



# Legal classes of a different nature: Impacts of active learning environments on interdisciplinary conservation education

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## ABSTRACT

Active Learning involves more than listening; it requires engagement. Technically speaking, it occurs through engagement in appropriate cognitive processing during experiences and is often summarized by the adage “learning by doing” (in a classroom sense, through simulated exercises, small group exercises, or role-playing; Cicero). These techniques are contrary to more traditional teaching styles, including lectures, which often depend on the effectiveness of the person teaching. The professor often provides information in a lecture while students listen and passively take notes; “Passive Learning” (PL). Modern classrooms feature both PL and AL in varying degrees, with a baseline for both being an ability to ask and answer questions. Graduate studies, including law, may apply more AL strategies than preceding grade levels, but there are calls for increasing this amount. Legal courses focused on environmental matters provide a unique opportunity to answer this call, given the prominence of environmental issues in the zeitgeist, the tangibility of nature, and how such matters can be approached.

**Keywords:** Active Learning, Role playing, Grade levels, Tangibility of nature; Environment

## INTRODUCTION

This work contributes to the discussion of AL use at the graduate level by comparing the effects of an ALE on self-identified AL and PL learners from an immersive environmental law course in Belize. The background of active learning is first discussed, including a review of pertinent active learning research, its use in schools, and the processes that support its acclaim. Next, applying the resultant framework to the law course evaluates its ability to create an ALE, as outlined by relevant literature, and subjectively create a valuable experience. The latter is evaluated utilizing survey data collected from the students pre- and post-experience and analyzed through T-tests in SPSS 22. Finally, the analysis presents interpretations and recommendations (Auster E, et al., 2006).

## LITERATURE REVIEW

Active learning promotes higher levels of thinking, which can be furthered by a student’s understanding of their

cognitive processes: “Metacognition”. Active learning, specifically, is a heuristic for kinesthetic metacognition, the primary application of which targets deeper involvement of students in the classroom. It is a paradigm that contrasts students’ “traditional” role as passive recipients of information and instead turns them into self-reflective, active participants in knowledge accumulation (Baker B, 1994). Active learning based theories shift focus from instructor centered classrooms to student centered environments with stimulation of self-exploration, expression, and knowledge accumulation as desired outcomes. This shift requires obtaining experiences with instructors and peers that assist in thinking about the subject matter. Acting upon those thoughts continues this process, and reflecting upon relevant actions concerning the subject matter creates a cyclical learning pattern that generates greater motivation and involvement (Ballen C, et al., 2017).

Active learning, as generally understood in the above terms, is widely considered the process that higher

education should seek to encourage. However, no agreed upon learning theory or curriculum utilizing experiential techniques can be considered “fully developed”. A “fully developed” curriculum would draw upon varying active learning theories and methods, adopting and dismissing them based on the subject material and course topic, and consider activities both outside and inside the classroom, including mock trials and other forms of simulation such as role playing or community service. This range can be considered as a continuum with levels of involvement and degrees of self-monitored understanding, from actively listening to guest lecturers, note taking, asking questions, and synthesizing concepts, all the way to actualizing comprehension in simulation or real life (Blaustone B, 2006).

In 2010, Eison outlined some of the generally accepted goals of active learning instructional strategies. He noted the context and the resulting methodological shifts, noting the importance of creating the opportunity to apply and demonstrate the accumulated knowledge and receiving instant feedback. This feedback, whether from internal dialog or external sources such as peers and instructors, is essential as “learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world” (Bloom B, et al. 1971).

### Eison’s Active Learning Outline

**Instructional strategies:** These should compel students to think critically or creatively, verbalize ideas in exchanges with others, write out their thoughts, remain conscious of their values and attitudes, give and receive feedback, and reflect on the entire learning process.

**Context:** Tasks inciting the above should compel students to complete them in and outside the classroom, as individuals and groups, and with and without assistive tools and technologies (Boyle RA, 2003).

**Methodological shifts:** This places certain demands upon the instructor, compelling them to allocate more time to assisting students with self-reflection and developing understanding skills instead of simply transferring surface level information on a topic.

### Origins of Active Learning Environments

The idea of “learning by doing” was documented in the early 1900’s; however, facets of active learning and its underlying functions were not given more formal treatment until later, beginning with Bruner’s mid-century works describing autonomous learning through cognitive modes of representation. This theory emphasized learning environments replacing out of context, abstract instruction (typical of passive learning) with self-reflection and authentic tasks in meaningful contexts. Following this reasoning, Tulving and Thomson’s “encoding specificity” principle stressed relevance of situation to memory/recall, theorizing that experiencing conditions (*i.e.*, the environment in which one encounters

something) and pre-existing knowledge control how the brain encodes new information (and thus its accessibility). Bonwell and Eison reviewed these theories and related empirical research to demonstrate the nature of active learning and its potential as a tool for educators. Baker further highlighted the importance of context by showing that students taught within an environment decontextualized from real world application neglected the holistic experience, subverting the encoding process and the opportunity to construct schemata of representative problems and solutions (Bradberry L, et al. 2019). Shepelack foresaw the need for innovative and varied techniques to assess the higher order thinking levels derived from such innovative methodologies. Meanwhile, Miller and Grocchia utilized direct controlled comparison of passive and active based methodologies in a college level biology course to find that the latter resulted in higher satisfaction levels. McCarthy and Anderson repeated similar experimentation in history and political science courses using group role play and peer discussion groups to find more significant satisfaction levels and higher degrees of preparation, participation, and (ultimately) performance (Bruner J, 1960).

In light of these and other findings, Chickering and Gamson highlighted the lack of creation and implementation of active learning theories. In the same vein, Cherney emphasized the need for greater application of diverse teaching techniques, drawing attention to the fact that students have varying degrees of self-awareness and networks of mental representation (Campbell M, et al. 2008). Boyle supported furthering active learning implementation due to its ability to reorient attention to the importance of reflection and expand beyond a focus on the material to metacognition, despite the process possibly being different for every student. Cavanagh sought to quantify these claims after using active learning techniques for extended periods and designed a survey to capture students’ perceptions about their learning processes rather than what they learned. The results indicated that students valued engagement, were conscious of the activation of deeper analytical thinking, and ultimately had an improved understanding of their learning processes and the material.

### Benefits of Active Learning Environments

Rote memorization is the first level of knowledge acquisition, comprehension and application indicate higher levels of learning, while evaluation, synthesis, and analysis signify cognition. Active learning in ALE is beneficial because it aids in developing the ability to perform these later skills during subject mastery and trains learners to recognize applicable scenarios for advancement and the necessary skills to identify and appropriately approach complex topics. This “training” occurs as self-reflection gradually develops mental “networks” of nodes where new information assimilates.

The learner specific connections to existing information reflect the freedom associated with active learning theories that encourage learners to consciously and subconsciously gravitate toward their appropriate learning strategy. While this appears to necessitate a base upon which to build subsequent knowledge, thus favouring those in upper level courses, research highlights preferences for, and the benefits of, active learning to different levels of learning and material comprehension (Carini R, et al. 2006).

Numerous researchers have experimented with active learning in different ALEs. For example, McKeachie et al., performed a meta-analysis of experiments gauging retention at a basic level after a course using measures of problem solving, thinking, attitude change, or motivation for further learning, with results showing support for active learning discussion methods over (passive) lecture. Machemer and Crawford compiled these and other results and found that AL in a cooperative environment fosters positive student attitudes towards the subject and learning and higher academic achievement, as well as several other benefits. However, they tempered their findings with caution: Some studies found that students valued active learning exposure and the lecture (passive) components of classes equally (Cavanagh M, 2011).

### Active Learning Environment Neuroscience

Active learning's premise is that students are not "blank slates" but use preconceptions, experience, and knowledge to categorize new information. Active learning research indicates this combination produces neural networks in the same manner as children first experiencing the world, whether or not there is a previous experience foundation (*i.e.*, existing networks). Advancement is not based on modifying an existing conception but rather on reconceptualization in combination with new stimuli (Ceci S, et al. 1992). This process contrasts passive "memorization," implying that active learning shapes neural networks toward cognition. This notion also implies the impossibility of a sole reasoning process given the complexity of the necessary reconstruction as nested in simultaneous plural examinations of the "new" concept. Information is not assimilated in individual fragments but rather experienced as portions of a larger environment, with parts gaining meaning instantaneously from the whole.

