teaching and Learning (OBTL) provides features for sustainability education and critical thinking components to be facilitated in terms of intended learning outcomes. Biggs and Tang (2011) stated that an "outcome statement tells us what students should be able to do after teaching, and how well they should do it, when they were unable, or only partially able, to do it before teaching" (p. 11). Learning outcomes,

as reference for the assessment criteria, are the set of knowledge, skills, and attitudes that students are expected to demonstrate as a result of their learning.

Constructive alignment is one of the most important features of OBTL. Wilhelm, Förster, and Zimmermann (2019) conclude that constructive alignment is an instrument of coherence and operationalizing sustainable development competencies. Constructive alignment is described as the intended alignment of content, teaching and learning activities, assessment tasks, and feedback with the expected learning outcome (Roach, 2008; Biggs & Tang, 2011; Maffei et al., 2022). This implies that the set learning outcome should be the basis of selecting the content, which will be used as a vehicle for students to demonstrate a skill specified in the context of their lesson or module. These designed teaching and learning activities shall then provide students with the opportunities to learn how to demonstrate the learning outcome, while the assessment task is based on what performance can be observed by the teacher indicative that the students can demonstrate the learning outcome.

2. Method

2.1. Research Design

This paper utilized the mixed methods approach to research. Specifically, Convergent Parallel Mixed Method Research Design was used in this study as the data set on the extent of sustainability education and critical thinking alignment, observed constructive alignment, and held teaching-learning beliefs were converged in the interpretation of findings.

2.2. Sources and Analysis of Data

Invitations and requests to participate in the study were sent to three colleges and universities in Philippines' University Belt area at Metro Manila. These schools have a bachelor's degree offering and have existing initiatives, efforts, or vision to contribute to and/or integrate Sustainable Development Goals in the curriculum. As shown in Table 1, the following data was obtained through the research instrument corresponding to each research question of the study.

Table 1. Sources of data

Research Question	Research Instrument	Mode of Analysis
RQ 1: What course curriculum components align to sustainability education and critical thinking components?	Course mapping and heat map of the GE course plans	Deductive content analysis and Percentage
RQ 2: How is constructive alignment observed in	Course mapping and heat map of the GE	Deductive content

Research Question	Research Instrument	Mode of Analysis
the course plans to reflect sustainability education and critical thinking?	course plans	analysis and Percentage
RQ 3: What teaching-learning beliefs are held in facilitating learning of sustainability education and critical thinking?	Interview with faculty about teaching-learning beliefs	Thematic analysis

The researcher did curriculum mapping of GE course plan components to Sustainable Development competencies, content, critical thinking skills, and values and attitudes. The curriculum mapping was conducted with an intercoder to check the inter-reliability of the categorization. Table 2 shows the intercoder reliability index based on the computed the value of Cohen's kappa. Curriculum Mapping (CM) is a tool that visualizes relationships of curriculum components (Harden, as cited in Al-Eyd et., 2018) and assists teachers examine the alignment of curriculum course components in either programs or course levels. The curriculum mapping worksheet used also underwent external review for content and construct validation. Findings from the curriculum mapping of course plans were analyzed through deductive content analysis. Following the stages of Elo and Kyngäs (as cited in Lee, 2018), deductive content analysis in this study was composed of three stages: preparation, organization, and reporting.

Table 2. Intercoder reliability index

GE Course	Domain	Sustainable Development Concept	Critical Thinking Component	Critical Thinking Skill	Sustainable Development Values	Sustainable Development Competency	Constructive Alignment
College 1							
STS	0.838	0.941	0.849	0.797	0.617	0.701	0.918
MMW	0.833	0.718	0.690	0.739	0.633	0.857	0.872
UTS	0.702	0.835	0.826	0.839	0.727	0.895	0.700
Ethics	1.000	1.000	1.000	0.910	1.000	1.000	1.000
RPH	1.000	1.000	0.940	0.950	1.000	1.000	1.000
Rizal	1.000	0.913	0.844	0.849	0.783	0.855	1.000
Purp Comm	1.000	1.000	1.000	1.000	0.714	0.956	1.000
FCW	0.765	0.730	0.932	0.872	0.704	0.940	1.000
Art App	1.000	0.925	0.635	0.677	0.647	0.872	1.000
College 2							
STS	1.000	1.000	1.000	1.000	1.000	1.000	1.000
MMW	0.787	0.787	0.724	0.736	0.808	0.696	1.000
UTS	1.000	1.000	0.875	0.887	1.000	0.849	1.000
Ethics	0.887	0.883	1.000	1.000	0.802	0.956	1.000
RPH	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Rizal	1.000	1.000	0.959	0.969	0.965	0.966	1.000
Purp Comm	1.000	1.000	0.951	0.958	0.618	1.000	1.000
FCW	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Art App	1.000	1.000	0.972	0.973	0.933	0.890	1.000
College 3							
MMW	1.000	1.000	1.000	0.984	1.000	1.000	1.000
RPH	1.000	1.000	1.000	1.000	1.000	0.907	1.000

GE Course	Domain	Sustainable Development Concept	Critical Thinking Component	Critical Thinking Skill	Sustainable Development Values	Sustainable Development Competency	Constructive Alignment
Rizal	0.895	0.942	0.954	0.963	0.973	0.920	1.000
Purp Comm	0.961	0.967	0.867	0.855	1.000	0.894	0.970
FCW	1.000	1.000	1.000	1.000	1.000	0.982	1.000
Art App	1.000	1.000	0.964	0.970	1.000	1.000	1.000
UTS	1.000	1.000	0.962	0.971	1.000	0.872	1.000

Note: < 0.00 – Poor Agreement; 0.00-0.20 – Slight Agreement; 0.20-0.40 – Fair Agreement; 0.41-0.60 – Moderate Agreement; 0.61-0.80 – Substantial Agreement; 0.81-1.00 – Almost Perfect Agreement (Rau et al., 2011)

Five key informants were selected for the interview from the 3 participating colleges. Since this interview focused on one's teaching belief system, specific attributes were defined as the inclusion criteria of key informants. These criteria were as follows: (1) has been in the teaching profession for at least 1 year; (2) has been teaching in the participating schools for at least 1 year; (3) teaching GE courses; (4) may be a full-time faculty or a department chair.

Utilizing Naeem et al. (2023), a 6-step inductive thematic analysis process was conducted. Interview with the participants was first transcribed and the researcher initially familiarized himself with the data provided. Guided by Apps (2006) examination of teaching beliefs framework, selection of quotations was used to represent different viewpoints relevant to the research questions. Keywords were then identified from these quotations to explore patterns of information from participants' experiences and perceptions. This was followed by coding, where the researcher assigned codes to segments of data that capture significant or key ideas relating to the participants' belief. Organizing these codes into categories based on patterns and relationships lead to theme developments and definitions, which revealed more in-depth interpretation of meanings from the interviewees' narratives. Finally, a conceptual model of the themes was developed to encapsulate the insights from the data.

3. Results

3.1. What course curriculum components align to sustainability education and critical thinking components?

Intended learning outcomes, teaching-learning activities, and assessment tasks are course curriculum components that align with sustainability education and critical thinking components. Figure 1 shows a heat map of the alignment of course curriculum components to sustainability education. Based on this, most of the intended learning outcomes hit and align to social concepts and themes (47 %), foundational (40 %) and higher-level (42 %) critical thinking skills, cultural values and attitudes (23 %), and critical (30 %) and systems (23 %) thinking competencies. Consequently, teaching-learning activities and assessment tasks also mostly align and hit the same critical

thinking skills and sustainable development competencies. However, it can also be noted that a high percentage of intended learning outcomes, teaching-learning activities, and assessment tasks are undefined and not explicit in terms of which sustainability education components it aligns with.

