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Blending Inductive and Deductive Processes in the English/Language Arts Classroom

Abstract

This article attempts to demonstrate how the inductive and deductive processing modes function together. Educational models associated with an inductive learning process provide a great opportunity for students to assess their accountability in the learning process. However, the lessons gleaned from such an inductive approach can be more insight-provoking when a synthesis of (or at least access to) deductive processing occurs. The topic is presented in two parts: The first part constitutes a review of the inductive/deductive dynamic through research, study, and theory across multiple learning contexts. The second part presents a qualitative study and data examples for the purposes of theoretically and practically applying various deductive/inductive processes to an English/Language Arts context.

Keywords

inductive, deductive, induction, deduction, english, language arts, processing, strategies, inductive approach, deductive approach, blended instruction, inquiry models

Cover Page Footnote

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Educational models associated with an inductive learning process provide a great opportunity for students to assess their own accountability in the learning process. However, the lessons gleaned from such an inductive approach can be more insightfully developed when a synthesis of (or at least access to) deductive processing occurs. Students can make judgements on which process will lend itself more successfully to the creation and completion of a particular project/assignment. Often, a project/assignment will require both processes at particular intervals.

For the purposes of this article, we should define deductive and inductive processes as those which inherently reflect the generally-accepted meanings of the terms *induction* and *deduction* (i.e. how they are discussed throughout philosophical, scientific, and educational contexts). *Induction* can be understood as a process where specific observations are considered and synthesized to form a more generalized conclusion which may possess implications for further analysis and development. By contrast, *deduction* constitutes any logical attempt to substantiate (or repudiate) a more generalized claim through the subsequent analysis of additional, specific research. Thus, *induction* reflects the use of specific evidence for generalizations while *deduction* reflects analyses of generalizations through evidential means, and similar conceptualizations of these terms are evident in the works of Bilica & Flores (2009) and Decoo (1996).

This article attempts to demonstrate how the two modes of learning function together: Inductive learning engages students in actively forming conceptual insights that may provide applicability to other lessons/contexts. Deductive learning furthers such insights by promoting the testing and refinement of the conclusions, especially in the English/Language Arts (ELA) classroom. The topic is presented in two parts: The first part constitutes a review of the inductive/deductive dynamic through research, study, and theory across multiple learning contexts. The second part presents a qualitative study and data examples for the purposes of theoretically and practically applying various deductive/inductive processes to an English/Language Arts context.

Literature Review

Defining the Inductive Process

Joyce, Weil, and Calhoun (2015) defer to Aristotle when positing that human cognition is biologically predisposed to operate in an inductive modality (p.43). Inquiry relies on many variables, including how information is disseminated, observed, organized, and hypothesized; thus, the complexity of the process depends largely on the developmental age of the students, but the process is applicable at all levels nonetheless (Joyce, et al., 2015, p.44). Thus, we can accept Joyce, et al.'s presentation of any inductive model as that which requires specific data/information/examples to generate conceptual understanding (p.10).

Building on inquiry through the use of examples, Oliveira and Brown (2016) conducted a study on how the strategic use of exemplification contributes to knowledge gains in the classroom. They focused on an undergraduate course, *Animal Behaviour*, and confined their participant range to a single class roster of 75 students. Their conclusions posit that the strategy of exemplification can influence inductive processes depending on how/when the strategy is utilized, stating, "...it [*exemplification*] can also be used for the purpose of inductively teaching science concepts to learners. The generative (inductive) use of exemplification in science can serve as powerful means to scaffold student conceptual learning" (Oliveira & Brown, 2016, p. 764).

Defining the Deductive Process

The work of Hanna and de Villiers (2008) has been cited frequently in discussions surrounding the nature of mathematical proofs, and the defining principle of deductive processes that they present can easily be contrasted with the inductive process that was defined in the previous section of this paper:

> "To specify clearly the assumptions made and to provide an appropriate argument supported by valid reasoning so as to draw necessary conclusions. This major principle at the heart of proof extends to a wide range of situations outside mathematics and provides a foundation for human reasoning. Its simplicity, however, is disguised in the subtlety of the deep and complex phrases ''to specify the assumptions clearly'', ''an appropriate argument'' and ''valid reasoning.'' (2008, p. 329)

Just as proofs are a critical variable in the complexity of a mathematical topic, they are also integral to the subject of philosophy, which draws upon various hypothetical scenarios, accepted logical axioms, and contextual interpretations to form theoretical notions. Accordingly, the successful classroom - regardless of content area - will require students to demonstrate proficiency by using acquired information to support a theory, idea, or opinion.