Real world situations provide the mind with diverse inputs; through the resulting "dilemmas" of experience, neural pathways form, and understanding is attained. Cognitive science has shown this to have greater long term value than rote memorization, especially for those consciously applying metacognition to such "self-created schemata", in other words, a focus on current experiences in relation to existing knowledge. While information is present in every experience, the applicability of resultant information gain is diminutive

without this self-reflection/metacognition (Cherney I, 2008). Information gain, however, does not imply knowledge gain. Some experiences, such as those in environments created through passive learning methodologies, may be mis-educative if disconnected from situations at least mimicking the context of real applicability, thereby underlying disintegrated habits that can hinder the development of knowledge. As reducing the complexity of a situation eliminates information that enriches cognition and changes the quality of the whole, maximization of learning requires the creation of dilemmas that allow students to contemplate various approaches and construct new solutions (Chickering A, et al. 2002).

### Active Learning Environments in an Education Context

The deeper level of comprehension and increased confidence with class materials facilitated through active learning theories does not negate the necessity of lectures. Rather, it requires the inspiration of appropriate reflection levels during these lectures and supplementation with various cooperative activities. Chickering and Gamson situated this strategy in the broader university context with "seven principles for good practice in undergraduate education," which promotes educators expanding from material providers to taking responsibility for creating an environment that engages students in higher order thinking tasks such as analysis, synthesis, and evaluation (Cicero J, 1989).

The successful promotion of ALE in the classroom involves a four dimensional approach involving setting the appropriate context, preparation, delivery, and a standardized means for continual improvement. This approach centers the educator's role in selecting material that connects with students' previous experiences, thereby guiding the progressive expansion of knowledge. Several strategies facilitate this ALE conception, such as guest speakers, connection with current events, contests, cumulative assessments, cooperative learning, and integration of debates or small group discussions. In addition, simply instigating dialog calls upon students to clarify (and thus organize) thoughts and actively process the viewpoints of others, processes amplified in case studies and simulations. Success in this regard often involves simultaneously utilizing multiple and varied approaches to accommodate diverse learning styles, continually recognizing student experiences as they progress, and adapting subject matter to fit. Ultimately, as students confront and discuss conflicting opinions, engaging in the necessary reflection and verbalization processes, they develop more awareness of themselves as learners (metacognition) (Clark R, et al. 2008).

For some, identifying more closely with peers than professors furthers learning. Some programs amplify this dynamic and rely on peer instruction, often more successfully than contrasting systems based on

instructional professionals. Moreover, such interaction style adjustment prepares students for participation in the interdisciplinary teams frequently utilized in the “real world”. This type of purposeful engagement in undergraduate curriculums produces not only higher grade point averages but self-image enhancement, psychosocial improvement, real-world competence, intellectual dexterity, social capital increases, personal ethic strengthening, and advanced environment acclimation, as well as productive racial and gender identity formation. These factors reinforce development by increasing motivation and heightening integration and differentiation in storing knowledge (Cohen J, 1998). Such advantages (or at least the accompanying levels of enjoyment experienced with success) are recognized by students, with numerous studies gauging student opinion showing results preferential to active learning strategies rather than traditional lectures. The active learning educator’s imperative is to maintain the continuity of such contextualized experience based environments long enough to allow students to engage with the process and maximize potential benefits fully.

### Active Learning Environments in Law School

Beyond student preference for active learning, ALE correlate with improved academic performance. For example, while law school admission test scores and undergraduate grade point averages correlate with first-semester law school grades, Hatamyar and Sullivan found ALE session attendance more strongly and significantly positively related to grades throughout law school experiences. The U.S. law school admissions council’s recommendation that law schools adopt active learning practices displays an appreciation for the fact that such courses help students better understand their metacognitive abilities and learning processes. As ALE improve, the forum for learning strengthens the ability to learn, and its value exceeds academic application; knowing how to best learn from experience benefits all professionals, particularly lawyers. Continuing legal education requirements, a mechanism that requires lawyers to reflect on professional progress and continue to learn, convey this understanding (Cohen M, et al. 2019).

Building these skills during law school, including the ability to transfer knowledge between contexts, requires the provision of materials in unique environments and that students interact with said material in multiple ways. The “case method,” calling on students to apply their knowledge of methodologies in discussions about real-world scenarios, partially accomplishes such skill building. The Socratic method, which is only “active” for the individual engaged with the professor while the class watches passively, is often the other applied method. The passive learning nature of traditional legal education lacks the emotional relevance that creates deeper engagement that mirrors real world lawyering tasks.

Unsurprisingly, devising effective law school learning theories that engage the whole class can be challenging.

With this understanding, Hess developed seven principles of good practice in legal education around Chickering and Gamson’s seven principles for good practice in undergraduate education, continuing the latter’s focus on active learning and its compliments. Hess elaborated by detailing how active learning develops the cognitive tools typically sought in legal education: Thinking skills, content mastery, professional skills, and attitude. In the context of law school, active learning theories:

- Benefit critical thinking by increasing students’ capacity for interpreting and making decisions about facts, arguments, and conclusions.
- Benefit content mastery by providing frequent opportunities to examine and articulate comprehension of new concepts.
- Benefit professional skills by allowing for tangible experiences, obtainment of feedback, reflection, assimilation of experience, and testing of newly developed understandings.
- Benefit attitude through increased enjoyment of subject matter, appreciation and tolerance of different perspectives, and motivation.

Increased motivational and emotional interface with material improves memory of experientially derived knowledge as the associated adrenaline, resultant of real world pressures, produces greater imprinting effects. Furthermore, the increased motivation, engagement, and enactment (synthesis and use) resulting from confronting genuine dilemmas are necessary to develop professional expertise. Beyond the Socratic and case methods, there are several commonly employed law school procedures reaching varying degrees of engagement that are improvable with active learning awareness and a reflective orientation by participants, that include: Discussion, writing exercises, simulation, and real life experiences (such as clinics, externships, and field trips) (Cooper KM, et al. 2018).

Discussion enhancement can occur through structured controversy. Students can research, advocate, and openly discuss their position, seeking agreement while creating a personal emotional context. Speaking in these scenarios requires clear thinking, and listening to others clarify their thoughts induces empathy, which allows for deeper reflections about alternative viewpoints. Basing discussion in real-life occurrences (informed by videos, guest speakers, or legal documents) adds further value through tangibility and facilitates reflection *via* connections made to standardized materials. This approach is mimicable in written responses; writing out thought processes during discussions can help solidify knowledge by requiring processing through alternate means. Further, having students comment on their written assignments and explain the thought processes

behind statements trains metacognition and improves engagement (Deslauriers L, et al. 2019).

Knowledge gained in classroom settings cannot fully replicate the interactive processes derived from experience. The complexity of reality, as opposed to the typical organized presentation manner of class materials, enhances the relationships between teachers and peers and heightens emotional engagement and motivation, further strengthening the active learning context. Avenues allowing law students to obtain real life experiences include field trips and clinics (including mechanisms such as simulations, legal aid, and externships), many of which provide reflection by including a classroom component. Field trips can produce authentic connections between actual life experiences and materials that may seem abstract in the classroom. Clinical work often follows a progression that begins with simulation and evolves toward legal aid and externships, boosting active learning through relevancy to student interests.

Simulations involving role playing within manufactured conditions that seek to emulate situations experienced by practicing attorneys can further enhance ALE by clearly defining: Temporal boundaries, the explicit focus of the assignment, and periods for reflection. The resulting emotional and motivational states of these experiences can positively affect learning and memory by imparting meaning and memory. Furthermore, because real world geographic and temporal constraints are alterable and the consequences for errors are minimal, simulations can be optimized for specific learning goals and allow students more freedom to express themselves. Active learning based simulations can provide educational value by giving context and helping to provide experiences essential to learning, including the taking in of information, integrating it with what already exists, and the future recall of this "new" schemata when needed.