Sustainability Education Constructs	ILOs	TLAs	ATs
Sustainable Development Concepts and Themes			
Social	47		
Environmental	2		
Economic	5		
Cultural	26		
Undefined/Not Explicit	21		
Critical Thinking Skills			
Foundational Skill	40	42	59
Higher Level Skill	42	28	10
Complex Skill	13	19	2
Metacognitive Skill	5	3	
Undefined/Not Explicit	1	8	28
Sustainable Development Values and Attitudes			
Social	15		
Environmental	9		
Economic	7		
Cultural	23		
Undefined/Not Explicit	45		
Sustainable Development Competencies			
Systems Thinking	23	8	6
Anticipatory Competency	1		
Normative Competency	8	1	1
Strategic Competency	5	2	7
Collaboration Competency	2	9	8
Critical Thinking	30	25	22
Self-Awareness Competency	9	5	8
Integrated Problem Solving	7	5	8
Undefined/Not Explicit	16	45	40

Figure 1. Heat Map of Course Curriculum Components Alignment to Sustainability Education

When viewed overall by GE courses, Figure 2 shows that social concepts (47 %) and values (15 %) and cultural concepts (26 %) and values (24 %) are the ones mostly hit by GE courses. The heat map shows an underemphasis on environmental and economic concepts and values. It is also notable that Mathematics in the Modern World has a very small percentage of topics and values that align with any sustainable development concepts and values and has huge percentage which are undefined and not explicit in terms of alignment to sustainable development themes (86 %) and attitudes (86 %). In terms of critical thinking skills, Figure 2 also shows that all GE courses align and mostly hit foundational and higher-level critical thinking skills. Complex (12 %) and metacognitive skills (4 %) in almost all of the GE courses are underemphasized with less of each GE course curriculum components aligning to these. In terms of sustainable

development competencies, systems thinking (20 %), and critical thinking (30 %) have the most alignment hit by the GE courses. There is an observed underemphasis to other competencies as each only accounts for less than 10 % of the course curriculum.

Sustainability Education Constructs	STS	MMW	UTS	Ethics	RPH	FCW	PURP COMM	ART APP	RIZAL	Overall
Sustainable Development Concepts and Themes										
Social	67	3	82	63	42	81	61	8	44	47
Environmental	14	1		3						2
Economic		9			2	12	1			5
Cultural	14		13	33	54	8	22	78	57	26
Undefined/Not Explicit	6	86	3		2		15	15		21
Critical Thinking Skills										
Foundational Skill	41	32	43	44	44	51	32	50	45	41
Higher Level Skill	39	45	34	35	26	35	37	35	35	36
Complex Skill	11	17	5	16	20	7	19	3	15	12
Metacognitive Skill	1	2	12		4	5	4	4	4	4
Undefined/Not Explicit	7	5	8	4	6	2	8	9	1	5
Sustainable Development Values and Attitudes										
Social	37	2	8	17	28	15	12	6	25	15
Environmental	24	2	7	30	2	7	10	28	15	9
Economic		9		3	7	23	4		1	7
Cultural	28	1	54	50	18	33	32	12	43	24
Undefined/Not Explicit	12	86	31		46	24	42	56	17	43
Sustainable Development Competencies										
Systems Thinking	25	14	6		9	42	11	24	20	20
Anticipatory Competency	1	1							1	0.29
Normative Competency	7		9	16	3	6	7	5	8	5
Strategic Competency	1	4	1			3	5	7	4	3
Collaboration Competency	3	3	6	2	8	5	9		3	4
Critical Thinking	25	22	20	45	39	30	35	15	40	30
Self-Awareness Competency	4	5	40	8	3	5	7	5	11	8
Integrated Problem Solving	8	21	1	4	6	1	7		1	6
Undefined/Not Explicit	25	29	18	24	33	9	19	43	13	23

Figure 2. Heat Map of GE Alignment to Sustainability Education

3.1.1. Alignment to sustainable development key concepts and themes

Figure 3 presents the heat map of alignment of GE courses to key sustainable development concepts and themes. Based on the heat map, globalization (12 %) and cultural critique (13 %) have the overall highest alignment of GE courses to sustainable development concepts and themes. It can also be noted that each GE course has its own focus in terms of these concepts and themes with a varied percentage of alignment. However, it can also be observed that several concepts and themes are not hit by any of the GE courses while some are underemphasized with a very small percentage of course components aligning to it. In particular, many of the environmental concepts (deforestation, desertification, disaster risk management, energy, fresh water, natural disasters, natural resource conservation, and pollution) and some of the social (HIV and

AIDS and reproductive health) and cultural (indigenous knowledge) concepts are not hit by any GE course. Inclusion (0.43 %), social discrimination (0.14 %), overconsumption (0.14 %), and rural development (0.29 %) are underemphasized in GE with less than 1 % of the overall course components aligning to it. When viewed for each GE course, it is also notable that Mathematics in the Modern World has 86 % of its course curriculum components which are undefined or not explicit in terms of what sustainable development concepts and themes it aligns with.

Categories	Sub-categories	STS	MMW	UTS	Ethics	RPH	FCW	PURP COMM	ART APP	RIZAL	Overall
Social	Building communities	39			3	4	5	10	1		5
	Citizenship	6	1	5	40	7	11	4	2	23	9
	Gender equity			4							1
	Globalization	2				7	43	32		2	12
	Good governance	4			7	9	3			5	2
	HIV and AIDS and reproductive health										
	Human rights	4			13	2				2	1
	Inclusion						1	1	1		0.43
	International understanding						14				3
	Leadership and organization	2		4		4	2	14	2	8	4
	Peace, conflict, and security	2	1	5		9					1
	Social discrimination									1	0.14
	Welfare, health, and wellbeing	8	1	64			2		2	3	8
Environmental	Biodiversity	6	1		3						1
	Climate change	8									1
	Deforestation										
	Desertification										
	Disaster risk reduction										
	Energy										
	Fresh water										
	Natural disasters										
	Natural resource conservation										
	Pollution										
Economic	Migration						3				1
	Overconsumption						1				0.14
	Poverty and equity		5								1
	Rural development		1								0.29
	Sustainable production and consumption		3			2	5	1			2
	Urbanization						3				1
Cultural	Cultural critique	4		1	13	48	2	7	31	27	13
	Cultural heritage	2				4			35	10	4
	Cultural preservation					2			7	1	1
	Cultural renewal						1			3	1
	Cultural values	2		8	7			15	1	16	4
	Indigenous knowledge										
	Religion and belief systems	6		4	13		5		4		3
Undefined	Unidentified / Not Explicit	6	86	3		2		15	15		21

Figure 3. Heat Map of GE Alignment to Sustainability Development Concepts and Themes

3.1.2. Alignment to sustainable development critical thinking skills

Figure 4 presents the heat map of GE alignment to critical thinking skills. Based on the overall results, the foundational skill of recognizing concepts and theories (33 %) and the higher-level skill of applying, comparing, contrasting, analyzing, or predicting using concepts and theories (25 %) are the most emphasized critical thinking skills in GE. Generally, other critical thinking skills are underemphasized with less than 8 % of overall course components aligning to it. Notably and unlike other GE courses, Science, Technology, and Society emphasizes challenging ideas (22%), Understanding the Self on metacognitive skill (12 %), and The Life and Works of Rizal on evaluating theories and claims (14 %). Ethics on the other hand is the only GE course which seems not to hit metacognitive skills.

