



An Assessment of the Students in the Independent Study Course “Fun with Science Toys”

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Abstract

This study provides a blueprint for teaching an Independent Study 1 (IS 1) course. The primary objectives of this research were 1) to design an Independent Study 1 (IS 1: Research and Knowledge Formation) course, “Fun with Science Toys,” using participatory action research (PAR); and 2) to evaluate ten Mini-English Program (MEP) seventh-graders in this course using a hybrid grading system combining numerical and pass/fail (S/U) grades, as proposed by Amer et al. (2023). The research instrument utilized was an assessment scheme designed specifically for the course. Data were collected and analyzed in accordance with PAR principles, consisting of planning (P), action (A), and reflection (R) stages, followed by the hybrid grading assessment. The results revealed that the IS 1 course design should place a greater emphasis on assessment for learning rather than traditional testing. Furthermore, the findings concluded that in the absence of midterm and final examinations (which account for 40%), a pass/fail (S/U) grading system can effectively replace the numeric system.

Keywords: Independent Study Course, Participatory Action Research, Students’ Evaluation



Introduction

Given that 21st-century information technology has evolved rapidly, 20th-century instructional methods are no longer viable in this modern era. When such outdated methods are employed, students struggle to think independently and apply their knowledge—a consequence of twelve years of educational underdevelopment marked by a weakly integrated teaching model and a lack of creative thinking skills (Sopitthammakun, 2019). Concurrently, the key problem of Thai education (Committee Steers National Education Reform, 2017) is that Thai students lack creative thinking in their practice, which ultimately hinders Thailand's international competitiveness.

At Panyaworakun School, the word “wisdom” is embedded in the school’s philosophy, identity, and vision statements. The school aims for students to be innovative and capable of producing creative works. The school’s vision is that innovation leads to wisdom, knowledge development, and international recognition. The school also strives for students to become virtuous Thai citizens, exhibiting exemplary Thai manners and the Thai spirit.

For this reason, the Independent Study (IS) course is essential for world-class standard schools. Koomkaew et al. (2019) defined world-class standard schools as institutions that provide instruction focusing on cultivating students with desirable characteristics comparable to global standards. Panyaworakun School is one of these world-class standard schools. Regarding students as world citizens—the most critical outcome of such schools—Chaengchenwet (2010) noted that the Ministry of Education outlines five key attributes: academic excellence, bilingual communication, progressive thinking, creative production, and global responsibilities. Therefore, the school piloted the IS 1 course with ten Mini-English Program (MEP) seventh-graders. This course aligned with teacher planning for instructional development and learning activities that support learners in developing creative thinking and projects, in accordance with the administrative conditions for world-class standard schools in the Secondary Educational Service Area (Koomkaew et al., 2019). Through periodic and regular



learning assessment (Koomkaew et al., 2019), students were able to produce projects and innovate for the benefit of themselves and society, embodying the spirit of progressive-thinking world citizens (Chaengchenwet, 2010).

At the beginning of this project, the teacher-researcher lacked specific instructional techniques for the IS course, despite the school's institutional support across all learning areas. Furthermore, no centralized school resources were available because each individual learning area designed its own IS curriculum. In the Foreign Language Department (FLD), the teacher-researcher therefore developed simple paper toys tailored to the ten MEP seventh-graders. Because the Independent Study 1 (IS 1) course was a new subject, the teacher-researcher's primary objective was to develop a comprehensive course syllabus, instructional media, assessment and evaluation frameworks, and a teacher's guidebook.

To design the Independent Study 1 (IS 1: Research and Knowledge Formation) course, "Fun with Science Toys," Chookhampaeng's (2017) participatory action research (PAR) method was employed. This approach comprised planning (P), action (A), and reflection (R) stages, followed by an assessment for the ten MEP seventh-graders using a hybrid grading system that transitions from numerical to pass/fail (satisfactory/unsatisfactory) grades. Through PAR, the study titled "An Evaluation of the Mini-English Program (MEP) Students in Independent Study 1 (IS 1) Course: 'Fun with Science Toys'" represents first-hand knowledge generated by the teacher-researcher. In the planning (P) stage, Chookhampaeng (2017) explained that the process involves identifying participants, selecting innovations, designing the innovation itself, and developing lesson plans. In the action (A) stage, notes and feedback were recorded, while in the reflection (R) stage, quantitative data were analyzed alongside the students' evaluations (Chookhampaeng, 2017).