Mock trials can generate new schemata by developing comprehension through the experience of making arguments and discussing moral issues in a contextualized setting. Being challenged by moral issues through debate can aid students in confronting their ingrained assumptions and reshaping existing schemata through switching between modes of reflection and action and feeling and thinking. Though mock trial scenarios need not mimic a real world case, the educator should strive for intellectual continuity in maintaining the context and experience of the environment. However, using an actual case can further enhance reflection, with parallels and dissimilarities compared to the actual outcomes and other intricacies surrounding real world results.

The structured ambiguity of a mock trial should employ a continuing flow of realistic dilemmas, with an authentic experience gained through immersion into the simulation. With the goal of a mock trial in mind, it is important to:

- Assign students roles within their "zone of proximal development".
- Provide a sense that each role makes a difference in the proceeding.
- Take steps to assure each student can identify with their role.

Achieving these goals requires the application of great care in simulation design. The last step, feedback, requires reflection by the students, improves attitudes through a sense of empowerment, and allows for the improvement of future iterations. This feedback helps instructors as they seek to recreate the demands upon real world legal practitioners, usually experienced through on location learning such as externships. To this end, Ferber and Hess outlined the elements necessary for enhancing active learning in a mock trial.

#### **Elements for enhancing active learning frameworks in legal contexts:**

- Articulate specific goals.
- Facts/roles should have enough complexity and ambiguity to reflect real life.
- Focus on learning how lawyers practice (interview, negotiate, draft, etc.).
- Significant outside fact gathering and preparation time.
- Engagement in multiple tasks (requiring prioritization and judgment).
- Inclusion of motions and briefs.
- Accentuate relevancy.
- Allow freedom to follow through on decisions.
- Outside witnesses, guests, and experts.
- Insist roles be taken seriously by all.
- Require processing of new inputs (unique venue, admit new evidence, etc.).
- Production of an output that requires reflection (test, essay, discussion, etc.).
- Clear grading criteria.
- Feedback from peers and faculty to students.
- Feedback from students and an evaluator to faculty.

#### **Belize Spring Course**

In the spring of 2014, the university of Florida Levin college of law offered a two credit course to familiarize students with the law, policy, and practice of sustainable development (course title). Numerous ALE facilitation factors saw integration in the class design and implementation. Foremost, accomplishing this integration involved using an environment that was both physically and figuratively immersive. The course took place in north central Florida on the university's campus and in southern Belize, in the Belize Foundation for Research and Environmental Education (BFREE) compound.

The primary active learning approach was a mock trial based on the combined elements of surrounding real

world scenarios, appropriately titled the 'rumble in the jungle.' These elements included a superfund settlement, Natural Resource Damage Assessment and Restoration (NRDA), Mayan land rights, land grabbing and degradation, and biodiversity restoration. In addition, instructors emphasized the federal rules of evidence, *Daubert v. Merrell*, *GE v. Joiner*, challenging expert witnesses, introducing scientific data, and expert opinion. Matters of procedure consisted of motions in limine, objections, impeaching witnesses, and entering documents into evidence.

Five of the 14 lectures were held 'pre-departure' to Belize. Four of these lectures were held in a standard classroom setting but given in an interactive format and featured guest lecturers with expertise in the following subjects: NRDA, scientific evidence, protected areas management and policy in Belize, and sustainable development and the Cacao value chain. The fifth pre-departure engagement was the required attendance of a public interest environmental conference panel concerning payments for agro-environmental services. In Belize, experts conducted several other interactive lectures featuring immersive aspects. These included: Hiking through damaged and undamaged forest areas with experts; visiting farms and speaking directly with farmers about their issues; touring the Belize zoo with the lecturer/founder; snorkeling near protected marine areas; touring an agroforestry based cacao plantation with both legal and scientific experts; meeting directly with Mayan peoples effected by land right infringements and natural resource degradations, and speaking with a conservation botanist in charge of monitoring protected forests.

### International Settlement

A 'first of its kind' settlement involving the international use of a superfund damage award was influential in generating the mock trial scenario. A 1998 natural resource damages settlement recovered approximately three million dollars in damages for use as deemed appropriate by the United States fish and wildlife service, the national oceanic and atmospheric administration, and the commonwealth of Massachusetts ('trustees') from the Nyanza Chemical Company (NCC), and related subsidiaries. Through textile production, specifically the inappropriate discarding of waste therefrom, NCC "contaminated soil and sediments, groundwater and surface water, wetlands, and the Sudbury river" related to a 35 acre parcel of Ashland, Massachusetts, over sixty years (1917-1978). Natural resources and the habitats of numerous life forms downstream of the Sudbury river were also affected.

One project of the resultant twelve part restoration plan allocated \$50,000 to \$75,000 to improve the wintering

habitat of migratory birds affected by this destruction. These neo-tropical songbirds (e.g., flycatchers, thrushes, and warblers) migrate from Ashland to areas in and around BFREE in the Toledo district of Southern Belize each winter. Unfortunately, the habitats of these birds in Belize also are in danger. Both Mayan Indians and Guatemalan immigrants continue to practice forms of agriculture involving Swidden slash and burn techniques in the same areas. The result of these practices is deforestation and songbird habitat destruction. The restoration project involves reforestation of affected areas and protection from further degradation. Implementation consisted of making payments for ecosystem services to respective farmers and training them in more sustainable production methods, namely shade grown cacao agroforestry; features that ultimately qualified the project as forms of both biodiversity offsetting and sustainable development. Long present land rights issues became a focal matter during implementation because participation in the program required proof of land ownership.

### Mayan Land Rights

'Boundaries' are not conceived in the same manner by the Mayan Indians of Belize and the European settlers that once controlled the country. As Mayan Indians do not have a system of communal use, temporary use of any land simply requires planting one's crops, provided that the land is currently not occupied by the crops of another person. Lands long occupied by Mayans and their ancestors lack formal title owing to this system. The constitution of Belize gives the Maya customary land tenure over areas established by 'traditional use.' A Belize court later deemed this practice sufficient under international law to constitute property ownership (in a communal form). The government of Belize, however, has a history of doing as it wants with these lands, including leasing, selling, and offering concessions for natural resources to outside parties through dismissing international law, citing lack of title, or simply offering no justification at all. While a second case was brought and won by Mayan communities that further solidified these rights, formal documentation from the government has been slow to materialize, and infractions of these rights continue. As a result, the Mayan people continue to struggle, not for rights to all the lands they occupied in the past, but to secure ownership of the lands they currently occupy and utilize. Given the mock trial's setting, this struggle's influence was unavoidable in its design and implementation (Table 1).

**Table 1:** Comparison of active learning framework to Belize field course.

Active learning framework	Belize field course
Articulate specific goals.	Students given materials containing goals before the course and specific segments.
Facts and roles should have enough complexity and ambiguity to reflect real life.	Roles identified for everyone at the same time and considered varied student experience.
Focus on learning how lawyers practice (interviews, negotiating, drafting, etc.)	Groups interviewed scientific experts and witnesses and drafted appropriate docs.
Significant outside fact gathering and preparation time.	Students accompanied scientists/experts to the field and witnessed assessments.
Engagement in multiple tasks (requiring prioritization and judgment).	Deadlines strategically determined to produce the necessity of trade-offs.
Inclusion of motions and briefs.	All encouraged and accepted, including a few that were unforeseen.
Accentuate relevancy.	Parallel to real world cases and location of trial highlighted relevancy.
Allow freedom to follow through on decisions.	Granted in all accounts; no idea discouraged but no assistance offered.
Outside witnesses, guests, and experts.	Along with scientists, experts, and attorneys, a longstanding judge was present.
Insist roles be taken seriously by all.	Presence of the above helped this to be the case; attention never had chance to wane.
Require processing of new inputs (unique venue, admission of new evidence, etc.)	Venue was “on location,” several surprise introductions into evidence/witness lists.
Production of an output that requires reflection (test, essay, discussion, etc.)	Cross examination, opening and closing statements, and following debate.
Clear grading criteria.	Marks deductions for lack of participation or clerical errors.
Feedback from peers and faculty to students.	Provided between segments and the end, but court proceedings were never interrupted.
Feedback from students and an evaluator to faculty.	Aside from open and frank dialog, the surveys and evaluations herein were discussed.