Categories	Sub-categories	STS	MMW	UTS	Ethics	RPH	FCW	PURP COMM	ART APP	RIZAL	Overall
Foundational Skills	Describe behavior	5	2	3	4	1	3	3	1	9	3
	Recognize concepts and theories	18	27	34	36	39	45	21	44	33	33
	Interpret behavior							3		1	0.42
	Identify assumptions			1	4			1		1	1
	Listening	18	3	5		4	3	4	5	1	4
Higher Level Skills	Apply, compare, contrast, analyze, or predict using concepts or theories	13	39	23	22	9	27	26	29	18	25
	Evaluate theories and claims (Question or synthesize theories and claims)	4	2	3	7	7	1	4	1	14	4
	Generate hypothesis				2			1			0.21
	Challenge ideas	22	4	8	4	10	7	6	5	3	7
Complex Skills	Problem-solving (Diagnose problems, design or propose research or solutions, or statistically analyze data)	5	6		7	7	2	8		3	4
	Building theory	1	2	1			1		1	1	1
	Do formal criticism (Analyze meaning and interpretation)	3	5	2		10	1	3	1	8	4
	Decision-making		2		7		1	3	1	1	1
	Collaborate	2	2	2	2	3	2	5		2	2
Metacognitive Skill	Monitor the quality of critical thinking process, product, and changes in the thinker through developmental self-assessment	1	2	12		4	5	4	4	4	4
Undefined	Unidentified / Not Explicit	7	5	8	4	6	2	8	9	1	5

Figure 4. Heat Map of GE Alignment to Critical Thinking Skills

3.1.3. Alignment to sustainable development values and attitudes

Figure 5 shows the heat map of alignment of GE courses to sustainable development values and attitudes. The overall results show that 43 % of the GE courses curriculum components are undefined or not explicit in terms of the sustainable values and attitudes it aligns with. The same results can be observed in almost all GE courses with the

exception of Ethics which has all course components identified in terms of alignment to values and attitudes. When viewed for each course, each GE course has its own focus in terms of aligning to sustainable development values and attitudes. For examples, Science, Technology, and Society focuses on the values of participation in decision making and access to justice (29 %) while Understanding the Self focuses on human dignity, bodily health, and spiritual wellbeing (34 %). Notably, the values of precautionary principle seem underemphasized with only an overall of 0.29 % of GE aligning to it.

Categories	Sub-categories	STS	MMW	UTS	Ethics	RPH	FCW	PURP COMM	ART APP	RIZAL	Overall
Social	Non-discrimination, inclusion, equity and social justice	8	1	2	10	2	5	4	2	8	4
	Participation in decision-making and access to justice	29	1	1	7	26	10	8	4	16	10
	Affirmation of gender and other forms of equity and inclusivity			5						1	1
Environmental	Protection of ecological integrity and care for the community of life	2	1						2		1
	Ethical actions needed to restore damaged ecosystems	6						4	2		1
	Prevention of harm	6		7							1
	Precautionary principle	4									0.29
	Respect and care for life and the community of life (human and non-human)	6	1		7	2	1	3	24	5	2
	Respect for future generations				23		6	3		10	4
Economic	Eradication of poverty as an ethical, social, and environmental imperative		6				4				2
	More equitable distribution and sharing of wealth and resources		2		3	7	16	4		1	4
	Safeguarding of the Earth's regenerative capacities, human rights and community well-being in production and consumption patterns		1				3				1
Cultural	Respect for the Earth and life in all its diversity	2					2	4	3	2	2
	Care for the community of life	2		9	7	7	12	4		10	5
	Care for others and their well-being	8		2	13		2	7	2	11	4
	Principles of equity and respect for others	4			23	9	12	10	4	7	6
	Human dignity, bodily health, and spiritual well-being	4	1	34	7			1	3	5	4
	Tolerance, non-violence, and peace	8		9		2	5	6		8	3
Undefined	Unidentified / Not Explicit	12	86	31		46	24	42	56	17	43

Figure 5. Heat Map of GE Alignment to Sustainable Development Values and Attitudes

3.1.4. Alignment to sustainable development competencies

Figure 6 shows the alignment of GE courses to sustainable development competencies. Based on this heat map, GE courses overall mostly hit systems thinking (20 %) or the

ability to understand and analyze complex systems and critical thinking (30 %) or the ability to question and reflect on practices and opinions. Notably, anticipatory competency (0.29 %) or the ability to understand multiple futures and plan actions has the lowest alignment. A huge percentage of course curriculum components in each GE course are undefined or not explicit in terms of what sustainable development competence it aligns with.

Sustainability Education		GE COURSES									
Categories	Sub-categories	STS	MMW	UTS	Ethics	RPH	FCW	PURP COMM	ART APP	RIZAL	Overall
Sustainable Development Competencies	Systems thinking	25	14	6		9	42	11	24	20	20
	Anticipatory compentency	1	1							1	0.29
	Normative competency	7		9	16	3	6	7	5	8	5
	Strategic competency	1	4	1			3	5	7	4	3
	Collaboration comptency	3	3	6	2	8	5	9		3	4
	Critical thinking	25	22	20	45	39	30	35	15	40	30
	Self-awareness competency	4	5	40	8	3	5	7	5	11	8
	Integrated problem-solving	8	21	1	4	6	1	7		1	6
	Unidentified / Not explicit	25	29	18	24	33	9	19	43	13	23

Figure 6. Heat Map of GE Alignment to Sustainable Development Competencies

3.2. How is constructive alignment observed in the course plans to reflect sustainability education and critical thinking?

Figure 7 shows the heat map of observed constructive alignment in GE course plans. The curriculum mapping suggests that while 6 to 25 % constructive alignment may be observed in the GE courses, overall results suggest that a high number of teaching-learning activities and assessment tasks were observed to be not aligned with the intended learning outcomes. Thus, the nature and focus of the activities and assessments do not match the target skills and competencies of the learning outcomes. The percentage of misaligned teaching-learning activities ranges from 3 % to 33 % for each sustainability education constructs while the percentage of misaligned assessment tasks ranges from 9 % to 44 %. The percentage of both cases of teaching-learning activities and assessment tasks misaligning to the intended learning outcome ranges from 38 % to 73 %. Notably, a high number of intended learning outcomes, teaching-learning activities, and assessment tasks were also observed not explicit in terms of aligning to sustainable development concepts, critical thinking skills, values, and competencies.

When observed based on colleges, Figure 8 shows that a bulk of misalignment occurs both on teaching-learning activities and assessment tasks. This seemingly indicates that students' achievement and demonstration of understanding of these sustainable

development competencies are uncertain as planned teaching-learning activities and assessment tasks do not match the target intended learning outcomes.