In their study of computer simulations and learning processes, Rieber and Kini (1995) reported that knowledge gains in science-related computer simulations (relating to Newton's Laws, in this case) were mostly achieved through the inclusion of a tutorial before active student engagement in the simulation occurred. They consider the concluded process to be identifiably deductive as it initially exposes the students to specific details (Rieber & Kini, 1995). Comparatively, Rieber and Parmley (1995) demonstrate that the deductive process also benefits adults studying science.

Theoretical Potential for Synchronous and/or Asynchronous Presence of both Processes Within the Same Setting

Jacqueline Gollin (1998) briefly noted the possibility of a teacher using each process in the same setting to mediate particular learning obstacles as they arise. In this sense, a switching between processes, often guided by formative assessment reflections, constitutes an *asynchronous* model that is largely dependent upon teacher discretion.

Unless the classroom is functioning in a self-paced and distance-learning context, the inherent *synchronous* nature of the classroom logically elicits potential for both processes to occur within the same setting and timeframe - this is especially true if the learning setting is observably student-individualized and teacher facilitated such as one that operates on a *nondirective* model, as expressed by Joyce, et al. (2015).

Societal/Humanistic Contexts

From a historical perspective, the Age of Enlightenment period in Western culture reflects the transcendent nature of epistemological understanding on a macro-societal level. During this timeframe, the processes of induction and deduction inevitably permeated many contexts, including science, politics, and art (Duignan, 2018). The aforementioned examples, pertaining to how learning occurs within a classroom, illuminate how the classroom may be analogously seen as a microcosm of macro-societal knowledge patterns because of the humanistic essence shared between the two. Further, Roger J. Williams (1986) reflected on the need for the educational setting to be less sectional and more inclined to permeate multiple branches of discipline when appropriate - the fundamental goal being to promote well-rounded knowledge (p.18).

In a similar vein to Williams' request for educational development of worldly perspectives, Sarah Burns Gilchrist (2016) considers the Renaissance period a macro-societal example of how complex the learning process can and should be. She attempts to logically connect the Renaissance-era trait of free-thought in cross-conceptual contexts that had formerly been governed by more compartmentalized structures (i.e. fixed versus growth mindsets) to how such dissonant mindsets can have residual impacts within a classroom. Gilchrist states, "Culture, politics, and art of that period would have remained stagnant without a growth mind-set...Educational institutions have conditioned many students to prefer a fixed mind-set through overuse of standardized testing and exercise of curricular control" (2016, p. 36).

Gilchrist's study blends such conceptual connections with more concrete analyses of how the complexities of information literacy (IL) are evident when students are actually studying this time period. As the learning process unfolded during the Renaissance study, IL complexity was ascertained yet largely dependent on the digital landscape of the content; in essence, a correlation may exist between the broad scope of the time period itself and the challenges of navigating digital representations of the time period (Gilchrist, 2016).

School-based Contexts

Oliveira and Brown's aforementioned study purported exemplification as a useful strategy in an inductive learning model, but they also acknowledge that its application to deductive models has been well-documented, stating, "Example-based assessment items or prompts provide students with an opportunity to demonstrate having learned how to *apply* a previously taught concept or idea" (2016, p. 764). Accordingly, their study was oriented to a science class, but its broader implications are obvious as assessment(s) and exemplification(s) are present in all content areas. In any subject, students will interact with examples to either generate understanding or demonstrate proficiency.

An underlying theoretical component - as it relates to a blending of the two processes - is observed in Lizbeth Finestack and Marc Fey's (2009) study correlating deductive learning and observed metalinguistic factors such as language impairment; specifically, this component is noted when they conclude on the implications of their study. While their data supports a causal linkage between increased testing performance among specified students and the utilization of deductive instruction as an intervention tool, they also concede that a blend of inductive and deductive instruction in the classroom could have favorable outcomes for students with grammatical deficits (Finestack & Fey, 2009, p. 300).