In the current study, the teacher-researcher aimed to investigate how to comprehensively assess MEP students in the IS 1 course, "Fun with Science Toys." The approach identified in this research provides a practical guideline for educators designing



assessments for Independent Study 1 (IS 1) courses. Specifically, this study offers an evaluation model to assist teachers who face challenges in grading students within the IS framework. Regarding course design, available tests and assessment-for-learning methods were analyzed to define the characteristics of an IS 1 course that emphasizes formative assessment over traditional testing. This alignment conforms to Koomkaew et al.'s (2019) academic administration model for world-class standard schools under a secondary educational service area. Guided by the reflection (R) stage of Chookhampaeng's (2017) PAR model, the teacher-researcher implemented Dechakupt and Yindeesuk's (2014) assessment-for-learning scheme, which features five distinct variations. Ultimately, this study serves as a blueprint for future IS 1 instructors, enabling them to effectively design courses and evaluate learners using a hybrid grading system that transitions numerical marks into pass/fail (satisfactory/unsatisfactory) grades.

Literature Review

The Grading System, the Gradeless System, and a Hybrid System

A grading system is typically a points-based framework used to assess students' degree of learning, accomplishment, or proficiency (Earl, 2022). Such systems can be implemented using either numeric scales (4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, and 0.0) or letter-based criteria (A, B+, B, C+, C, D+, D, and F).

A gradeless system, in contrast, eschews the quantitative grading characteristic of numeric and letter-based systems, instead utilizing 'Pass' or 'Fail' designations on a transcript (Amer et al., 2023). Alternatively, 'Satisfactory' (S) or 'Unsatisfactory' (U) may be employed. Upon receiving formative feedback, students continually revise and resubmit their work until it meets the established 'Pass' or 'Satisfactory' standard.

Cain et al. (2022) stated that although traditional tiered grading systems (i.e., A, B, C, etc.) motivate students to learn and provide them with feedback, grades can adversely affect student motivation, and they are not an effective form of feedback. To solve these two problems of



traditional tiered grading systems, Cain et al. (2022) suggested that “instead of using grades as an external reward to motivate students, we should focus more on cultivating intrinsic motivation, and grades should be separated from feedback because of the tendency to focus more on grades than on feedback.”

Besides numeric, letter-based, and gradeless systems, a hybrid framework can be employed as a viable compromise. Amer et al. (2023) pointed out that “one could also incorporate a hybrid system that allows students to choose between having a letter grade or a pass or fail on their transcript at the end of the semester based on what they believe is advantageous.”

This current study attempted to overcome problems inherent in grading systems by utilizing a hybrid system. However, such hybrid systems do not conform to the standard secondary education system in Thailand. This research thus only provides a blueprint of a hybrid system that was applied to the small group of students who participated as pilot learners in the IS 1 course, which was designed based on Chookhampaeng’s (2017) participatory action research (PAR). In this study, after the numeric grading system (4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, and 0.0) had been reported to the students in 2018, Amer et al.’s (2023) hybrid system of translating the numerical grades into a pass/fail (satisfactory/unsatisfactory) grading system was employed in 2024.

Past Studies and Theory on the Grading System, the Gradeless System, and a Hybrid System

Amer et al. (2023) examined gradeless learning in higher education. In addition to incorporating a hybrid system that can be reciprocal, they preferred the gradeless system to the grading system because of the benefits of gradeless assessments involving detailed qualitative feedback on student performance. The advantages of gradeless assessments noted were: (1) to reduce students’ cognitive load, (2) to enhance students’ well-being, (3) to support students’ learning, (4) to encourage students to collaborate with one another, and (5) to mitigate peer competition.