Sustainability Education Constructs	ILOs	TLAs	ATs	Constructively Aligned	TLA Misaligned to	AT Misaligned to	Misaligned TLA and AT
Sustainable Development Concepts and Themes							
Social	47			13	7	26	54
Environmental	2			11		44	44
Economic	5			23	3		73
Cultural	26			22	14	18	46
Undefined/Not Explicit	21			14	22	22	42
Critical Thinking Skills							
Foundational Skill	40	42	59	24	10	25	41
Higher Level Skill	42	28	10	11	14	23	52
Complex Skill	13	19	2	12	10	9	69
Metacognitive Skill	5	3		6	15	24	56
Undefined/Not Explicit	1	8	28	25		38	38
Sustainable Development Values and Attitudes							
Social	15			16	8	28	47
Environmental	9			15	4	30	51
Economic	7			16	8	12	64
Cultural	23			12	10	21	57
Undefined/Not Explicit	45			19	16	21	45
Sustainable Development Competencies							
Systems Thinking	23	8	6	15	13	24	48
Anticipatory Competency	1				33		67
Normative Competency	8	1	1	19	8	21	53
Strategic Competency	5	2	7		13	19	69
Collaboration Competency	2	9	8	8		25	67
Critical Thinking	30	25	22	14	11	26	48
Self-Awareness Competency	9	5	8	7	7	20	65
Integrated Problem Solving	7	5	8	13	29	9	49
Undefined/Not Explicit	16	45	40	34	9	18	39

Figure 7. Heat Map of Constructive Alignment in GE Courses

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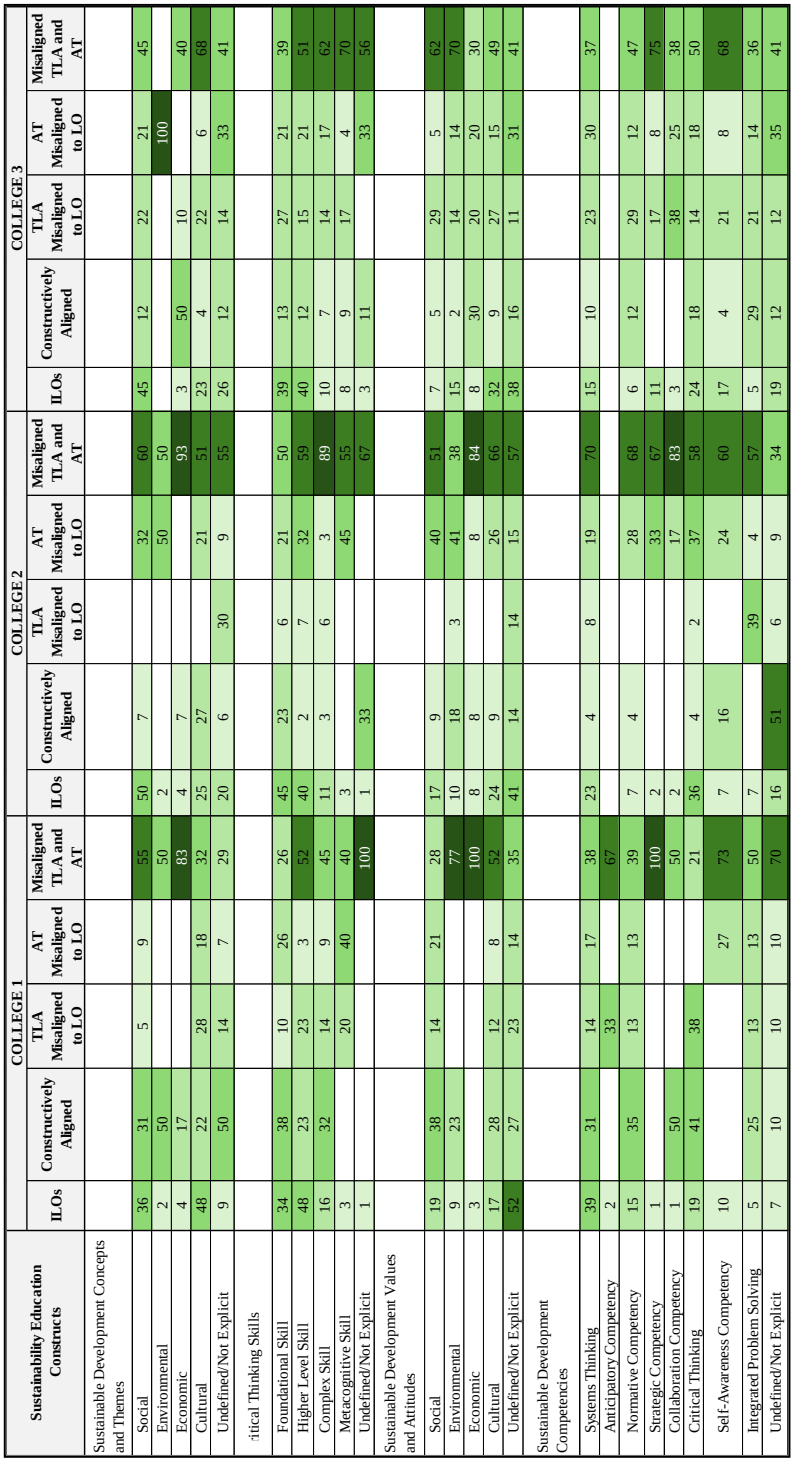

Sustainability Education Constructs	COLLEGE 1					COLLEGE 2					COLLEGE 3				
	ILOs	Constructively Aligned	TLA Misaligned to LO	AT Misaligned to LO	Misaligned TLA and AT	ILOs	Constructively Aligned	TLA Misaligned to LO	AT Misaligned to LO	Misaligned TLA and AT	ILOs	Constructively Aligned	TLA Misaligned to LO	AT Misaligned to LO	Misaligned TLA and AT
Sustainable Development Concepts and Themes															
Social	36	31	5	9	55	50	7		32	60	45	12	22	21	45
Environmental	2	50			50	2			50	50				100	
Economic	4	17			83	4	7			93	3	50	10		40
Cultural	48	22	28	18	32	25	27		21	51	23	4	22	6	68
Undefined/Not Explicit	9	50	14	7	29	20	6	30	9	55	26	12	14	33	41
ritical Thinking Skills															
Foundational Skill	34	38	10	26	26	45	23	6	21	50	39	13	27	21	39
Higher Level Skill	48	23	23	3	52	40	2	7	32	59	40	12	15	21	51
Complex Skill	16	32	14	9	45	11	3	6	3	89	10	7	14	17	62
Metacognitive Skill	3		20	40	40	3			45	55	8	9	17	4	70
Undefined/Not Explicit	1				100	1	33			67	3	11		33	56
Sustainable Development Values and Attiudes															
Social	19	38	14	21	28	17	9		40	51	7	5	29	5	62
Environmental	9	23			77	10	18	3	41	38	15	2	14	14	70
Economic	3				100	8	8		8	84	8	30	20	20	30
Cultural	17	28	12	8	52	24	9		26	66	32	9	27	15	49
Undefined/Not Explicit	62	27	23	14	35	41	14	14	15	57	38	16	11	31	41
Sustainable Development Competencies															
Systems Thinking	39	31	14	17	38	23	4	8	19	70	15	10	23	30	37
Anticipatory Competency	2		33		67										
Normative Competency	15	35	13	13	39	7	4		28	68	6	12	29	12	47
Strategic Competency	1				100	2			33	67	11		17	8	75
Collaboration Competency	1	50			50	2			17	83	3		38	25	38
Critical Thinking	19	41	38		21	36	4	2	37	58	24	18	14	18	50
Self-Awareness Competency	10			27	73	7	16		24	60	17	4	21	8	68
Integrated Problem Solving	5	25	13	13	50	7		39	4	57	5	29	21	14	36
Undefined/Not Explicit	7	10	10	10	70	16	51	6	9	34	19	12	12	35	41

Figure 8. Heat Map of Constructive Alignment in Colleges

3.3. What teaching-learning beliefs are held in facilitating learning of sustainability education and critical thinking?

Table 3 presents the thematic analysis of the interviews. From the transcribed interviews, significant statements were culled and assigned keywords to form themes.