With a substantive goal in mind, Finestack (2014) conducted a study - with similar parameters to the aforementioned one in 2009 - using students who were not diagnosed with language impairments. In this study, however, Finestack's reflection of the data proposes that the level of a student's language skills may influence whether an inductive or deductive instructional approach is applied (2014, p. 519). Essentially, the implications of each study (Finestack & Fey, 2009, and Finestack, 2014) suggest that both inductive *and* deductive approaches should be considered and applied within the same educational setting.

Example of an Asynchronous Lesson in the Classroom

Essay writing is an area which requires careful consideration of many instructional variables, including time constraints, student capacities, *a priori* content exposures, and essay purposes. *Appendix A* demonstrates how the processes were asynchronously applied in my English/Language Arts classrooms. The figure included is a flowchart that was initially developed as a long-range plan for a unit on argumentative writing, but the flowchart was then provided to the students during the introduction of the unit.

To summarize the unit/flowchart, an inquiry-based approach was used as students inductively worked through text examples to analyze their practical and stylistic aspects. This allowed the students to develop a working foundation for how such elements may be incorporated into their own writing; applicably, the conjunction of text analysis and inquiry-based learning is substantiated by Joyce, et al. (2015, p.86). Students then shifted to a *deductive* approach by generating a working thesis on an argumentative topic and then gathering evidence. At the revision stage of the essay, the students reverted back to an inductive approach to form conclusions about the rhetorical efficacy of their grammatical/structural choices.

Example of a Synchronous Lesson in the Classroom

Appendix B includes an exercise that was conducted in my ELA classes while the students read a fictional novel. While reading the text, the students engaged in an annotating strategy that was comprehensive and able to be refined depending on class consensus (i.e. the students and teacher agreeing on how to implement improvements to the annotating process). This particular process included students initially annotating the text freely - then, they analyzed each annotation to see whether or not it could be categorized as a text summary, a reflection on the text, or an interpretation of the text. The figure in *Appendix B* is color-coded to reflect the inductive and deductive nature of each annotation category as well as the exercise as a whole. The *summary* and *reflection* categories are coded as inductive because they largely reflect observations and intuitive reactions to the text. The *interpretation* category is coded to reflect both inductive and deductive processing because it reflects the student's attempt to substantiate or refine an application of a particular theme, abstract concept, or societal connection.

The synchronous nature of this exercise lies in the observation that each student switched between inductive and deductive processes at random intervals. Variables that influenced the interval changes were the perceived quality of initial annotations as well as the numeric quantity of initial annotations. Fundamentally, the students used inductive processing to analyze the quality of their initial text interactions, they deductively worked to refine and expand the scope of their initial work, and then they blended both processes while validating or refining their hypotheses; however, they operated each of the processes in varying degrees due to the individualized and self-paced nature of the exercise.

Method

A document/content analysis approach was utilized to create a standardized methodology for evaluating classroom lessons and activities which demonstrate two aspects: First, whether or not a lesson provides the opportunity for inductive and deductive processes to occur for the students and/or the facilitator. Second, whether the processing foci are primarily teacher or student dependent in relation to conducting the lesson.

The following tables consist of factors that were observably present in my lesson reflections from the ELA-based units that my classes completed during the 2016-2017 school year. The lesson data samples were compiled from 6 instructional units that were conducted. Each unit contained lessons which served one or both of the following purposes: 1) content dissemination, by which students received information provided/delivered by the instructor, or the instructor assessed information presented by the student(s), and 2) content analysis, in which the students were engaged in an inquiry-based activity that required text interaction, evidence gathering, and/or information synthesis. The units were varied in quantity of specific lessons, ranging from 12 to 28 daily and/or multi-day lessons. In total, 126 lessons were analyzed from this school year.