The current research employed the hybrid assessment system proposed by Amer et al. (2023). In other words, students could choose between having numeric grades, pass/fail options, or satisfactory/unsatisfactory designations on their transcripts. Although this hybrid system is not currently implemented in practice, it serves as a viable model that can be utilized to transition between grading and gradeless systems.

Therefore, in accordance with Amer et al. (2023), this hybrid framework was applied to the ten MEP seventh-graders in the IS 1 course as an evaluative experiment prior to potential large-scale implementation in the future. Through this approach, the traditional grading system and the pass/fail (P/F) framework complement each other within the context of the current study.

Objectives of the Study

This study was carried out with the following objectives:

1. To design an Independent Study 1 (IS 1: Research and Knowledge Formation) course through participatory action research (PAR).
2. To assess the learning of the ten Mini-English Program (MEP) seventh-graders in this IS 1 course using a hybrid grading system.

Methods

The IS 1 course integrated Fried-Booth's (2003) project-based learning approach into Chookhampaeng's (2017) participatory action research (PAR) method, which consisted of planning (P), action (A), and reflection (R) stages. This was followed by a student assessment utilizing a hybrid grading system that transitions from numerical marks to pass/fail (S/U) grades. Ultimately, this integration aimed to assist the ten MEP seventh-graders in enhancing their thinking skills, particularly for creative learning (Dankongrak, 2024).

The Students' Evaluation

Materials

Materials used in the evaluation of the ten MEP seventh-graders in the IS 1 course, "Fun with Science Toys," consisted of a sample assessment scheme and instruments both



with and without scoring rubrics. An assessment scheme for the Independent Study 1 (IS 1) course, “Fun with Science Toys,” is presented in Table 1.

Table 1: An assessment scheme for the Independent Study 1 (IS 1) course: “Fun with Science Toys”

What to Assess	Instrument		Percentage
	No Rubrics	Analytic Scoring Rubrics	
Cognitive Domain (Knowledge and Comprehension)			
- Exam Evaluation	- A midterm examination paper (20%)	-	40%
	- A final examination paper (20%)		
Psychomotor Domain (Practice and Skills)			
- Making and Presenting a Poster (End-Product)	-	- The criteria of work evaluation and presentation	10%
- Participation in IS 1 Symposium	-	- The criteria of project presentation	10%
- Class Participation	-	- The criteria of group discussion evaluation	10%
Affective Domain (Virtue and Attitudes)			
- Class Attendance	- The class attendance checklist	-	10%
- Working in Groups	- The group works	-	20%
- Collaboration	evaluation form		
Total			100%

Source: Adapted from assessment for learning with 5 variations (Dechakupt & Yindeesuk, 2014)



As shown in Table 1, the sample assessment scheme consisted of the following assignments: Midterm examination (20%), final examination (20%), making and presenting a poster (end-product) (10%), participation in the IS 1 symposium (10%), class participation (10%), class attendance (10%), and working in groups and collaboration (20%).

Procedures

The assessment procedures were structured as shown in Table 1, categorizing learning into three domains: (1) the cognitive domain (knowledge and comprehension); (2) the psychomotor domain (practice and skills); and (3) the affective domain (virtues and attitudes) (Dechakupt & Yindeesuk, 2014). Consequently, the instructional evaluation strictly prioritized these three domains throughout the course implementation.

Cognitive Domain (Knowledge and Comprehension)

(1) The students took the midterm examination on the designated date for the IS 1 course. To pass this examination, students were required to achieve a minimum score of 10 points. If they scored below 10 points, they were granted a second attempt to reach the passing threshold.

(2) The students took the final examination on the scheduled date for the IS 1 course. The maximum score was 20 points, with only one opportunity allocated for the final examination.

Psychomotor Domain (Practice and Skills)

(1) The students submitted a poster and presented it at the IS 1 symposium arranged at the school. Within these collaborative activities, the ten MEP students had the option to resubmit their poster. They received continuous feedback from the teacher-researcher until their poster and presentation rehearsals reached a satisfactory level, in accordance with the established criteria for poster and presentation assessment (Arayaphan, 2008).



(2) The students participated in the IS 1 symposium arranged at the school, where they presented their posters individually within an authentic environment. Unedited by prior rehearsals, each student's final performance was evaluated using the project presentation criteria (Arayaphan, 2008).

(3) In the classroom, students were assessed on their group discussions during each instance of sharing ideas with peers. The teacher-researcher observed and recorded notes on each student's participation, subsequent to which they were evaluated based on the group discussion assessment criteria (Arayaphan, 2008).

Affective Domain (Virtue and Attitudes)

(1) Students' attendance was verified during each class session and the IS 1 symposium, excluding the two examination days. The course comprised forty periods across twenty weeks, with every four periods (55 minutes each) equivalent to one point. Scores were rounded down to the nearest whole integer, and attendance was documented utilizing the standardized class attendance checklist prepared by the school's academic affairs department.

(2) The ten students were divided into two triads and one group of four. Group 1 developed paper windmills, Group 2 constructed paper helicopters, and Group 3 designed spinning paper plates. The teacher-researcher, acting as timekeeper, recorded the spinning duration of each toy across three distinct trials for all three categories. Ultimately, the three groups were evaluated using the standardized group work evaluation form (Youngsathian, 2017).

(3) Subsequently, students' scores across the cognitive, psychomotor, and affective domains were aggregated. Each student was graded using the eight-level numeric grading system (4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, and 0.0). Final course grades were awarded based on the following criteria: Grade 4.0 (80%–100%), Grade 3.5 (75%–79%), Grade 3.0 (70%–74%), Grade 2.5 (65%–69%), Grade 2.0 (60%–64%), Grade 1.5 (55%–59%), Grade 1.0 (50%–54%), and Grade 0.0 (below 50%).



(4) Once the ten MEP seventh-graders obtained their grades from the numeric grading system, the exam components (40%) and the assessment-for-learning elements (60%) within the IS 1 course design were analyzed using frequencies, percentages, mean scores (*M*), and standard deviations (*S.D.*). This analysis aimed to determine whether examinations or assessment-for-learning methods were more emphasized in this IS 1 course.

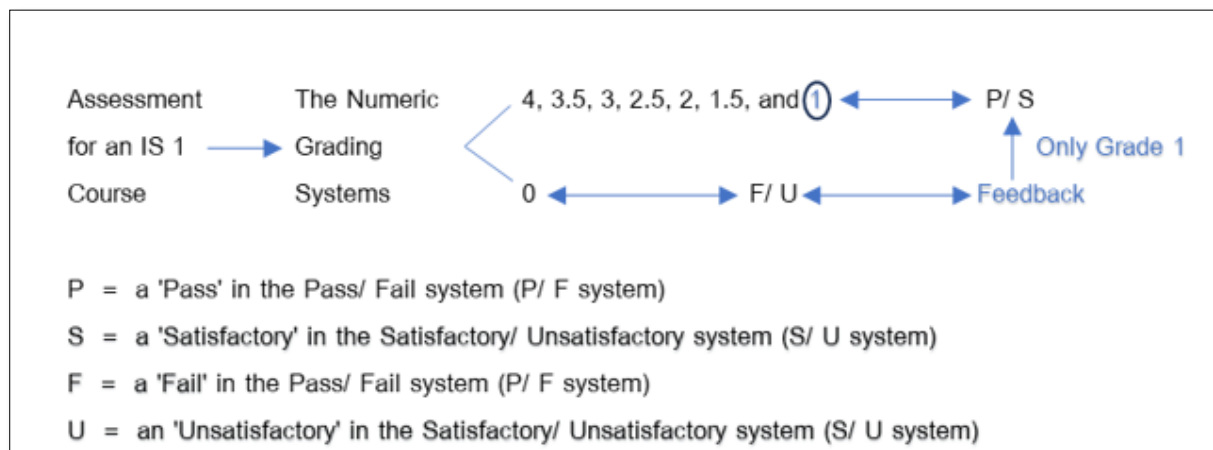


Figure 1: Hybrid Assessment System

Source: Adapted from Amer et al. (2023).

Results

The assessment results of the Independent Study 1 (IS 1) course, “Fun with Science Toys,” regarding examinations, students’ grades, and the hybrid system are presented in Tables 2, 3, and 4, respectively. The scores obtained through examinations (40%) and formative assessment for learning (60%)—including poster presentation (10%), symposium participation (10%), class participation (10%), class attendance (10%), and group collaboration (20%)—are shown in Table 2 to compare testing and assessment-for-learning outcomes and to determine which approach was more emphasized. The students’ grades in the numeric grading system are presented in Table 3. The hybrid system converting numeric grades (4.0, 3.5, 3.0, 2.5, 2.0, 1.5, 1.0, and 0.0) to pass/fail grades is illustrated in Table 4.



Table 2: The Tests and Assessment for Learning of the IS 1 Course Design to Find out Which One Is More Emphasized.

No.	Name	Tests		Assessment for Learning					Total (100)
		Exams (40)	Work (10)	Project (10)	Discuss (10)	Attend (10)	Group Work (20)	Total (60)	
1	C, P	27	9	8	10	9	17	53	80
2	T, K	24	9	9	9	10	19	56	80
3	T, D	22	9	8	9	10	18	54	76
4	P, Y	22	9	9	9	9	20	56	78
5	W, A	26	9	9	9	10	18	55	81
6	W, S	25	9	9	9	10	20	57	82
7	S, C	22	10	10	9	10	17	56	78
8	P, F	24	9	9	9	10	20	57	81
9	C, Y	22	10	10	10	10	18	58	80
10	R, C	28	10	10	10	10	20	60	88
-	Percentage	60.50%	-	-	-	-	-	93.67%	80.40%
-	<i>M</i>	24.20	-	-	-	-	-	56.20	80.40
-	<i>S.D.</i>	2.25	-	-	-	-	-	1.99	3.20

Table 2 indicates that the test component accounted for 60.50% of the total score ($M = 24.20/40.00$, $S.D. = 2.25$). Conversely, the assessment-for-learning component yielded 93.67% ($M = 56.20/60.00$, $S.D. = 1.99$). Consequently, the performance in assessment for learning was substantially higher than that of the traditional examinations. The IS 1 course design, therefore, places a significantly greater emphasis on assessment for learning rather than testing.



Table 3: The Students' Grades in the Numeric Grading System Consisting of Eight Levels

No.	Name	Exams (40)	Work (10)	Project (10)	Discussion (10)	Attendance (10)	Group Work (20)	Total Score (100)	Numeric Grade
1	C, P	27	9	8	10	9	17	80	4.0
2	T, K	24	9	9	9	10	19	80	4.0
3	T, D	22	9	8	9	10	18	76	3.5
4	P, Y	22	9	9	9	9	20	78	3.5
5	W, A	26	9	9	9	10	18	81	4.0
6	W, S	25	9	9	9	10	20	82	4.0
7	S, C	22	10	10	9	10	17	78	3.5
8	P, F	24	9	9	9	10	20	81	4.0
9	C, Y	22	10	10	10	10	18	80	4.0
10	R, C	28	10	10	10	10	20	88	4.0

As shown in Table 3, all students achieved final numeric grades of either 4.0 (70%) or 3.5 (30%). With regard to these academic outcomes, a hybrid framework that serves as a viable model to transition between the eight-level numeric grading system and the two-level pass/fail (P/F) or satisfactory/unsatisfactory (S/U) system is demonstrated in Table 4.



Table 4: The Students' Grades in a Hybrid System for an Evaluation in an IS 1 Course

Numeric Grade	Score Range	Pass / Satisfactory (S)	Fail / Unsatisfactory (U)	Total Students (n)	Percentage (%)
4.0	80%–100%	7	0	7	70.00%
3.5	75%–79%	3	0	3	30.00%
3.0	70%–74%	0	0	0	0.00%
2.5	65%–69%	0	0	0	0.00%
2.0	60%–64%	0	0	0	0.00%
1.5	55%–59%	0	0	0	0.00%
1.0	50%–54%	0	0	0	0.00%
0.0	Below 50%	0	0	0	0.00%
Total	-	10	0	10	100.00%

Table 4 illustrates the application of the hybrid grading framework to convert numeric scales into binary outcomes. The data demonstrate that 100% of the pilot learners (all ten students) successfully translated their academic performance into the 'Pass' or 'Satisfactory' (S) designation. Specifically, seven students (70.00%) from the Grade 4.0 bracket and three students (30.00%) from the Grade 3.5 bracket met the established threshold, with zero occurrences of 'Fail' or 'Unsatisfactory' (U) outcomes. This empirical evidence validates that the hybrid system can function as an effective bridge between traditional numeric grading and gradeless competency assessment within the IS 1 curriculum context.

Discussions

1. The primary focus of the IS 1 course should not be standardized tests (such as midterm and final examinations); instead, the curriculum must concentrate on independent study, creative thinking, project development, and periodic, regular evaluation (Koomkaew et al., 2019). The findings of the present study clearly indicated that the scores from the assessment-for-learning component were substantially higher than those of the examinations.



2. Consequently, the true core of the IS 1 course resides in assessment for learning. For this reason, it is inappropriate to implement IS courses through traditional schooling models that narrowly focus on improving students' performance in examinations. Rather, the emphasis of IS courses ought to be on instructing students to think creatively and to produce innovations, in accordance with the school's philosophy, identity, and vision.

3. Regardless of whether IS course students receive a "Pass/Satisfactory" grade, they can be shown their numerical grades if necessary—for instance, when applying for scholarships. Conversely, in cases of a "Fail/Unsatisfactory" outcome, students can opt not to view or receive numerical marks to safeguard their psychological well-being.

For example, students who achieve a grade of 3.5 may experience less stress, anxiety, burnout, and depression if they only receive a "Pass/Satisfactory" designation, because for some learners, seeing a 3.5 instead of a 4.0 can be discouraging. Therefore, within the context of the present study, for the students who scored a 3.5, displaying only a "Pass/Satisfactory" status on their transcripts could be highly beneficial for their well-being and intrinsic motivation. A hybrid system allowing students to select between a "Pass/Satisfactory" grade and a numerical grade based on their preference is thus advantageous for learners (Amer et al., 2023; Lyboldt et al., 2023). Pass/fail grading fosters intrinsic motivation and self-direction; conversely, numerical grading supports extrinsic motivation and self-improvement, except when it engenders unhealthy competition (Melrose, 2017).

In keeping with a hybrid grading system, it is highly beneficial if students can choose, for each subject, whether their performance is displayed using a Pass/Fail (P/F) or Satisfactory/Unsatisfactory (S/U) designation on their transcripts. This flexibility is particularly crucial when students are concerned about lower marks owing to their inability to perform well in midterm and final examinations (40%). Under these circumstances, those who underperform in tests can opt for binary grading. As discussed by Cain et al. (2022), numerical grades can exert adverse effects on student motivation, as they often fail to serve as an effective form of feedback. However, binary grading also carries drawbacks; these include a



lack of recognition for high-achieving students, a less precise reflection of specific learning attainment compared to numerical scales, the risk of critical course objectives going unmastered and undetected, and potential declines in classroom attendance (Melrose, 2017). Considering these diverse perspectives, both evaluation methods effectively complement each other within a hybrid system, as argued in this study.

Recommendations for Further Research

Future research could involve interviewing students regarding what they have learned within the IS 1 course, alongside surveying their opinions and satisfaction levels. With these multiple data sources, rigorous data triangulation can be performed. Furthermore, similar studies could be carried out with a larger cohort of students, such as those in general education or gifted programs across a variety of academic tracks.

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