Table 3. Thematic Analysis of Interviews

Quotations	Keywords	Codes	Themes
DATA / SIGNIFICANT STATEMENTS	Achievement	Preparation for work	Aims of Teaching and Learning
	Initial goal to get this degree		
	Degree		
	Practicing their professions		
	Future professions		
	Practical skills		
	Present condition		
	Learn for the future		
	Family		
	Fulfillment of career		
	Field of work		
	Entrepreneurship	Application of learning	
	Practical skills		
	Contributed to their lives		
	Contributed to goals and achievements	Interest and needs of students	Design of the Learning Environment
	Interest of students		
	Serving the needs of the students		
	More interesting for the students		
	Serving the needs of the students		
	Innovative	Life-long learning	
	Adaptive to technology		
	Adaptability		
	To learn		
	Equip themselves		
	Safe space	Safe learning environment	
	Open environment		
	Inclusive		
	Less pressure		
	Content as objectives	Content as an end	Role of Subject Matter
	Theories as backbones		
	Content as ultimate thing		
	Content is a guide		
	Recitation policy	Content as a means	
	Class recitation		
	Assessment of their discipline		
	Explanation of theories		
	Opportunity to improve	Constructive feedback	Role of Feedback
	Function is improvement		
	Rooms for improvement		

3.3.1. Aim of Teaching and Learning

The findings of the study suggest emphasis on students' preparation for work as the aim of teaching and learning. According to the participants, students' primary motivation to learn is to get their degree and practice their future professions in college. Participants affirmed this by stating that students should see how the things being taught should be relevant in practicing their profession. Participants believe that learning should be directed at practical skills that students would be needing in the workplace. This aim according to the participants is driven by students' motivation to help their family financially and to fulfill their pursuit to graduate and their career.

3.3.2. Design of the Learning Environment

In terms of the learning environment, participants believe that it should be anchored and designed based on students' needs and interest and should be open and safe. Participants said that students would be motivated to learn if the activities designed are fun, creative, and innovative where chosen topics and technology used are based on students' needs and interests. Participants believe that the learning environment should be developing lifelong learning skills among students so that they can adapt to the advancement of technologies and ideas in society. Apart from this, participants also claimed that the learning environment should be a safe space where students are recognized and have ideas to share regardless of their diverse background. They added that it should not discriminate and puts less pressure on students.

3.3.3. Role of Subject Matter

Participants shared two main ideas about the role of the subject matter in teaching – content being a goal and content being a means. According to the participants, content is interchangeable with the lesson objectives. It is used to organize subtopics intended to master the course. Content for the participants is the 'ultimate thing' that will define what students must learn as it is the one used by students to make interpretations. On another note, participants also described content through the activities they do inside the classroom. They cited that the nature of courses they teach are dominantly theoretical and thus are concerned with explanation of theories. So, they do graded recitations. One participant described graded recitations as a class policy where students are required to provide answers while another participant described it as a form of assessment of their discipline.

3.3.4. Role of Feedback

Participants are unanimous in viewing feedback as constructive as it provides students opportunities for improvement. According to the participants, feedback explains to

students the gap between what was expected and what they demonstrated. Further, it allows students to close this gap by providing information on what can be done to improve. One participant also described feedback as reflective as it prompts students to self-assess how they perform the tasks and what should be done for improvement.

4. Discussion

4.1.1. Alignment of course curriculum to sustainability education and critical thinking

The curriculum mapping of GE courses overall shows that most courses intended learning outcomes, teaching-learning activities, and assessment tasks hit and align to social and cultural concepts, themes, values and attitude. The curriculum mapping shows most emphasis of GE courses on foundational and higher-level critical thinking skills. However, the curriculum mapping suggests that only systems thinking, and critical thinking competencies are the ones given emphasis in GE while the other competencies are underemphasized. Such difference exhibits contrast in teachers' espoused theory and theory-in-use (Kaymakamoglu, 2017) as curriculum integration requires organizing teaching and learning to selected units of study and alignment involves consistency between desired outcomes and course content (Yilmaz & Oner Sunkur, 2021). The course plans indicate that only not all these competencies were consistent with the course learning outcomes, teaching-learning activities, and assessment tasks.

The high percentage of intended learning outcomes, teaching-learning activities, and assessment tasks, which were undefined and not explicit in terms of which sustainability education constructs it align with, seems to contribute to some sustainable development concepts, critical thinking skills, values, and competencies being underemphasized. As emphasized in this paper, learning outcomes are target results and evidence of learning (Harden, 2002). Thus, it is a statement that structures expectations on what skills and values to be demonstrated using chosen content topic as medium in given teaching-learning activities and assessment tasks. On the case of ILOs which are not explicit in terms of what sustainability education constructs it aligns with, the researcher noted the unstructured manner of how learning outcomes were written. This includes using vague verbs (e.g. understand, acknowledge, observe honesty, comprehend) and confusing format which lacks integration of sustainability context (e.g. create a blog; detect error; to enhance students' communication skills through prepared speech observing the seven Cs of communication) which make it difficult to identify which sustainable development concepts, critical thinking skills, values, and competencies the ILOs align with. The vagueness in recurring and input-based types of teaching-learning and assessment activities (e.g. lecture, watching video, graded recitation) also contributes to a high percentage of course components that are not explicit in terms of target sustainable development competencies.

Structuring the development of learning outcomes can make it consistent and explicit in terms of alignment to sustainability education targets (Harris & Clayton, 2019; Kioupi & Voulvoulis, 2022). Biggs and Tang (2011, as cited in Jaiswal, 2019) suggested that learning outcomes be developed through the structure: Verb + Content + Context. While the use of specific and measurable verbs encapsulates the critical thinking skills needed to be demonstrated by students, the content and context captures the sustainable development concepts and values needed as medium and condition where the target skill will be demonstrated. Constructively aligning the teaching-learning activities and assessment tasks to these developed learning outcomes will avoid the use of vague and recurring input-based type activities to really align and reflect critical thinking skills and sustainable development competencies. Constructive alignment, being the intentional alignment of TLAs and ATs to ILOs (Wilhelm, Förster, & Zimmermann, 2019), ensures to meet target skills in program and course designs (Hamdoun, 2023) as students use the right cognitive skills (Biggs & Tang, 2011) aligned with sustainability education targets during conduct of activities and assessments.

Underemphasis on environmental and economic concepts and values were also observed in the curriculum mapping. Notably, many of the environmental concepts were not hit by any GE course, economic concepts were less hit, and almost half of the course components are not explicit in terms of alignment to sustainable development values and attitudes. The researcher has noted that several learning outcomes were too disciplinal and thus may not provide flexibility to relate to any sustainability concepts and values. Case in point again is the course Mathematics in the Modern World which has very few topics and values that align with any sustainable development concepts and values and has many course ILOs not explicit in terms of alignment (e.g. define statistics; construct graphs and plots; define measures of central tendency; etc.). Reinforcing the earlier claim, disciplinal approach to teaching and learning limits integration of sustainability as social, environmental, economic, and contextual relevance are limited if topics and activities are in an atomistical approach. Such atomistic approach to learning has been associated by Barr and Tagg (1995) to an instruction paradigm whose attributes are of a teacher-centered and prescriptive instructional design (Väljataga & Laanpere, 2010) and whose metrics of students' success are the number of inputs rather than students' demonstration of outcomes.

In terms of critical thinking skills, majority of the GE course components align with the foundational skill of recognizing concepts and theories followed by the higher-level skill of applying theories. Relative to the other skills, this suggests underemphasis of other higher-level and many complex, and metacognitive skills. This is consistent with the earlier results suggesting emphasis on disciplinal approach to content as most focus of learning outcomes is on students' recognition of concepts and further reinforce by input-based activities in TLAs and ATs such as lectures and graded recitations. Such learning outcomes are associated by Biggs and Tang (2011) to declarative knowledge as it

focuses on knowing content (Anderson, 1982, as cited in Gamero, García-Ceberino, Ibáñez, & Feu, 2021). While this kind of knowledge is important as it serves as baseline knowledge/schema required to initiate critical thinking (Willingham, 2009; Ossa, Rivas, & Saiz, 2023), it should be used to perform other higher-level and complex skills. Such use of declarative knowledge leads to functional knowledge being exemplified by use of content-knowledge to synthesize new information or methods for decision making and problem-solving (Cörvers et al., 2016). Such decision-making and acting aligned with sustainable development principles (Boojh & Ishwaran, 2022) rely on complex and metacognitive skills and interrelated sustainable development competencies (Cebrián et al., 2020; 2021).