After concluding that all lesson units contained aspects of content analysis and/or dissemination, a matrix was created that served to identify how deductive/inductive processing functioned for a particular lesson type. The purpose for this was two-fold in that the criteria provided a means for establishing how inductive/deductive processing was occurring as well as for gauging

dependence on a conscious shift between inductive/deductive processing - this is referred to as the "Type-Criteria Matrix":

Type-Criteria Matrix

Content	Teacher-Led	Teacher-Facilitated	Whole-Group	Individual	Inductive Processor	Deductive Processor	Asynchronous	Synchronous	Type
Disseminated	☑	☐	☑	☐	S	T	☑	☐	DW-A
Disseminated	☐	☑	☐	☑	T	S	☑	☐	DI-A
Analyzed	☐	☑	☐	☑	T	S	☐	☑	AI-S
Analyzed	☐	☑	☐	☑	S	T	☐	☑	AI-S
Analyzed	☑	☐	☑	☐	S	T	☑	☐	AW-A
Analyzed	☑	☐	☑	☐	T	S	☑	☐	AW-A

Where applicable: "T" refers to *teacher* / "S" refers to *student

***"Type" refers to an acronym generated by combining content (disseminated/analyzed), conduct (whole-group/individual) and theoretical shifting of inductive/deductive processes. For example, "DW-A" may be read as a lesson which disseminates content to an entire group and has potential for asynchronous processing to occur.**

Figure 1

Afterward, a more condensed matrix was developed to function as an anticipatory (or reflective) tool for a teacher to identify lesson "type" - this is referred to as the "Lesson-Type Matrix":

Figure 2

Lesson-Type Matrix

Lesson	Content	Teacher-led	Teacher-facilitated	Whole-Group	Individual	Type
Example 1	disseminated	☑	☐	☑	☐	DW-A
Example 2	analyzed	☐	☑	☐	☑	AI-S

***This matrix serves as a tool for either anticipatory planning of a lesson or reflection on a previously-conducted lesson (in relation to its potential for inductive/deductive processing).**

The function of the "Lesson-Type Matrix" relies on the instructor identifying contextual factors that are inherent to the learning process: content delivery style and instructional mode. Once these factors are considered, the instructor is able to categorize the lesson and attribute a processing label of asynchronous or synchronous. For example, it may be observed from Figure 2 that Lesson Example 1 consists of content dissemination ("D") and whole-group instruction ("W"), which would designate the lesson as "DW". Then, the Type-Criteria Matrix (fig. 1) can be referenced to attribute the asynchronous ("A") or synchronous ("S") label; thus, Lesson Example 1 is a DW-A lesson type.

Once I had developed a methodology by using my 2016-2017 lessons as preliminary data, I then utilized both matrices to conduct a post-reflection of my 2017-2018 ELA lessons/units.

Results

Using the same methodology as previously outlined, I identified lessons from the 2017-2018 school year which were pedagogically similar across all lesson units. Over 6 units, 112 lessons were conducted, and there were 9 lesson types that were observably used in all of the units. Then, I analyzed those 9 lesson types by using the "Lesson-Type Matrix". The results are shown in the following figure:

Lesson-Type Matrix

Lesson	Content	Teacher-led	Teacher-facilitated	Whole-Group	Individual	Type
Essay Lecture	Disseminated	☑	☐	☑	☐	DW-A
Essay Workshop	Analyzed	☐	☑	☐	☑	AI-S
Annotating Model	Disseminated	☑	☐	☑	☐	DW-A
Annotating Exercise	Analyzed	☐	☑	☐	☑	AI-S
Literary Device Lecture	Disseminated	☑	☐	☑	☐	DW-A
Literary Device Discussion	Analyzed	☐	☑	☐	☑	AW-A
Text/Society Model	Disseminated	☑	☐	☑	☐	DW-A
Text/Society Inquiry	Analyzed	☐	☑	☐	☑	AI-S
Student Presentations	Disseminated	☐	☑	☐	☑	DI-A

Shared Lesson Types in ELA Units Throughout 2017-2018 School Year
(Data is restricted to self-created lessons utilized in my classroom)

Figure 3

While applying the Lesson-Type Matrix, I was able to identify the lessons which were either asynchronous or synchronous in relation to how deductive and/or inductive processing might occur as well as how the teacher and the students might be processing (i.e. thinking inductively, deductively, or both) during the lessons. Another benefit of using this matrix was that it supplemented my intuitive pedagogical judgements with a more concrete gauge for anticipating induction/deduction and asynchronicity/synchronicity during the planning process; in turn, this allowed me to identify exemplar lessons in a more systematic and efficient way than I had in the past.