**METHODOLOGY**

**Demographics**

The population of this study was 13 law students (seven ‘3Ls’ and six ‘2Ls’) enrolled in a class designed and taught by clinical professors in the 2014 spring semester. As noted, ALE principles permeated the class design and implementation. The class saw nearly equal division in gender and learning style, with seven men and six women (ranging in age from 23 to 33 years) and seven and six active and passive learners, respectively. Four students had undergraduate degrees in hard science, seven in social science, and two in the arts. Only five students were seeking specializations in environmental law. The average credit load was 14 during the semester

of the course, and the average GPA of students entering the class was 3.34.

**Assessment**

Student assessment consisted of three efforts: A “pre-evaluation” gauging learning expectations for (and current knowledge of or comfort with) topics determined in a class focus group to be of importance, a post-evaluation measuring new knowledge levels for the pre-evaluation learning expectation topics, and a post-course survey gauging ALE learning theory application “success.” The study's objectives were to determine if an ALE produced the same educational value for students who self-identified as preferring active learning and students who self-identified as preferring passive learning and to gauge students' overall perception of the

class. Comparison of the focus group determined measures (*i.e.*, evaluation formation) and survey responses is permissible given the sample homogeneity (same group), controlled exposure (same course), use of identical variables (same study), and consistent results.

**Evaluations**

The pre-course and post-course evaluations were constructed based on the results of a pre-course focus group where the class collectively outlined expectations for the course. The population met the criteria necessary for focus group application: Being of the same school, comfortable speaking with one another, of the same age range and other socio-characteristics, and ‘focused’ within the commonality of the shared course. An experienced moderator led the focus group using predetermined open ended questions designed to encourage discussion about topics of knowledge and learning expectations for the class. The resulting evaluations consisted of a four point scale (little, some, quite, very), wherein students privately specified their agreement with statements indicating knowledge of (or level of comfort with) each of the group determined concepts/expectations. Students also were asked to rank

these expectations based on their personal interest in each concept. These levels of knowledge/comfort and rankings were then independently averaged to determine baselines for the expectations and interests of the population.

**Concepts Tested**

From the students’ perspective, there were ten core expectations, learning about International Environmental Settlement procedure (IES procedure), the Belize Foundation for Research and Environmental Education (BFREE), the country of Belize (Belize), cultivating relationships with farmers (farmer relations), environmental law, trial procedure, comparative law, conservation, the feeling of being disconnected from stresses typically associated with modern urban lifestyles (disconnected), and meeting school requirements (requirements). Table 2 (below) identifies each of these concepts along with its short name and brief description (as interpreted and agreed upon by the members of the focus group).

**Table 2:** Concept descriptions.

Concept name	Short for
IES procedure	International environmental settlement procedure.
BFREE	Belize foundation for research and environmental education.
Belize fun	Having fun learning about the country of Belize.
Farmer relations	Cultivating relationships with farmers.
Environment law	Environmental law.
Trial procedure	Trial procedures and protocol.
Comparative law	International comparative law.
Conservation	Preservation and conservation methodologies.
Disconnected	Feeling disconnected from stress associated with modern lifestyles.
Requirements	Meeting school requirements.

**Survey**

Instructors distributed a self-administered survey with the course’s final examination. The survey borrowed from various peer reviewed, research based ALE and law course evaluation studies, including the Law School Survey of Student Engagement (LSSSE), and modified these inputs to focus on specific aspects of ALE and resulting comprehension and development. In all, 64 measures gauged the following six concepts: Emphasis on mental activities (memorizing, analyzing, synthesizing,

making judgments, and applying); contribution of overall course to ability to learn; nature of learning environment; contribution to personal development; the value of the primary active learning exercise (mock trial); and engagement created by interactive lectures. The surveys consisted of a four point scale (little, some, quite, very), wherein students privately specified their agreement with statements indicating levels of ALE components determined by reviewing the relevant peer reviewed literature.

## Data Analysis

Hand tallied results were entered directly into SPSS (version 22) for all three assessment methods. Initially, descriptive statistics were tabulated for the overall population. Then, descriptive statistics for the self-identified AL and PL samples were run separately, and means for both samples and the population were determined independently. Finally, correlations were sought between the sample groups and learning expectations (knowledge of the class determined indicators noted in the above evaluation section, the “ten core expectations,” before the course), perception of the learning environment, and learning outcomes (knowledge of the class determined indicators/expectations after the course).

T-tests performed on the measures determined differences in means and variation significances. These tests were applicable because the two samples came from within the same population and responded to the same measures, making the mean differences unbiased estimates of population differences. Furthermore, despite the small sample size, parametric tests were appropriate given the homogeneity, central tendency, dispersion, absence of outliers, normality (detected *via* the Shapiro-Wilk test), and triangulation with the studies mentioned above and related literature.

Independent T-tests compared AL and PL mean responses at specific times. These tests were run separately on the pre-evaluation and the post evaluation responses. Independent T-tests are the standard method for determining the statistically significant difference between two sets of independent (unrelated) subject responses gathered simultaneously. They work by identifying the means of the two unrelated samples, assuming the null hypothesis that such means are equivalent, and statistically testing this assumption at the 90% and 95% confidence levels. Relative to this study, an independent T-test with AL and PL as the two independent samples, using their sample means for each of the ten core expectations and learning outcomes, indicates whether their respective members perceived their knowledge of, or comfort with, these concepts in a statistically significant similar way (null hypothesis). Rejecting the null hypothesis for a specific concept would mean that the two groups had different levels of knowledge or comfort with that concept at such time.

Paired T-tests were used to compare mean differences over time (pre-course and post-course). The tests were run for the population and separately for the AL and PL samples to determine if there were “significant” mean changes among the learning expectations and learning outcomes for the different groups over the tested period. Paired T-tests are the appropriate standard for determining if there are significant differences (in most cases at the 0.05 confidence level, but in some cases at the 0.10 level between the mean values of two

dependent samples (*i.e.*, repeated measurements of the same subjects/individuals). They accomplish this objective by measuring the differences between the same individuals' responses at two different times, summing those differences and dividing by the number of subjects to find the mean, and then determining whether the difference between those means is statistically close to zero (the inherent null hypothesis). Therefore, if the null hypothesis holds, there is no statistically significant difference between the means at the two separate times (*i.e.*, the difference is essentially zero). Alternatively, rejecting the null hypothesis means that there is a statistically significant difference between the means of the responses gathered at the two separate times. The primary inference from rejecting the null hypothesis is that something between the two separate response gathering events impacted the subjects' understanding of the concepts explored by the measures. Retaining the null hypothesis means the opposite is true; nothing between the two response gathering events impacted the subjects' understanding of those concepts. The subjects took part in a completely immersive course between the two testing points, so external influences can be ruled out (*i.e.*, significant differences in means for these tests could only be due to ALE impacts).

Due to the students' ALE immersion, self-identified AL should have greater learning outcomes (*i.e.*, greater and more significant mean increases) than PL. Therefore, positive AL knowledge/comfort level changes would be expected and significant in the paired T-test, indicating a notable difference in AL scores before and after the course. This result would allow for null hypothesis rejection and indicate that the course positively impacted AL knowledge of (or comfort with) the matters represented by the measures. On the other hand, expectations for the learning outcomes of self-identified PL would be lower than those for AL. Therefore, while perhaps still expected, positive change in PL knowledge levels would likely not be significant (or as significant as those of AL), suggesting that the course did not greatly impact these students' knowledge/comfort level of the matters represented by the measures. Finally, a paired T-test was run on the class as a whole to show its overall progression. Administration of this test acknowledges that, despite how people self-identify, everyone learns in varying combinations of active and passive styles depending on context.

Effect sizes were calculated to assist results interpretation. The effect size of a T-test on a null hypothesis informs the strength of the difference, or in this context, the magnitude of the course's impact relative to the concept in question. Effect size calculation occurs by subtracting the means of the two groups from one another (in the case of a paired T-test, the pre and post-survey results) and dividing that amount by the average of the two groups' standard deviations. There are three categories of effect sizes: Below 0.4 (small), from 0.4 to

0.79 (medium), and 0.79 and above (large). Due to the small sample size in this study, "Hedges' correction" is employed. Before comparing the effect sizes returned by the above formula with the aforementioned scale, this correction adjusted down the returned values by multiplying them by the result of the formula:

$$1-(3/(4*(n1 + n2)-9))$$

Where;

$n1$ =Sample size of the first sample.

$n2$ =Sample size of the second sample (which in the case of typical paired T-tests, and this case, are the same).

### Hypotheses

Using the previously described means, this study sought to test five null hypotheses:

**ALE produces no significant difference in learning outcomes:** Testing this null hypothesis utilized a paired T-test with the data for each measure from the entire class (*i.e.*, a singular test comparing each individual's responses at one time (before the course) to those same individuals' responses at a second time (after the course)). This null hypothesis provides that the change in the means of learning outcomes for the entire class should not be at a significance level below 0.05 ( $p < 0.05$ ) (*i.e.*, whether the mean difference is significantly different from zero). Rejecting this null hypothesis would indicate that the ALE positively impacted the subject's knowledge/comfort level regarding the tested core course concepts.

**ALE produces no significant change in the learning outcomes of PL:** This null hypothesis tests the responses of the self-identified PL students using a paired T-test (with times one and two corresponding to before and after the course, respectively). If this null hypothesis is accepted, there is no statistical difference between the mean scores gathered before and after the course (thus, it is inferable that the course ALE had no impact on the PL knowledge/comfort levels regarding the tested concepts). Conversely, rejecting this null hypothesis means there is a statistical difference between the mean scores taken before and after the course (and as such, it is inferable that the course ALE impacted the PL self-reported knowledge/comfort levels regarding the tested concepts).

**ALE produces no significant change in the learning outcomes of AL:** This null hypothesis tests the responses of the self-identified AL using a paired T-test (with times one and two corresponding to before and after the course, respectively). If this null hypothesis holds, it means there is no statistical difference between the mean scores taken before and after the course (and as such, it is inferable that the course ALE had no impact on the AL knowledge/comfort levels regarding the tested concepts). Conversely, rejecting this null hypothesis means there is a statistical difference between the mean

scores taken before and after the course (and as such, it is inferable that the course ALE impacted the AL self-reported knowledge/comfort levels regarding the tested concepts).

**ALE produces the same significance of change in learning outcomes within AL and PL:** Testing this null hypothesis involves performing two paired T-tests, one on the PL means (comparing pre and post-evaluations) and one on the AL means (comparing pre and post-evaluations). This procedure denotes whether the means of the PL responses taken before and after the course are significantly different (the result of testing null hypothesis two), whether the means for the AL responses before and after the course are significantly different (the result of null hypothesis three), and whether these significance levels are consistent (either both significant or both not significant; as determined by comparison of the null hypotheses two and three test results). Accepting this null hypothesis would mean that the course ALE impacted both self-identified AL and PL at the same significance level regarding their knowledge/comfort level of the studied concepts. Rejecting this null hypothesis would indicate that the course ALE more significantly impacted one of the groups (either the AL or PL) regarding their knowledge/comfort level of the studied concepts.

**ALE produces the same significance of change in learning outcomes between AL and PL:** This null hypothesis uses two separate individual T-tests (*i.e.*, comparing AL and PL before and after the course), then compares the significance levels of their respective means. Essentially, knowledge/comfort regarding the noted expectations/concepts is compared for AL and PL before the course to determine if these levels are close enough to be considered significantly similar. Then, the same comparison is made again after the course to see if one of the groups had a shift in the knowledge/comfort level. The significance level of the AL/PL means differences before the course either will be below 0.05 or above 0.05 (*i.e.*, significant or not). When tested post-course, according to this null hypothesis, this significance level should remain the same (as the below 0.05 or above 0.05 level found in the pre-course test). If the significance level changes from below or above this threshold to the opposite position, this shift would mean rejecting the null hypothesis, denoting that there was a greater change in the knowledge/comfort level of one group of learners (*i.e.*, AL or PL) over the course. It would not indicate which group underwent the greater mean shift, but that is readily determinable by review of the actual mean data.

The results of testing these null hypotheses are presented in tabular form and discussed below.

## RESULTS AND DISCUSSION

Based on means comparison: Prior to the class, 63% of students expressed (“quite much” to “very much”) knowledge of or comfort with the concepts the class collectively decided were relevant to their interpretation of the intent of the course. After completion of the course, addressing the same survey in the past tense, 84% indicated having (“quite much” to “very much”) knowledge of or comfort with those same concepts. Furthermore, despite 46% claiming preference for non-active learning (*i.e.*, passive visual and aural learning), 85% found the ALE beneficial, 69% found the core ALE exercise (mock trial) beneficial, and 74% found the overall course beneficial to learning. However, only 43% considered what they learned conducive to personal career development. The fact that not all the students expressed career desires commensurate with the course's objectives (*i.e.*, only 39% had career aspirations involving environmental law) explains this low level of conduciveness.

The literature demonstrates various means of testing ALE effects and supports this study's general findings. Of particular relevance, Partanen used, among other methods, analysis of self-administered conceptual inventories gathered at the beginning and end of courses that did and did not employ ALE. Aside from such self-assessment in and of itself emanating from and contributing to ALE (as described above), in analyzing the pre and post-course results of such inventories, she found substantial improvements in those involving ALE beyond those obtained by courses not employing such elements. Another example involving self-assessment is the work of Deslauriers et al., who found a strong anti-correlation between the “feeling of learning” and actual learning. Their point was not that ALE was ineffective; on the contrary, the same study found that students scored

higher on tests following active learning sessions. They caution against placing too much faith in the value of self-assessments made by PL who have yet to engage with an ALE, as the study pointed to such persons quickly adjusting or displaying a change in preference after an ALE experience. Moreover, for the 43% in this study that categorized the learning as conducive to personal and career development, their self-assessment finds even further support in the literature. A 2022 literature review by Ribeiro-Silva et al., regarding active learning methodologies in higher education found broad support for contentions such as ALE contributes positively to students' professional futures, social lives, and academic achievements.

The null hypotheses test results discussed below echo these overall self-assessment findings in the literature.

### H<sub>1</sub>: ALE Produces No Significant Difference in Learning Outcomes

Null hypothesis 1 can be rejected with high confidence for “BFREE” ( $p < 0.01$ ) and “disconnected” ( $p < 0.02$ ) and rejected with lower confidence for “Belize Fun” ( $p < 0.07$ ), “trial procedure” ( $p < 0.07$ ), “comparative law” ( $p < 0.07$ ), and “conservation” ( $p < 0.09$ ). The null hypothesis “ALE produces no significant difference in learning outcomes” being rejected for these concepts denotes a significant (or at least nearly significant) change in the means of the responses in these categories for the entire population. Comparing the group pre-mean and group post-Mean columns in Table 3 below, save for requirements, it is clear that this change was in a positive direction for every tested core expectation (and, to a significant ( $p < 0.05$ ) or mildly significant ( $p < 0.10$ ) degree for more than half).

**Table 3:** Population paired T-test results.

Concept	Group pre-mean	Group post-mean	Mean diff.	Mean change percent	Paired T-test	Sig.
IES procedure	3.04	3.57	0.53	17.4	1.53	(0.15)
BFREE	3.32	4.7	1.38	41.6	5.2	(0.01)
Belize fun	3.94	4.61	0.67	17	1.2	(0.07)
Farmer relations	3.02	3.5	0.48	15.9	1.34	(0.21)
Env. law	3.94	4.22	0.28	7.1	1.17	(0.26)
Trial procedure	3.17	3.84	0.67	21.1	1.2	(0.07)
Comp. law	3.31	3.91	0.6	18.1	1.98	(0.07)
Conservation	3.87	4.38	0.51	13.2	1.85	(0.09)

Disconnected	3.19	4.2	1.01	31.7	2.79	(0.02)
Requirements	3.22	3.15	-0.07	2.2	0.19	(0.85)

**Note:** Diff.=Difference/Sig.=Significance/=Significant

Null hypothesis 1 cannot be rejected for “IES procedure” (p=0.15), “farmer relations” (p=0.21), “environment law” (p=0.26), and “requirements” (p=0.85). The null hypothesis “ALE produces no significant difference in learning outcomes” being accepted for these concepts denotes that, while it is clear from Table 3 above that the means for these responses did increase (save for requirements), the changes were not significant. Either these concepts did not have room to increase significantly due to the subjects’ associated knowledge/comfort levels of them beginning in a high position, an idea revisited below, or the ALE did not produce significant knowledge/comfort gain for the class as a whole concerning these concepts. This later contention and its support in the literature also are explored below.

**H<sub>2</sub>: ALE Produces No Significant Change in the Learning Outcomes of PL**

Null hypothesis 2 can be rejected with high confidence for “BFREE” (p<0.01). The null hypothesis “ALE produces no significant change in the learning outcomes of PL” being rejected for this concept indicates a change of its mean significance between the beginning and end of the course (Table 4). Essentially, PL increased their knowledge/comfort level with all the core concepts (save for farmer relations and environment law, which experienced respective five and four percent mean decreases). However, the only statistically significant increase was their familiarity with the Belize Foundation for Research and Environmental Education (BFREE); this stand out significance speaks to the power of immersion, as most of the course was spent in this location, interacting with and studying under its

professional staff. Relatedly, the mean increased by 38% (99% more than the average of the other concepts), and the effect size (0.73) indicates that the course had an upper medium magnitude of impact on the subjects’ knowledge/comfort level with this concept. This result aligns with the findings of various research efforts. For example, Givelber et al., reviewed data related to 532 questionnaires completed by legal interns and new lawyers to find that the immersive ALE of their experiences (what Givelber referred to as “ecological learning” or “cognitive contextualism”) contributed “much more” to their education than law school in general. Bradberry and DeMaio reviewed model United Nations and judicial internship survey data to find that immersive ALE improve time to graduation and that respondents considered them significant contributing factors to career success.

The lack of change in comfort with meeting school requirements is not surprising as, despite being identified by the focus group as a “core concept,” it was not a focus during the course (and perhaps only came about, if at all, after grade release). On the other hand, the decrease in the means of farmer relations and environment law is unexpected. The decreases are minute (approximately five and four percent, respectively) and not significant. However, they represent an unmet expectation of PL regarding improving their knowledge of or comfort with these concepts. Potential causes for these shortcomings are discussed below, along with the other concepts that lacked significance in the analysis results.

**Table 4:** Passive learner paired T-test results.

Concept	PL pre-mean	PL post-mean	Mean Diff.	Mean change percent	Paired T-test	Effect size	Sig.
IES procedure	3.5	4	0.5	14	1.46	0.04	(0.2)
BFREE	3.5	4.83	1.33	38	4	0.73	(0.01)
Belize fun	4.17	4.5	0.33	8	1	1.76	(0.36)
Farmer relate	3.17	3	-0.17	5	0.26	0.17	(0.81)
Env. law	4.17	4	-0.17	4	0.54	0.98	(0.61)

Trial procedure	3.33	3.67	0.34	10	0.06	0.59	(0.58)
Comp. law	3.33	3.67	0.34	10	0.6	0.96	(0.58)
Conservation	4.17	4.33	0.16	4	0.54	0.9	(0.61)
Disconnected	2.67	3.5	0.83	31	1.39	0.87	(0.22)
Requirements	3	3	0	0	0	0.42	(1)

**Note:** Diff.=Difference/Sig.=Significance/=Significant

Null hypothesis 2 cannot be rejected for: “IES procedure” (p=0.02), “Belize fun” (p=0.36), “farmer relations” (p=0.81), “environment law” (p=0.61), “trial procedure” (p=0.58), “comparative law” (p=0.58), “conservation” (p=0.61), feeling “disconnected” (p=0.22), and meeting school “requirements” (p=1.00). Accepting the null hypothesis, “ALE produces no significant change in the learning outcomes of PL” for all expectations/concepts, save for BFREE Table 4, above, attests to the ALE not being the optimal learning environment for PL who have self-identified accurately (discussed below). While the PL did see a mean increase for all expectations/concepts (save for farmer relations and environmental law), their lack of significance aligns with the research of various scholars who identified disadvantages PL face when attempting to adjust to an ALE. These disadvantages include social anxiety (or psychological discomfort associated with having to interact in what they deem uncomfortable settings), study and reflection decisions based on a misidentified learning style, and inability to self-motivate or regulate their learning. Perhaps future iterations of the course in question or similar efforts could benefit by taking note of these distinctions.

**H<sub>3</sub>: ALE Produces No Significant Change in the Learning Outcomes of AL**

Null hypothesis 3 can be rejected with high confidence for “BFREE” (p<0.02), “farmer relations” (p<0.03), “trial procedure” (p<0.05), and “comparative law” (p<0.05),

and rejected with lower confidence for “environment law” (p<0.09), “conservation” (p<0.10), and feeling “disconnected” (p<0.06). The null hypothesis “ALE produces no significant change in the learning outcomes of AL” being rejected for these concepts means that the course ALE created a significant change in mean scores, representing (in all cases) a positive increase in the students’ knowledge of or comfort with them. As with PL, review of Table 5 active pre-mean and active post-mean columns reveals that means increased across all categories, save for requirements. Unlike with PL, nearly all such increases were significant for this sample and of medium to large effect size. Of these significant concepts, BFREE (0.79), farmer relations (1.49), comparative law (1.55), and conservation (0.90) were all of a large effect size, while trial procedure (0.74) and disconnected (0.69) were of a medium effect size, and environment law (0.08) was of a small effect size. The ALE being conducive to AL knowledge acquisition is akin to the findings of nearly all previously cited works, in particular Hess, Ferber, and Lewis (identified in boxes 1 and 2 above, along with similarities to design and implementation of the course). Moreover, Moore and Sullivan showed a high correlation between students’ increasing self-selected attendance to ALE sessions and cumulative GPA increases, with benefits up to half a letter grade that carried over into the second and third years of law school.

**Table 5:** Learning outcomes of AL.

Concept	Active pre-mean	Active post-mean	Mean diff.	Mean change percent	Paired T-test	Effect size	Sig.
IES procedure	2.57	3.14	0.57	22	0.93	0.66	(0.39)
BFREE	3.14	4.57	1.43	46	3.33	0.79	(0.02)
Belize fun	3.71	4.71	1	27	1.73	0.69	(0.13)

Farmer relate	2.86	4	1.14	40	2.83	1.49	(0.03)
Env. law	3.71	4.43	0.72	19	1.99	0.08	(0.09)
Trial procedure	3	4	1	33	2.5	0.74	(0.05)
Comp. law	3.29	4.14	0.85	26	2.52	1.55	(0.05)
Conservation	3.57	4.43	0.86	24	1.87	0.9	(0.1)
Disconnected	3.71	4.9	1.19	32	2.29	0.69	(0.06)
Requirements	3.43	3.29	-0.14	4	0.31	0.09	(0.77)

**Note:** Diff.=Difference/Sig.=Significance/=Significant

Null hypothesis 3 cannot be rejected for: “IES procedure” ( $p=0.39$ ), “Belize fun” ( $p=0.13$ ), and meeting school “requirements” ( $p=0.77$ ). The null hypothesis “ALE produces no significant change in the learning outcomes of AL” being accepted for these concepts indicates that, despite their means increasing; the course ALE failed to produce a significant change in associated knowledge or comfort levels (Table 5). While having fun learning about Belize (Belize fun) saw the largest mean increase of the three, its lack of significance is likely due to the personal nature of how “fun” is conceived and the lack of focus in the curriculum on general Belize knowledge. The course’s failure to significantly impact international environmental settlement procedure is more challenging to interpret. While its mean increased by approximately 22% over the course, the fact that this increase was not significant gives cause to reconsider the information’s manner of presentation. A possible reason is that procedural information’s nature is more formulaic than other legal practice elements, requiring less “creativity” and thus eliciting less mental engagement. For example, consider the “law as art hypothesis” and the long standing belief in the importance of creativity as an attribute that should be fostered in legal education.

**H4: ALE Produces the Same Significance of Change in Learning Outcomes Within AL and PL**

Null hypothesis 4 can be rejected for: “Farmer relations,” “environment law,” “trial Procedure,” “comparative law,” “conservation,” and feeling “disconnected.” Rejecting the null hypothesis “ALE produces the same significance of change in learning outcomes within AL and PL” for farmer relations ( $p=0.81$  vs.  $p<0.03$ ), environment law ( $p=0.61$  vs.  $p<0.10$ ), trial procedure ( $p=0.58$  vs.  $p<0.05$ ), comparative law ( $p=0.58$  vs.  $p<0.05$ ), conservation ( $p=0.61$  vs.  $p<0.10$ ), and disconnected ( $p=0.22$  vs.  $p<0.06$ ) is denoted by a difference in mean significance

for AL and PL when comparing the results of each samples’ paired T-tests (Table 6). The paired T-tests show significant ( $p<0.05$ ) differences in the means of AL pre- and post-course, while there were no significant differences in the means of PL over this same period for these concepts. Generally, for these concepts, PL averages increased by 11% during the course while AL averages for the same concepts over the same period increased by 29% (Table 5). As noted previously, this could be due to some PL beginning at a higher level of knowledge regarding these concepts and, while gaining knowledge, they did not have room to make as large gains as AL. Although this contention makes mathematical sense, there may be underlying reasons at play that are worthy of further investigation.

For example, one reason for AL beginning at a lower knowledge/comfort level regarding many of these topics may be a lack of prior exposure to learning environments best suited to their learning style/needs, namely ALE. As established above, the educational styles often employed in law school settings feature few active learning methodologies. As such, when the AL entered an environment better suited to their learning style, their knowledge/comfort level with these concepts began low but rapidly improved (outpacing the self-assessed PL) to end up with similar mean scores on the post-course T-tests. Moreover, for farmer relations, trial procedure, and comparative law, the effect sizes for AL were 776%, 25% and 61% greater than those of their PL counterparts (and categorized as large or upper medium). However, for environment law and disconnected, the PL results, while not significant, showed larger effect sizes by 1125% and 26%, respectively (both large effects). Conservation had the same effect size (0.9; large) for both PL and AL (also categorized as a large effect). Therefore, ALE proponents may consider rejecting this null hypothesis a positive sign (based on both samples’ positive direction

change and effect size increases), as it indicates a shift toward an ALE learning theory may not be disadvantageous to PL in all contexts. While ALE aspects may challenge PL with certain sociological propensities (discussed above), these results point toward such disadvantages being of a limited degree.

The issue has not gone unaddressed in the literature, with various opinions abounding regarding the appropriate balancing of teaching methodologies for active and passive learning styles.

**Table 6:** Change significance in learning outcomes.

Concept	PL paired T-test Sig.	Sig. diff.	AL paired T-test Sig.	PL paired effect size	Effect size diff. percent	AL paired effect size
IES procedure	(0.2)	No	(0.39)	0.04	177	0.66
BFREE	(0.01)	No	(0.02)	0.73	7.9	0.79
Belize fun	(0.36)	No	(0.13)	1.76	87.3	0.69
Farmer relations	(0.81)	Yes	(0.03)	0.17	159	1.49
Env. law	(0.61)	Yes	(0.09)	0.98	170	0.08
Trial procedure	(0.58)	Yes	(0.05)	0.59	22.6	0.74
Comp. law	(0.58)	Yes	(0.05)	0.96	47	1.55
Conservation	(0.61)	Yes	(0.1)	0.9	0	0.9
Disconnected	(0.22)	Yes	(0.06)	0.87	23.1	0.69
Requirements	(1)	No	(0.77)	0.42	129	0.09

**Note:** Diff.=Difference/Sig.=Significance/=Significant

Null hypothesis 4 cannot be rejected for: “IES procedure,” “BFREE,” “Belize Fun,” and meeting school “Requirements.” The paired T-tests revealed no difference in the level of significance (past the 0.05 threshold) for these concepts’ associated AL and PL means relative to one another (*i.e.*, the significance level of the AL and PL means either were both not significant ( $p>0.05$ ) or both significant ( $p<0.05$ )). As such, the null hypothesis “ALE produces the same significance of change in learning outcomes within AL and PL” for IES procedure ( $p=0.20$  vs.  $p=0.39$ ), BFREE ( $p=0.01$  vs.  $p=0.02$ ), Belize fun ( $p=0.36$  vs.  $p=0.13$ ), and requirements ( $p=1.00$  vs.  $p=0.77$ ) must be accepted (Table 6). This parallel denotes that the course ALE had similar effects on both AL and PL for these concepts. Save for requirements, both PL and AL increased their knowledge/comfort level with these concepts during exposure to the course ALE, 20% and 32%, respectively, with neither sample doing so to a more significant degree than the other (Tables 4 and 5). Perhaps counterintuitively, this echoes the discussion above (regarding rejecting this same null hypothesis) in that, save for differences in significance, there were convergences toward increased average means and varying effect size findings between the AL and PL.

**H<sub>5</sub>: Ale Produces the Same Significance of Change in Learning Outcomes between Al and Pl**

Null hypothesis 5 can be rejected for “IES procedure” and feeling “disconnected.” The null hypothesis “ALE produces the same significance of change in learning outcomes between AL and PL” being rejected for IES procedure and disconnected is visible in these concepts’ difference in mean significance before and after the course. This finding results from performing separate Independent T-tests on AL and PL pre-course means and AL and PL post-course means and then comparing the significance levels of these two tests’ results (Table 7).

For “IES procedure,” there was a significant difference in the pre-course means between AL and PL ( $p<0.03$ ), with the PL mean being 36% higher than the AL mean, but no significant difference in the post-course means between AL and PL ( $p=0.26$ ), where the PL mean was only 27% higher than the AL mean (Tables 8 and 9). This in congruency is due to the difference between AL and PL means for IES procedure decreasing by eight percent between the pre and post-testing (Table 7). The PL mean only increased by 14%, while the AL mean increased by 22% (Table 5). Consequently, the ALE did not produce the same levels of change in AL and PL mean

significance for IES procedure, leading to the rejection of the null hypothesis for this concept.

The independent T-test for “disconnected” identified a weakly significant difference in the pre-course means between AL and PL ( $p < 0.08$ ). The AL mean was 28% higher than the PL mean (Table 8 below). Such tests also revealed a fully significant difference in the post-course means for AL and PL ( $p < 0.02$ ), where the AL mean was 29% higher than the PL mean (Table 9). The difference between AL and PL means for disconnected increased by 35% between the pre-test and post-test. The PL mean increased by 31%, while the AL mean increased by 32% (Table 5). Consequently, in this case, the ALE did not produce the same level of change significance for AL and PL, leading to the null hypothesis being rejected for this concept as well. Although the ability to experience the feeling of being disconnected while in Belize was not a teaching objective of the course, it is still interesting to note that PL experienced a significant change in this regard while AL did not.

In practical terms, these findings suggest that the ALE had a greater impact on one of the groups than the other regarding these concepts. While it is clear from null hypotheses 2 and 3 (above) that AL generally see greater increases in knowledge/comfort level from ALE

exposure, improvements were seen by both learning types, reinforcing the finding in null hypothesis 4 (above) concerning the convergence of means. This finding also is supported by the work of Weltman and Whiteside. They describe exposing 300 business students of varying grade point averages (higher and lower levels) to classes that employed either traditional or active learning environments. They found that when exposed to an ALE, student test scores in the relative subjects converged around the mean, despite the expectation that those with higher grade point averages would outperform others. In short, the test scores of higher grade point average students did not increase as much as those of lower grade point average students, leading to a similar convergence. One explanation for the Weltman study’s convergence may be that the higher grade point average students were PL. They established strong GPAs in the more common passive style courses offered before the experiment but did not benefit as much from the ALE as their AL counterparts. While not a perfect comparison to this study, with AL who entered the course with lower knowledge/comfort levels rather than GPAs, the parallel supports its similar positive convergence trend.

**Table 7:** Independent T-Tests on AL and PL pre and post-course means.

Concept	AL-PL pre-mean diff.	AL-PL post-mean diff.	Mean diff. diff.	Mean diff. change percent	Pre-Course sig.	Post-course sig.	Sig. shift
IES procedure	0.93	0.86	-0.07	8	(0.03)	(0.26)	Yes
BFREE	0.36	0.26	-0.1	28	(0.48)	(0.48)	No
Belize fun	0.46	0.21	-0.25	54	(0.49)	(0.47)	No
Farmer relations	0.31	1	0.69	223	(0.63)	(0.16)	No
Env. law	0.46	0.43	-0.03	7	(0.42)	(0.31)	No
Trial procedure	0.33	0.33	0	0	(0.57)	(0.48)	No
Comp. Law	0.04	0.47	0.43	1075	(0.93)	(0.48)	No
Conservation	0.6	0.1	-0.5	83	(0.34)	(0.84)	No
Disconnected	1.04	1.4	0.36	35	(0.08)	(0.02)	Yes
Requirements	0.43	0.29	-0.14	33	(0.56)	(0.62)	No

**Note:** Diff.=Difference/Sig.=Significance/=Significant

**Table 8:** Pre-course independent T-tests.

Concept	Active pre-mean	Passive pre-mean	Mean diff.	Mean diff. percent	Ind. T-Test	Sig.
IES procedure	2.57	3.5	0.93	30.6	2.42	(0.03)
BFREE	3.14	3.5	0.36	10.8	0.74	(0.48)
Belize fun	3.71	4.17	0.46	11.7	0.71	(0.49)
Farmer relations	2.86	3.17	0.31	10.3	0.5	(0.63)
Env. law	3.71	4.17	0.46	11.7	0.84	(0.42)
Trial procedure	3	3.33	0.33	10.4	0.59	(0.57)
Comp. Law	3.29	3.33	0.04	1.2	0.1	(0.93)
Conservation	3.57	4.17	0.6	15.5	1	(0.34)
Disconnected	3.71	2.67	1.04	32.6	1.9	(0.08)
Requirements	3.43	3	0.43	13.4	0.61	(0.56)

**Note:** Diff.=Difference/Ind.=Independent/Sig.=Significance/=Significant

**Table 9:** Post-course independent T-tests.

Concept	Active post-mean	Passive post-mean	Mean diff.	Mean diff. percent	Ind. T-Test	Sig.
IES procedure	3.14	4	0.86	24.1	1.18	(0.26)
BFREE	4.57	4.83	0.26	5.5	0.73	(0.48)
Belize fun	4.71	4.5	0.21	4.6	0.75	(0.47)
Farmer relations	4	3	1	28.6	1.49	(0.16)
Env. law	4.43	4	0.43	10.2	1.07	(0.31)
Trial procedure	4	3.67	0.33	8.6	0.73	(0.48)
Comp. law	4.14	3.67	0.47	12	0.76	(0.48)
Conservation	4.43	4.33	0.1	2.3	0.21	(0.84)
Disconnected	4.9	3.5	1.4	33.3	3	(0.02)
Requirements	3.29	3	0.29	9.2	0.5	(0.62)

**Note:** Diff.=Difference/Ind.=Independent/Sig.=Significance/=Significant

Null hypothesis 5 cannot be rejected for: “BFREE,” “Belize Fun,” “Farmer Relations,” “Environment law,” “trial procedure,” “comparative law,” “conservation,” and meeting school “requirements.” The Independent T-test of these concepts revealed no significance change (past

the 0.05 threshold) for their associated AL and PL means relative to one another, pre-course and post-course. Specifically, the significance level of the changes in the AL and PL means before and after the course either were both above the alpha level ( $p > 0.05$ ; not significant)

or both below the alpha level ( $p < 0.05$ ; significant). The null hypothesis "ALE produces the same significance of change in learning outcomes between AL and PL" for BFREE ( $p = 0.48$  vs.  $p = 0.48$ ), Belize fun ( $p = 0.49$  vs.  $p = 0.47$ ), farmer relations ( $p = 0.63$  vs.  $p = 0.16$ ), environment law ( $p = 0.42$  vs.  $p = 0.31$ ), trial procedure ( $p = 0.57$  vs.  $p = 0.48$ ), comparative law ( $p = 0.93$  vs.  $p = 0.48$ ), conservation ( $p = 0.34$  vs.  $p = 0.84$ ), and requirements ( $p = 0.56$  vs.  $p = 0.62$ ) must be accepted (Table 7). For these concepts, the average percentage of mean difference before the course was 11%, while the average percentage after the course was only slightly different at 9.5% (Table 9). In practical terms, this suggests that, regarding these concepts, the course ALE had a similar effect on both self-identified AL and self-identified PL. This similarity is a positive sign for proponents of ALE in that it indicates a shift in paradigm towards more frequent use of ALE learning theories (at least regarding these particular concepts) will not disadvantage either group. Somewhat relatedly, Ballen et al., studied the effects of ALE on underrepresented STEM students' ability to close the gap in achievement between themselves and their classmates. The results showed that ALE positively influenced both closing such gap and improving the sense of social well-being experienced by the minority students. Three years later, Theobald et al., also found that ALE reduced achievement gaps in STEM exam scores and passing rates between underrepresented minorities, including low income students, and their classmates, but only in courses that implemented "high intensity" ALE. While there are counterpoints to this contention in the literature, for example, Weltman found a reduction in the test scores of top performers when exposed to an ALE. In contrast, Chen et al., point toward a "high level agreement" regarding the fondness of students in higher education for the ability of ALE to produce "optimum learning outcomes." They noted a preference for group discussion and project and case studies; the most famous examples are those employed by the Harvard business and law schools.

As the tenants of active learning dictate, this may be an excellent point to stop and reflect on these latter findings, clarifying the distinction between null hypothesis 4 and null hypothesis 5. The prior compared the change in PL over the course and the change in AL over the course and asked if these two sets of changes were similar in significance and effect. The answer shows, for most of the concepts, there were significant changes in AL knowledge/comfort acquisition but not PL knowledge/comfort acquisition and that the effect size of the acquired knowledge/comfort was larger for most of the AL significant concepts but not all. Alternatively, null hypothesis 5 compared the significance of the AL and PL pre-course difference and the significance of the post-course AL and PL difference to see if there were any shifts in significance, indicating that the means for the two types of learners either grew closer together or

farther apart. It found that for most concepts, the significance of the AL and PL mean differences did not change over the course, indicating that (when tested individually) both types of learners experienced enough gains that the differences between their respective means did not change significance level. Overall, for most of the concepts tested in this study, the gap between AL and PL means differences (*i.e.*, the "mean difference, difference;") decreased by an average of 35%. However, when the gap did increase, the increase was very substantial (223% in the case of farmer relations and 1075% in the case of comparative law).

## CONCLUSION

This work aimed to display student perceptions of the Active Learning Environment (ALE) created by a Spring Belize field course and to evaluate student perceptions of their knowledge gain. Qualifying perceptions of the environment involved a post-course survey highlighting the course's ability to stimulate active learning. The averages of responses to the survey measures produced percentages that exemplified the fact that a large majority of the class found this to be the case; the ALE stimulated knowledge acquisition but to varying degrees depending on the learning preference of the student (*i.e.*, as an active learner or passive learner). Responses to pre-course and post-course knowledge level evaluations, regarding concepts deemed by the entire class as fundamental course objectives, showed that the ALE produced knowledge gain for all measures. For self-assessed active learners, this gain was to a significant degree, and for self-assessed passive learners, it was not. However, both types of learners experienced knowledge gains with large effect sizes for multiple concepts. While most students valued the course, future studies on courses containing mock trials could look for a relationship between trial outcomes (winners vs. losers) and student perceptions of value while accounting for underlying factors in learning type self-assessment (such as social anxiety).

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