4.1.2. Constructive alignment in the course plans to reflect sustainability education and critical thinking

Overall results suggest that a high number of teaching-learning activities and assessment tasks were not aligned with the intended learning outcomes. Thus, the nature and focus of the activities and assessments do not match the target skills and competencies of the learning outcomes. This is despite constructive alignment being an important feature of Outcomes-Based Teaching and Learning to ensure students learning of target skills and competencies. As mentioned by Hristov, Nakov, & Miocinovic (2023), students' success in higher education primarily depends on constructive alignment as competencies are determined before the start of teaching and from which design and selection of activities and assessments are based on. As such, while course components hit different sustainable development concepts, critical thinking skills, and values, students' achievement of these may be least likely since target competencies in the intended learning outcomes do not match the ones hit by teaching-learning activities and assessment tasks.

Aside from the problem of developing learning outcomes earlier discussed in this paper, misunderstanding of what learning outcomes also contributes to misalignments. Intended learning outcomes are being viewed as content-knowledge rather than desired results. Whether it is a course unit or a module, the course sets too many learning outcomes to be accomplished in a very short period of time but with only recurring input-based activities such as lectures, recitations, and viewing of videos. The researcher noted that some course plans indicate more than sixty intended learning outcomes in a semester as one topic is assigned one learning outcome. This makes it challenging to design feasible and different activities that can cater and will align to all of these individual learning outcomes. Learning outcomes are set of formal statements of results indicating what students can achieve and demonstrate after learning (Mahajan & Sarjit Singh, 2017; Biggs & Tang, 2011; Suskie, 2009; Allan, 1996). As such, learning outcomes are desired results and demonstration of students acquiring the target competence and

not the content. Thus, learning outcomes are what students can do for having sustainable development competencies and may be established based on set of content and not necessarily per one topic. Proper understanding of what learning outcomes are can allow establishment of target results feasible to be demonstrated by students in the given time and instructional designing of right and aligned number of activities and assessments to allow students learn and demonstrate desired results.

Additionally, recognition of concepts has been hit most of the time in all course components – intended learning outcomes, teaching-learning activities, and assessment tasks. This then explains the emphasis of most GE courses in the foundational skill. However, vague, recurring, and very few types of input-based activities and assessments (e.g. lectures, graded recitation, traditional paper and pencil test, viewing of video) even outcomes involving higher level and complex skills were observed which then propelled the misalignment in the course plans. This reinforces disciplinal approach to teaching as the focus is on recognizing content-knowledge rather than how these may be used to make decisions and propose solutions to transdisciplinary themes such as those of sustainability (Seatter & Ceulemans, 2017; Risopoulos-Pichler et al., 2020). Remembering concepts gives emphasis to lower order thinking skills. Thus, learning outcomes, teaching-learning activities, and assessment tasks are encouraged to integrate opportunities to make decisions and propose solutions (Pitts, 1935) to address sustainability challenges and issues (Boojh & Ishwaran, 2022). This may be done by aligning TLAs and ATs to ILOs targeting complex and metacognitive skills which include problem solving, decision-making, and monitoring quality of learning (Wales & Nardi, 1984; Halonen, 1995). Using content as a vehicle for students to develop skills (Weimer, 2002) in activities that will provide opportunities for students to relate concepts and different aspects of tasks, and to view and approach problems in new ways, target what Biggs and Tang (2011) and Caniglia and Meadows (2018) cited as relational and extended abstract level of learning outcomes.

4.1.3. Teaching beliefs in facilitating sustainability education

Figure 9 shows the thematic embodiment of the teaching beliefs held by participants in facilitating sustainability education. The unifying theme of the aims of teaching and learning is on preparing students to the workplace and thus shows inclination to pragmatic education. Participants emphasized that teaching and learning should include applications specifically in terms of the chosen degree and future work of the students. According to them, this also boosts students' interest in the subject matter as this will ensure that all things being covered will be relevant to their future career. In essence, this aim is responsive to the needs of the industry as demands in terms of skills and practice in the workplace are the priorities to be learned in schools.

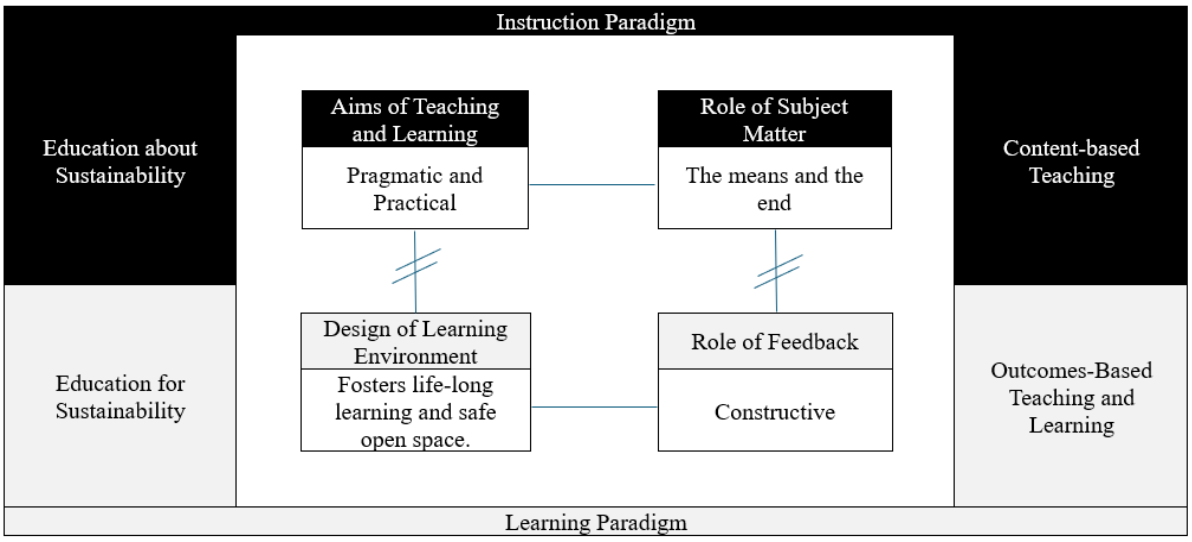

Figure 9. Held Teaching Beliefs in Facilitating Sustainability Education

While education aimed at industry responsiveness may first look like addressing skill gaps between colleges and the workplace, such aim may limit one's ability to transfer skills in different contexts. Wedekind and Mutereko (2016) cited challenges in graduates' articulation and portability of skills between different industries. Natale and Doran (2012) noted that preparing students through industry-focused education impairs them the ability to abstract and critical thinking. Despite the centrality of experience in its learning process, Kivinen and Ristela (2003) cited that pragmatic education emphasized formation of habit and action that derived from the experience rather than development of cognitive structures. Thus, such aim is limiting as it prepares students for the current needs of the industry but overlooks or does not anticipate factors and demands that may arise in the coming years. In such cases, students may be able to equip themselves with the current skills needed by the industry but fail to adapt to new demands in the future.