Multiple conclusions can be inferred from the data with varying implications for lesson planning and reflection. In particular, the "Content" column identifies 4 of the 9 lessons/activities as "Analyzed" and 5 of the 9 lessons/activities as "Disseminated". One of the lessons categorized as disseminated, however, is related to student presentations (i.e. the students are disseminating information rather than the instructor). The data also reflects similar numbers for teacher-led and teacher-facilitated lesson models. Accordingly, it may be assumed from the results that the curricular units comprising the 2017-2018 school year were relatively balanced with lesson content and delivery methods where students were not assuming the role of information

presenter. This inference could possibly aid the instructor in determining the benefits and/or drawbacks of having balanced lesson modes. Further, the "Type" category might also provide an opportunity for the instructor to investigate whether an asynchronous/synchronous appropriation of inductive/deductive processing is conducive to respective content and delivery methods, which might contribute to the refinement of a lesson(s) for efficacy or alignment with long-range objectives.

Limitations

The subjectivity within this study might reside in the concession that the lesson data gathered and analyzed during the development of the matrices is derivative of the researcher - the lessons were created by me as well as the study methods. However, it might also be posited that the qualitative nature of this study permeates the data as well as the study methods. Among other variables, lesson plans are an amalgamation of presuppositions, practicality, *a priori* data, and arbitrary requirements - furthermore, a carefully-constructed lesson plan does not only consider the measurable aspects of a classroom environment just as it does not dwell solely on intuitive attempts to foster student engagement. Consequently, neither qualitative nor quantitative approaches can account for the complexity of identifying exemplar lessons without coexistence.

Contextually, this study manifested as a means for establishing a supplemental tool to gauge the quality of my lessons as they pertain to the theoretical perspective of cognitive induction/deduction. The data utilized for this study was longitudinal in scope, in the sense that the lessons analyzed during the 2016-2017 school year provided a foundation for creating the matrices, and the lessons of the 2017-2018 school year were utilized as a means for evaluating the efficacy of the matrices as a supplementary pedagogical tool. In sum, the benefits of the matrices appear to outweigh the limitations by providing an additional evaluative tool for pedagogical planning, a resource for pedagogical post reflection, and a systematized means for pedagogically applying information- processing theory.

Perhaps the paramount limitation of this study lies in how either the presence or absence of its generalizability may be subjectively inferred - the lessons analyzed do not necessarily cover the entire scope of ELA curriculum as well as how they are created and tailored with respect to environmental dispositions. It does, however, succeed as a focal point for discussing the pedagogical essence of a lesson, especially in those contexts where such discussions are systemically lacking.

Conclusion

A majority of published research and theory on this essay's topic is related to the content areas that are traditionally perceived as scientific in essence. One possibility for the overwhelming association between these processes and STEM-related content areas is because the terms, induction/deduction and inductive/deductive, may be defaulted to the realm of scientific jargon. Yet, as a classroom journeys through a lesson, the complexities of knowledge can produce content applicability which transcends presupposed instructional objectives. A class may be reading a fictional novel written in 1900, but the potential for a character trait or plot event to connect with a scientific branch of study - such as psychology or sociology - becomes increasingly apparent as insights are gained.

While discussing the inductive learning process, Joyce, et al. list six components that are essential to its productivity and applicability. The following is a condensed version of their list: Identifying an area of study; Building data sets; Constructing ideas for conceptual control over topic(s); Generating ideas/causal hypotheses; Testing hypotheses; Building/Practicing concepts (2015, p.46). At the conclusion of their list, the authors mention that the process is antithetical to deductive thinking, but they also suggest that the inductive process can be inversely traced from any starting point and that it does not have to begin in sequence of the list (2015, p.47). In contrast to this view, it might prove logical to counter that if a class begins with generating causal links between concepts, and then proceeds to testing/validating hypotheses, it must be acknowledged that the class has embarked on a deductive mode of learning rather than inductive. The underlying - and perhaps most important - consideration is that the processes of induction and deduction are essentially composed of the same elements, and students as well as teachers are accountable for actively making decisions on how the thought process should be applied and refined as needed: This is a notion that is not confined to a single content area.