In contrast to an industry-focused aim of education, Outcomes-Based Teaching and Learning (OBTL) focuses on developing learning skills and thereby leads students to high level of adaptability (Pang, Ho, & Man, 2008). This aim seems to be not coherent with the belief perceived by the participants as practical and pragmatic education only address the needs of the present while life-long learning anticipates the problems and issues which are not yet observed. Focus on learning and adaptability improves skills in communication, critical thinking, and lifelong learning which then promotes complexity and long-term change (Werners et al., 2021; Alali & Wardat, 2024). Such focus is also consistent with sustainability education as it emphasizes students' ability to inquire and cope with challenging and complex situations and their ability to adapt to society's challenges (Chen et al., 2020). In principle, sustainability education focuses on

developing competence among students to address issues and problems by equipping adaptability skills which are not limited to the current demands of the industry.

On the other hand, beliefs about the learning environment and the role of feedback are consistent with one another and with the goals of sustainability education and OBTL. The design of the learning environment being focused on developing students lifelong learning skills is important to prepare them for the challenges of globalization (Taşçı & Titrek, 2019) as it allows them to continuously acquire and apply competences (Parisi et al., 2018) in different context. As mentioned earlier, such adaptability through focus on learning allows transfer and application of knowledge and skills in different contexts. This will also provide opportunities for individuals to address multifaceted problems and issues of sustainability. An open and safe learning environment reinforces lifelong learning as it encourages constructive feedback for improvement. Feedback allows students to be informed of critical gaps between expected learning outcomes and actual results (Hattie & Yates, 2014) thus allows them to self-regulate (Tan, 2020) paving way for reflection and recalibration of learning and practice. Such self-regulation is crucial for lifelong learning as it enables students to plan, monitor, and evaluate their learning processes for improvement and recalibration (Matuga, 2007; Russell et al., 2020; Kostyantynivna et al. 2023).

The perceived role of the subject matter on the other hand is incoherent with the belief about the design of the learning environment and role of feedback. While the learning environment promotes lifelong learning and open space paving for constructive feedback, the role of content is perceived as both an end and a means. This means that content is given priority both as the metric of student success and a method of achieving it. Barr and Tagg (1995) suggested that the number of contents covered as a criterion for success is closely associated with an instruction paradigm or belief system whose focus is on instruction or teaching efficiency rather than students' learning. Graded recitation as an example of input-based method of assessing content covered promotes low level of questioning, domination of selected students over the others, pre-packaged knowledge, and predictable conversations (Hattie & Yates, 2014). As mentioned by Weimer (2002), allegiance to content promotes rote learning. Focus on content over skills and competencies serves as a hindrance to allowing students to challenge and reflect on ideas and thus impair their ability to develop both critical thinking and lifelong learning skills. Consequently, such focus on content does not allow constructive feedback on skills as the emphasis is on the content mastery rather than demonstration of learning outcomes.

In sum, the practical aims of teaching and learning to prepare students for the workforce and the perceived role of subject matter as both end and means seemed consistent with the instruction paradigm whose focus is on course content and disciplinal approach to teaching and learning. In terms of sustainability, this reinforces education

about sustainability (Thomas, 2009) as students may be aware of sustainability concepts and issues but may not have the skills to critically think and reflect on actions and solutions. On the other hand, the perceived design of the learning environment being able to foster lifelong learning and a safe open space, and the role of feedback to help students improve, adhere to the learning paradigm which focuses on learning skills and students' demonstration of outcomes. This kind of learning environment and feedback provides opportunities for students to construct knowledge and thereby paves way for students to acquire and develop sustainable development competencies needed to address sustainability issues and problems. As cited by Culala and De Leon (2019), curriculum design which focuses on competencies demonstrated as outcomes and opportunities for students to construct knowledge promotes education for sustainability as it allows students to critically think, reflect, and propose actions and solutions to issues concerning sustainability.

4.1.4. Integrating Sustainability Education, Critical Thinking, and Outcomes-Based Teaching and Learning

Synthesizing the findings of the study along with the related literature and studies, Figure 10 presents an integrated Sustainability Education – Critical Thinking – Outcomes-Based Teaching and Learning (SE-CT-OBTL) Framework.

The principles embedded in this integrated framework are as follows:

4.1.4.1. Sustainable development competencies are expressed and demonstrated as learning outcomes.

Sustainable development competencies are skill sets that individuals use to make decisions and propose solutions aligned with sustainable development (Shephard, 2008; Redman & Wiek, 2021). Thus, these are observable and measurable through the results which one can exhibit by having these skill sets. These results are formally stated as learning outcomes (e.g. What can students do as a result of learning anticipatory competency?) which serve as basis for instructional designing.

4.1.4.2. Sustainable development competencies are expressed and demonstrated as learning outcomes.

Learning outcomes are formal statements of understanding. Such statement specifies in what form will understanding be demonstrated. Hence, learning outcomes indicate specific results. Learning outcomes are not content-knowledge but may indicate results of students gaining set of content-knowledge. Thus, students learning multiple topics may lead to sets of learning outcomes but does not automatically suggest that there is one learning outcome assigned for each topic.

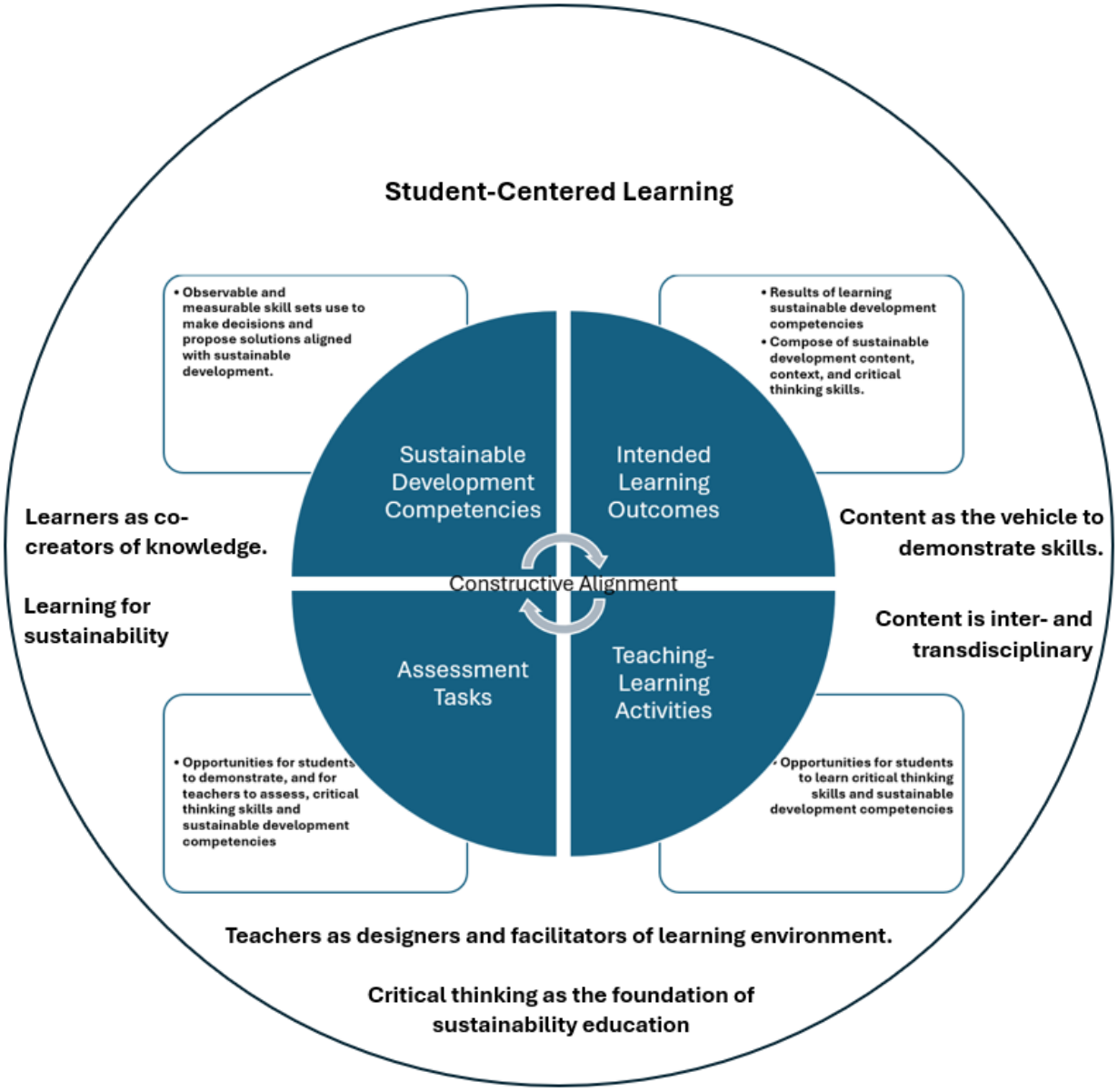

Figure 10. Integrated SE-CT-OBTL Framework

4.1.4.3. Learning outcomes are formulated by combining skills, content, and context.

Structuring the learning outcome ensures explicitness of which components of sustainability education does it align with. Hence, learning outcomes may be formulated through the formula: Stem + Verb + Content + Context (Biggs & Tang, 2011). The stem specifies the doer and time frame when the result will be demonstrated while the verb indicates the target critical thinking skill. On the other hand, the content is the topic or sets of topics to be learned and the context describes the condition of the demonstration.

An example applying this formula is the learning outcome "At the end of this course, students should be able to propose investment strategies based on equitable distribution of wealth and resources."

4.1.4.4. Sustainable development concepts and themes serve as content and vehicle for students to learn and demonstrate critical thinking skills.

Since sustainability education facilitates learning for sustainability, students learning, and demonstration of critical thinking skills are the focus as this serves as the foundation (Shutaleva, 2023) to make reflections on practice and proposed actions towards sustainable development. As such, the function of sustainable development concepts and themes is to serve as a medium for students to demonstrate critical thinking skills (Weimer, 2002). On the given example of learning outcome earlier, the topic on investment strategies serves as the vehicle for students to learn and demonstrate problem solving skills.

4.1.4.5. Sustainability education focuses on the development of complex and metacognitive skills of critical thinking.

Since sustainability education aims to develop individuals who can make decisions and act based on sustainable development principles, complex and metacognitive skills are emphasized in the intended learning outcomes, teaching-learning activities, and assessment tasks, as these entail skills on synthesizing knowledge to make decisions and actions, as well as reflect on one's thinking and practice. Recognizing the importance as well of foundational and higher-level critical thinking skills as prerequisites, concept recognition and application are developed towards students' learning and demonstration of relational and extended abstract level of outcomes as these cultivate students' ability to relate different knowledge and tasks and develop new ways and methods in approaching sustainability problems and issues.

4.1.4.6. Context in learning outcomes provides opportunities for students to connect sustainable development concepts and values.

Context in the learning outcomes set conditions which then provide opportunities for students to connect sustainability to the topics and activities and therefore reflect sustainable development concepts and values. While content may be disciplinal at times, context provides flexibility to go beyond the orientation of specific disciplines and include interdisciplinary and transdisciplinary themes. In the example earlier stated, the condition of proposing investment strategies based on equitable distribution of wealth and resources relate the content to social, environmental, economic, and cultural dimensions of sustainability and thus reflect sustainable development concepts and values.

4.1.4.7. Teaching-learning activities provide opportunities for students to learn critical thinking skills constructively aligned to learning outcomes.

Teaching-learning activities lead students to achieving desired learning outcomes (Tungpalan & Antalan, 2021). Constructively aligning the set of activities means instructionally designing the learning environment in such way students will be learning and practicing the target sustainable development competencies and critical thinking skills. Input-based activities (e.g. lecture) when intended to teach students higher-level to complex and metacognitive skills defeat the purpose of such alignment as students are not provided opportunities to practice and demonstrate the target skills.

4.1.4.8. Assessment tasks provide opportunities for students to demonstrate, and for teachers to assess critical thinking skills constructively aligned to learning outcomes.

Constructively aligned assessment tasks provide evidence of students' achievement of leaning outcomes and demonstration of sustainable development competencies and critical thinking skills. Since sustainability education promotes development of decision-making, problem-solving, and reflection skills among students, many constructively aligned assessment tasks are expected to hit complex and metacognitive skills. Input-based activities such as graded recitation promote lower order thinking skills as it focuses on pre-package knowledge (Hattie & Yates, 2014).

4.1.4.9. Sustainability education operates within the student-centered learning paradigm.

Sustainability education operates within a learner-centered paradigm (Herranen et al., 2018; Komatsu et al., 2022; Tsogtsaikhan, Park, & Park, 2023). Sustainability education and student-centered learning can't be reduced to a teaching approach, method, or just learning activities. One's attempt to integrate and align with sustainable development competencies and critical thinking skills may not be done on a piecemeal basis as beliefs may contradict practice. Case in point are the misalignments between intended learning outcomes, teaching-learning activities, and assessment tasks. Implementation of student-centered-based activities should be consistent with one's belief about the role of teachers, learners, content, and their interactions. Being selective of what constitutes of the paradigm to apply in teaching and learning promotes practicality of whatever works but overlooks students' achievement of desired results and the goal of developing among students the awareness and critical examinations of existing structures and understanding which are priorities of education for sustainability (Thomas, 2009; Meisert & Böttcher, 2019).

5. Conclusions

Based on the results of the study, the following are drawn out key findings, contribution to knowledge, and practice.

- Each course has its own focus in terms of sustainable development concepts, critical thinking skills, values, and competencies. Thus, each course integrates and aligns with specific sustainable development constructs. However since sustainable development interrelates the social, environmental, economic, and cultural domains and are presumed to progress together, interrelation of these sustainable development constructs within an individual course and across different courses is needed as a very rigid curriculum, instructional design, and disciplinal teaching may not provide enough flexibility to integrate different and relevant sustainable development competencies as a whole.
- Outcomes-based teaching and learning provides the avenue to facilitate learning of sustainable development competencies and critical thinking skills. Synthesizing, building theories and claims, and decision making are some of the critical thinking skills for sustainability. However, these skills among other competencies are seemingly not captured in the learning outcomes of examined courses. This is due to the learning outcomes being treated as content-knowledge rather than demonstration of desired results as demonstrated on how they are structured and written. As such, there is a high level of misalignment observed between learning outcomes, teaching-learning activities, and assessment tasks of the courses. Moreover, vague, recurring, and very few types of content-based activities and assessments involving higher level and complex skills propelled the misalignment in the examined course plans.
- Teaching belief seems to influence the practice of integration and alignment to sustainability education. Teachers' beliefs about the aims of teaching and function of content are seemingly inconsistent with the aims of sustainability education and outcomes-based teaching and learning. While the latter aims for students to demonstrate critical thinking skills in the form of desired results, the former aims to prepare students for work and to master content. As such, focus on practical skills and content knowledge are emphasized rather than habits of thinking and decision-making. Moreover, content knowledge being viewed as both the end and the means seemingly influence how learning outcomes are understood and written. Thus, learning outcomes are treated as content knowledge rather than demonstration of skills.

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