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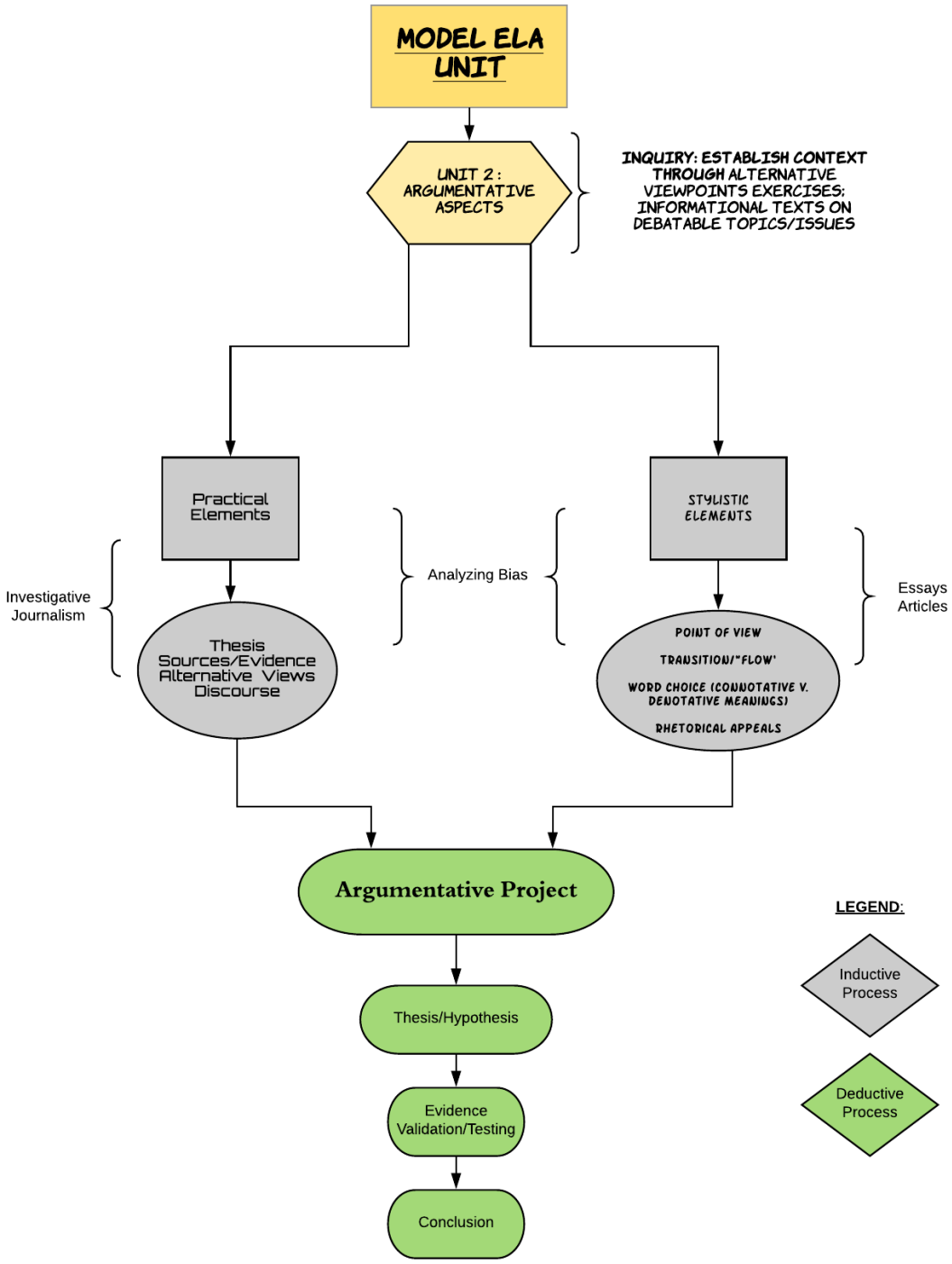
Appendix A:
Inductive and Deductive Processes while Teaching Argumentative Writing:



Appendix B:
Inductive and Deductive Processes while Annotating Texts in ELA Classroom: