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The Impact of Teaching Reasoning Fallacies on the Critical Thinking Ability of Moroccan Engineering Students: The Case of ENSAM Meknes

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ARTICLE INFORMATION	ABSTRACT

This research paper reports an experimental study geared to examine the effect of teaching reasoning fallacies on the critical thinking ability of a group of Moroccan university students. In a random assignment post-test design, 40 subjects took part in the study treatment. While the subjects in both experimental groups (n 20) received treatment on how to avoid and spot fallacies in arguments, the control group was involved straightway in taking the pre-test and the post test (with no prior assistance) for comparison purposes. After the treatment -which consisted in having the experimental group (n 20 subjects) receive training on the meaning of 15 reasoning fallacies and reinforcements tasks on how to identify them in statements and how to avoid them when they speak or write - all the subjects answered a twenty item multiple-choice test and 5 of them responded to structured interview to identify their attitudes. The final scores were then subjected to descriptive as well as referential statistics (independent and paired samples T-test) for between-group comparison purposes. The results reveal a significant facilitative and positive effect of reasoning fallacies training understudy, particularly when compared to the control condition. A follow-up investigation through an independent simplest-test) attested to the fact that the training resulted in an increased critical thinking ability as measured by the receptive and productive and this is particularly so when compared to the control condition. The study concludes with the main finding together with their interpretation. Some practical implications related to critical thinking instruction, lesson planning and material development, in general, brings the full paper circle.

1. Introduction

Critical thinking "henceforth, CT" is a skill that learners need to acquire to cope with the new demands of the twenty-first century. The nature of the skills required nowadays in the workplace is different; the need for effective oral and written communication skills is greater today than ever before. Today, people are required to read and write and perform basic mathematical calculations to be considered literate; they are supposed to be functionally literate. That is to say, they have to be able to use "these skills in ways that contribute to socio-economic development, to developing the capacity for social awareness and critical reflection as a basis for personal and social change" (Education for All global monitoring report, 2006). So, critical reflection in this quote is a key term that suggests that educational programs should incorporate critical thinking as one of their priorities.

This new trend in education inspired educationalists and researchers to seek ways to enhance critical thinking abilities in students by equipping them with the necessary tools to cope with this ever-changing world. To achieve this objective, they had

to define the concept of CT and come up with a well-defined taxonomy that can help teachers facilitate their students learning by using CT as a "means by which students process content" (Elder & Paul, 2013, p. 34).

In the Moroccan context, however, Until very recently, teaching critical thinking has not been given its due importance as a full skill in higher education and seems to have been nonexistent at the high school level(as evidenced by the English textbooks adopted so far). Gradually the subject has started to attract the educators' attention, especially in higher education. Many research studies are now conducted on critical thinking, and the focus was usually on Bloom's taxonomy of educational objectives. Yet, incorporating reasoning fallacies "henceforth, RF" as a promising framework for teaching and boosting students' critical thinking skills is an area that requires consideration and close investigation.

2. Background of the study
2.1. Critical Thinking: key concepts and major issues
Various researchers and educators suggested many definitions of the concept, yet they all contribute to the growing picture of the term Hughes (2014). 2500 years ago, the Greek philosopher Socrates initiated the idea of deep questioning that involves thinking to search for the truth before deciding to accept or refute an idea. The same premise was adopted by many researchers who dealt with CT as the readiness to question the others' assumptions and evidence (as well as their own assumptions and ideas) to draw sound conclusions and improve their thinking. Barnet &Bedau (2016) defines critical thinking as a "sceptical state of mind" (p: 3). Facione (2011) defines it as "Purposeful, reflective judgment which manifests itself in reasoned consideration of the evidence, context, methods, standards, and conceptualizations in deciding what to believe or what to do." (p.22) . According to him, critical thinking is related to cognitive skills and predispositions, namely interpretation, analysis, evaluation, inference, explanation, and self-regulation (Facione, 2015).

Therefore, critical thinkers are those who are capable of using their cognitive skills to think about their own thinking to improve it (Elder and Paul, 1994). Each of these skills encompasses a set of sub-skills that reinforce it. This eventually means that critical thinking has to do with the learners' use of logic, analysis and good judgments when dealing with different situations. Learners are said to have acquired critical thinking skills when they can have an attitude towards the various issues they may be exposed to; when they are able to look for, analyze and use evidence before accepting or refuting others' propositions and opinions.

Most of the studies on critical thinking were based on Bloom's taxonomy, the main objective of moving students from lower-order thinking skills to higher-order thinking skills. This move starts with enhancing the students' superficially understanding types of discourse to deeply analysing, interpreting, explaining, and evaluating information. This is to teach them to make good judgements in various situations that involve problem-solving and decision making. Students may be taught these evaluative skills according to an order of acquisition (Gratton, 2001). Different studies were conducted in this area and some of them went as far as to support the explicit instruction of CT. Others suggested that teaching CT should be infused into different subjects in a kind of content-based instruction.

2.2. Explicit instruction of critical thinking
Many research studies supported the explicit instruction of CR (Bensley & Spero, 2013; Ennis, 1989; Marin and Halpern, 2011). Marin & Halpern (2010) claim that CT can be taught, either through an embedded instruction or through an explicit one, and that students are more likely to transfer their critical thinking skills to new situations if they are taught these skills explicitly. This can be done through three phases; introducing the skills, deliberately practising them and providing students with opportunities to apply their learning and hopefully transfer their knowledge to new and novel situations. Marin and Halpern (2010) compared explicit and embedded instructional modes of teaching critical thinking in their study. The participants were high school American students who were enrolled in low-performing high schools. The results of the study provided strong evidence that the explicit instruction of CT was more effective than the embedded or implicit one.

Bensley, Crowe, Bernhardt, Buckner and Allman (2010) conducted an experiment to test the effect of the explicit instruction of critical thinking on the students' argument analysis skills. They compared two groups who were taking research methods classes. The experimental group was taught the subject by using critical thinking based instructional strategies. More precisely, the students were taught how to differentiate facts from opinions and arguments from non-arguments; they were instructed on how to evaluate evidence and analyze and synthesize literature review. The second group was taught the subject the traditional way. The researchers conclude that the experimental group who received the training improved in terms of their argument analysis skills. The authors recommended the incorporation of critical thinking into regular course instruction.

Bensley and Spero (2014) compared three similar groups taking the same course with different types of instruction. The first group received a direct infusion of critical thinking. They were taught how to analyze psychological arguments. They were also introduced to critical reading and were given feedback on their CT skills acquisition. The second group received a direct infusion of principles of memory improvement, and the third group focused on content knowledge acquisition. The study revealed that the CT group improved significantly in argument analysis and overall critical reading ability, unlike the second and third groups.

In summary, Most of the studies on CT supported the explicit instruction of this skill. Based on their findings, the purpose of the current study is to investigate the effect of the explicit instruction of reasoning fallacies on students' CT ability. The first step to achieving this objective is to understand what reasoning fallacies mean and review previous studies on this issue.

2.3. Reasoning fallacies

Another area of critical thinking research, which is the focus of this study, is reasoning fallacies "henceforth, RF." These defects, flaws, and errors in an argument that cause it to be invalid, unsound or weak. There are two broad categories of fallacies (i.e. formal and inform). Formal fallacies have to do with the form of argument; that is, how the arguments are sequenced … etc. Informal fallacies have to do with the content of the argument. They are manifested in an inability to construct a rational link between the evidence and the claim. According to Walton (2010) reasoning fallacies are commonly used sophisms or errors in reasoning. They take the form of good and well-reasoned arguments with an ability to persuade, yet they contain elements of deception that violate the norms of argumentation. These elements of deception are systematically concealed (Ricco, 2007). They include practices such as *appeals to authority, force, pity, converse accident, equivocation, hasty generalization, etc. an explanation of each type of* fallacies is provided in the appendix of this article. Fallacies may be committed intentionally; for example, in the media, in political advertisements… or unintentionally, as is the case in academic writing, everyday conversations …etc. So, the importance of the theory of fallacy stems from the fact that it contributes to the evaluation of reasoning (Finocchiaro, 1981). Accordingly, students need to be aware of them to evaluate their own arguments and the others' arguments.

2.4 Research on reasoning fallacies

Despite the importance of teaching reasoning fallacies in education, research in this area is still lagging because only a limited number of studies have been conducted, especially in the Moroccan context. Hiba (2020) experimented with investigating the effect of teaching fallacies analysis through a critical reading course on the students' critical thinking abilities. The participants in the study were 25 Masters' students in the English department at the faculty of letters in Rabat. They took the reading class for one semester. They were exposed to a set of frequently committed informal fallacies in debates and day-to-day conversations. The findings revealed that the students' ability to detect fallacies in discourses and use meta-language to describe the argumentative structure of discourses improved significantly thanks to the treatment they received in the form of explicit instruction of the reasoning fallacies.

Amrous&Nejmaoui (2016) investigated university students' ability to evaluate arguments and identify errors in the participants' reasoning processes. They found out that semester six students, who were close to graduating, could not construct sound arguments and detect fallacies underlying them. Master's students, on the other hand, were able to construct arguments, but they could not evaluate arguments. Bardakç i & Çakir (2014) delineated the effect of the explicit instruction of reasoning fallacies on the learners' development of critical reading skills. The participants were first-year EFL university students. An experimental design was used to compare the experimental group, who received training on RF. while they were taking reading classes, to the control group, who took regular reading classes. The results of the study showed that the experimental group's critical reading skills improved thanks to the treatment, suggesting as a research finding that learning how to identify reasoning fallacies can have a positive impact on the students' critical reading skills.

El Khoiri & Widiati (2017) investigated logical fallacies in the argumentative writing of Indonesian EFL learners. They used argumentative essay writing and focus group discussion on identifying the fallacies in the students' writing and exploring their perception of the fallacies. The research findings showed that students use a number of fallacies in their argumentative writing; namely oversimplification, fallacy by distraction, overgeneralization, false analogy, false inductive reasoning, questionable claim concerning "real cases" which are scientifically absurd. The study also revealed that Students have limited knowledge of logical fallacies. In the focus group discussion, the majority of the students were able to identify the fallacious arguments. Yet, they were unable to explain why they were faulty.

3. The Study
3.1. Study Objectives

The objective of the present study is threefold. First, it aims at identifying whether training on reasoning fallacies will foster critical thinking skills amongst Moroccan first-year university students. Second, it seeks to highlight whether this very same training would yield different degrees of critical thinking ability as measured by receptive and productive tasks of the subjects involved in the study. The present study's third and final objective is to find out how the experimental group participants react to the training on reasoning fallacy recognition and production by identifying their attitudes towards the treatment as measured by a feedback questionnaire and structured interviews administered immediately after the subject takes the post-test.

3.2.1. Research Questions
To attain the objectives listed above, two research questions are addressed, focusing on what aspect of the treatment is under study.

1) Does strategy training on recognizing reasoning fallacies foster critical thinking skills amongst first year University students?
2) Does strategy training on reasoning fallacies have a positive impact on recognition or also on production of sounds arguments (writing an argumentative paragraph)
From the above research questions, three major research hypotheses were formulated as preliminary answers

2.2.2. Research Hypotheses
1) The mean score of the subjects who received training in reasoning fallacies (i.e. experimental group) will be higher than the mean score of the subjects who received none (i.e. the control group).
2) The subjects in the experimental groups are predicted to display signs of a positive attitude towards and appreciate the treatments on their critical ability skills and competencies. (the tool used for this hypothesis is the post-treatment questionnaire and structured interviews)

The present study aims at investigating the effect of training on reasoning fallacies on the ability of Moroccan first-year university students to think critically. For this purpose, a before-and-after design is used to examine the extent to which a one-month training on how to spot fallacies in others arguments and how to avoid them on one's own is provided to EFL students. After exposing them to a set of reasoning fallacies (more precisely, 15 fallacies are taught in terms of meaning and use), participants in the experimental group are asked to study, analyze and spot errors in argumentative tasks immediately after the training. In the case of the control group, students were simply asked to take the pre- and the post-test to compare their performance with that or the experimental group.

Put more precisely, the study involves one experimental group and a control condition. While the experimental group subject received prior instruction in reasoning fallacies (presentation and practice tasks), the control group embarks directly in the post-test with no prior instruction or treatment on how to identify reasoning fallacies.

The design underlying the study is also known as a random assignment. That is to say, the subjects are randomly assigned to either the experimental or the control group. Participants who received training sessions on recognising reasoning fallacies are required to analyze the same arguments in reading and viewing tasks and answer the post-treatment test. Upon taking the pre-test subjects of both the control and the experimental group are therefore be randomly assigned to one of the following testing conditions

Group1 (Experimental group)
The first group was involved in interactive tasks and a whole-class discussion of reasoning fallacies. The researcher facilitated the workshops and explained unfamiliar fallacies before asking students to work in pairs or groups to practice further and reinforce newly learned concepts. They embark on studying/explaining fallacies to identify ill-structured arguments and name the fallacies underlying them. The researcher starts the class by pre-teaching first familiar then inaccessible reasoning fallacies, especially those whose meaning is difficult to guess by resorting to contextual clues and cues provided by the text. Focus is especially put on the 15 fallacies targeted and investigated in the current study

Group 2: (control group)
This second group in the study is simply required to take the per- and the post-test. The latter consists of argumentative task analysis of both the statements and the ads and will be tasked to write and argumentative paragraph / with no prior help or treatment whatsoever of the reasoning fallacies; the study assumes that the absence of prior instruction is the common practice in most EFL classes and hence the rationale behind conduction the present study.

That said, it seems already clear that the study is geared to explore the potential kingship between reasoning fallacy training (recognition/production) as reflected in the test scores (dependent variable) of the subjects and the treatment under study (as the independent variable) when compared with the absence of prior instruction as is reflected in the case of the control group.

3.3. Subject of the study

Sampling Measures

Group	N	Native Language	n	Gender (n)
Control group	20	Moroccan Arabic	35	Male 20
Treatment group	20	Tamazight	5	Female 20
Age range		18 to 21		

To achieve its objectives, the present study sought to recruit 40 first-year university students from one of the eight groups of first-year students enrolled at ENSAM in the academic year 2020-2021. A group of 50 participants was initially recruited for the study. For the sake of controlling variables,10 of them were randomly eliminated for validity and reliability reasons. While four participants were withdrawn because of their significantly below average mean score in the pre-test, three others were eliminated to minimize both the gender and age differences across the two groups. The other 3 participants were disqualified from the main study because they apologized for not attending all the sessions devoted to the treatment despite displaying interest in the study.

Thus the remaining 40 subjects were randomly assigned to either the experimental or the control group. The entire group was assumed to be highly homogenous, particularly in terms of their age, gender and language proficiency level. All of the subjects were assumed to belong to more or less similar language proficiency levels in that they were mostly no-repeaters who have had the same amount of exposure to the target language (English) over the last four or five years spent in middle and high school levels. This assumption was also all the more confirmed by the results of the pre-test prior to running the experiments in the main study. Thus, given their native language, gender and age variables, the three groups were judged by both their teacher and the researcher to be highly homogenous and above all comparable with regards to their cultural background, cognitive maturity and above reasoning capabilities.

Also of paramount importance at this stage of data collection was that they were all students who belonged to the same engineering school and were taught by the same university teachers. This might have helped to accentuate the subjects' homogeneity were the kind of language instruction they received prior to the experiment. This is especially true since they all had the same ESP English as preparatory classes' students during their first years. Similarly, as far as their linguistic background is concerned, all subjects spoke French 100% as a second language and Moroccan Arabic as their L1. Only 20% spoke Berber as their first native language instead of the remaining 90% others who spoke Moroccan Arabic.

3.3.1. Descriptive statistics for the age variable

	Groups	
Age	Control	Experimental
Min. age	18.00	18.00
Max. age	19.00	21.00
Median	20.00	21.00
Mean	20.10	21.83
SD	5.84	6.01

The age of the study participants ranges between 18 and 21. Both the experimental and the control groups consist of 20 participants. Each group is comprised of 10 males and 10 females to control for gender variables. Only students who met the study requirements and those who actually took part in the pre-test and the post test were involved in the study. This is especially true for the experimental group where only those students who kept their promise to attend all the four scheduled training sessions on reasoning fallacies were eventually taken into account during data collection and eventual interpretation of the results.

3.4.2. Research instruments and data collection procedure

Study groups	Pre-test	*Treatment	Post-test	Questionnaire/ interview
Control G.	Yes	NO	Yes	Yes
Experimental G	Yes	Yes	Yes	Yes

*Treatment consists of a workshop on reasoning fallacies: Concept defining /illustrative examples and training sessions for further practice and reinforcement (reading & analysis of advertisements for receptive/whole class discussion for productive skills)

Definition of treatment, prior instruction and the distribution of timing
Table: Treatment Procedures

Type of measurement (Pre-test)		Study Groups	Number of subjects 20		Duration of treatment	Type of measurement (post-test)		Feedback questionnaire Structured interview
			Male	female				
	Receptive tasks Productive tasks	Experimental	10	10	4 weeks training related to 15 fallacies under study		Receptive tasks Productive tasks	
		Control group	10	10	no prior treatment or training			

As is clearly shown in the table above, the timing and procedures for the experimental and the control group were similar in all respects except for treatments of the reasoning fallacies under study. The training on the reasoning fallacies lasted almost four weeks, with an average 2 hours a week. The subjects involved in the experimental group were made aware that this was a study seeking to identify the effect of strategy training in reasoning fallacies awareness and the extent to which this might positively or facilitate their critical thinking skills. They were also made aware that following the treatment procedure, they are going to take a post test to measure the effect if any, of the training they received on their ability to spot/avoid reasoning fallacies, a capability that is used synonymously with critical thinking acquisition in this study.

Further instructions by the researcher made it clear that they could withdraw from the experiment any time they wished to. Finally, it was pointed out that once they have taken the post-test, they would have to freely provide any feedback by filling in a post-test written questionnaire and/or answering a structured oral interview to delve deeper into their experience and get some qualitative data concerning the treatment they have received. Care was particularly taken to have the same person (i.e. the researcher) conduct the experiment or provide the treatment for the experimental groups if only to make sure that clear instructions are given. The right treatment is provided to the participants prior to the post-test administration to gauge their performance. Also, with the hope of maximising students' involvement and interest in the experiments, enough time was allotted for the experimental and control groups to take the post-test and fill in the feedback questionnaire.

Put more precisely, the treatment under study consisting of four training sessions extended over a period of one month- was scheduled to expose participants in the experimental group to the meaning and use of 15 reasoning fallacies in arguments. Interestingly enough, one of the underlying assumptions of the current study is that being able to identify reasoning errors in others' arguments- be them in written or oral discourse- and at the same time being able to avoid them in one's oral or written discourse is, among other things, what teaching critical thinking is mostly abo ut. This evokes the variable of the study. The independent variable is the training on recognizing reasoning fallacies under study. The dependent variable is the scores the subjects receive in both the pre-test and the post-test to measure the effect of the training they received; the main assumption

being that this intervention will impact positively the subjects' ability to think and reason more critically/logically than when they are not exposed to such training. The controlled variables are the age, gender, proficiency level and cognitive maturity of the study participants. The table in appendix A provides a list of the reasoning fallacies investigated with illustrative examples of how they are defined for the sake of this study.

4. Results and Discussion
Statistical Analysis: Sample unpaired T-test
The study uses 40 subjects altogether. They were randomly assigned to a control group (n 20) and an experimental group (n 20), respectively. The latter group received the treatment in the form of reasoning fallacies both in terms of use and meaning. The researchers believe this treatment will positively affect their ability to think critically both in the productive and receptive stack used in the study as pre- and post-test. In so doing, the study hopes to examine the extent to which the awareness-raising training on how to avoid fallacies in one's arguments and how to spot them when others produce them will boost the students' ability to make accurate reasoning moves when they speak and spot flaws in others arguments when they produce them. For the statistical analysis of the data, the study uses a paired samples T test. This means the mean scores of the study participants' before the treatment (pre-test) and after the treatment (post-test) are compared and contrasted for significance. If their scores in the post test are significantly higher than in the scores in the pre-test, we can conclude that the treatment examined had an effect.

While 20 students comprising the experimental group received training, the control group was not. As the number of errors is a quantitative variable, the methods of statistical inference that is applied here usually found under labels such as "independent samples t-test" in software menus or code. An appropriate analysis report includes summary statistics, the estimated difference of means with a 95% confidence interval, and a P-value. The P-value is for a test of the null hypothesis of no difference in the true means of the two groups. Here is a summary table that combines descriptive and inferential statistics.

T-Test: Comparing the two Groups

Group	N	Mean	SD	Std Error. Mean	P-value
Treatment	20	19.35	2.04	0.27	0.062
Control	20	14.20	1.80	0.57	

The mean scores of the two groups are compared as shown in the table above. The Independent Samples T-Test is a statistical tool used generally to compare two samples means to determine whether the population means are significantly different due to the treatment or training that the experimental group received using reasoning fallacies. So in the current study (H1: μ1 ≠ μ2) the two group means are not equal but significantly different, confirming thus the first research hypothesis that the treatment group would outperform the control group. This is evidenced by the fact that the mean score of the subjects who received training in reasoning fallacies (i.e. experimental group) are significantly higher than the mean score of the subjects who received none (i.e. the control group). This means that subjects who received training on how to detect fallacies in arguments did well on the post test and scored higher than those who did not.

Independent Samples T-Test

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	T	df	Sig. (2-tailed)
EqualVariances Assumed	.166	.62	1.88	85	.062

As far as the second research hypothesis is concerned and based on the results reported above, the case for including fallacies in teaching critical thinking is empirically supported by the qualitative data derived from the post-treatment semi-structured interviews with a good sample of participants from both groups of the study. The treatment underlying the present study revealed the kinds of errors in reasoning that occur most commonly in arguments. The post-test interviews used to delve deeper into the subjects experience reveal that they learned how to analyze arguments for reasoning errors and admitted that "the training on reasoning fallacies has completely changed my perspective. When involved in a conversation with someone, I attend more to my arguments and I try to avoid reasoning fallacies that I was not even aware of before I volunteered to participate in your study." Most study participants who took part in the experimental group draw the researcher's attention to the idea that

"my critical skills have developed tremendously thanks to the training we received on how to spot fallacies, I am so lucky to have participated in this study". A female participant admitted that "I have grown more sceptics now that I have learned about the various fallacies used to manipulate people and particularly those who were never exposed to this type of critical thinking training strategies before." These comments and many similar others   attest to the positive effect of teaching the fallacieshave on students' critical thinking disposition and analytic skills in general.

5. Concluding Remarks and Implication

Broadly speaking, there are at least two arguments in favour of using fallacies as a framework for teaching critical thinking. The first is that students in the experimental group have tried to avoid them in their arguments (being spoken or written) and the second is that they managed to detect weaknesses in others' written or spoken arguments discourse. The fact that the experimental group outperformed the control group may be interpreted as implying that, like the studies it replicates, the current study provides corroborating evidence attesting the pivotal role of incorporating reasoning fallacies training tasks on students' critical thinking performance. Subjects in the control group scored lower and committed more reasoning fallacies, most probably, as a result of the absence of training or some kind of instruction to raise their awareness to the fact that in much the same way, there are structural/syntactic/grammatical errors that affect the quality of their second language acquisition, there are reasoning errors that weaken their arguments and impact the credibility of their ides/discourse negatively be it written or spoken.

The current study seems to have implications/applications in terms of instructional strategies and classroom practices and textbook designing and curriculum development as a whole. There is a need for a paradigm shift from an overemphasis of content, also known as declarative knowledge as such (i.e. "what to learn/ think"), to a more focus on the process of reasoning/thinking, also known as procedural knowledge (i.e. how to learn/ why/). Textbook writers need to attend to the grammar of thought (reasoning logically) in exactly the same way they do to the language's grammar. Incorporating reasoning fallacies in practice, pedagogy and curriculum are likely to raise EFL and ESL students to the idea that there are rules of thought and logic without which rules of lexis, grammar and/or structure would all be useless.

As well, the curriculum needs revisiting at all levels. There is a need to develop teaching materials that give room for students to develop the habit of thinking not only independently and autonomously but also sceptically and critically before they can accept or reject a proposition or argument. Raising students' awareness of various reasoning fallacies asevidenced by the current study's findings will contribute a great deal to their four skills as foreign language learners and users.

Last but not least, interestingly enough, the present study has pedagogical implications especially with regards to translating theory to hands-on classroom practices. In other words, the same instruments used in this study to train the study participant on how to spot and avoid reasoning fallacies might be used in the classroom to familiarize students with sound and logical reasoning strategies without which their second language learning experience would be meaningless and incomplete.

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Appendix A

Reasoning fallacies investigated: concept defining and scoring measures

Type of Reasoning Fallacy	Definition	Example
Non sequitur /It does not follow/	An illogical statement, one that seems to draw a conclusion not supported by the premises	"My essay will get a good grade because I put a lot of effort into it."
Personal Attack	An ad hominem argument evades the task of addressing the question and instead appeals to the feelings of the audience	"Clinton's infidelity to his wife invalidates his Mideast peace policy."
Appeal to (false or otherwise) Authority	Inappropriate appeals to authority are very popular in advertising; they depend upon the substitution of a famous name for a serious argument. It is assumed that the opinions of a recognized expert in one area should be heeded in another area	a physics professor who tries to give out medical advice despite having no medical training is a false authority with irrelevant credentials.
False Analogy	A false or over-extended analogy is an assertion that because a similarity exists in one aspect, it must also exist in other aspects.	For example, say Joan and Mary both drive pickup trucks. Since Joan is a teacher, Mary must also be a teacher.
Bandwagon Argument	A bandwagon argument appeals to the beliefs or prejudices of the crowd. Such arguments often depend on popular generalizations and associations	That most people hold an opinion does not make it right. Everyone believes Martin's ideas are stupid; Martin must be wrong.
Circular Reasoning	Begging the question, sometimes considered a synonym for circular reasoning, treats matters under debate as already established.	C/R evades a real conclusion by restating the problem in new words "Clearly, Mary is failing the class because she cannot manage to achieve at the level required to pass" a restatement of a point is not a proof of it
False Dichotomy (either...or....)	This is the fallacious presentation of two possibilities as the only possibilities	"Citizens must choose between supporting gun control and supporting murder" In most situations, however, it will be difficult to limit the possibilities to a manageable half dozen, let alone two.
Hasty Generalization	Hasty generalizations make poor arguments because they rely upon an non-exhaustive body of evidence. They are usually not supported by specific information but by an appeal to common sense or common experience	Mary's husband beats her; men always oppress women. (that this one case is true proves nothing about all men)
Post hoc (after this, thus because of this)	After this, thus because of this," is an error created by assuming that sequence indicates	Just because two events are related sequentially, the case for causation cannot

	causation. Many things happen in succession without any direct connection.	be assumed
Argument from ignorance	It assumes that because something has not been proven false, it is therefore true. Conversely, such an argument may assume that because something has not been proven true, it must therefore be false.	The absence of disproof is not proof. The US has not proved that Iraq has weapons of mass destruction; therefore, Iraq has no such weapons. (consider the reverse: Iraq has not disproved that it has weapons of mass destruction; therefore, it has such weapons)
Genetic Fallacy	A genetic fallacy occurs when a claim is accepted as true or false based on the origin of the claim. So, instead of looking at the actual merits of the claim, it is judged based on its origin.	My parents told me that God exists; therefore, God exists
Appeal to Anonymous Authority	When an unspecified source is used as evidence for the claim. This is commonly indicated by phrases such as "They say that…", "It has been said…", "I heard that…", "Studies show…", or generalized groups such as, "scientists say…"	You know, they say that if you swallow gum it takes seven years to digest. So whatever you do, don't swallow the gum!
Exigency/Emergency Fallacy	"Exigency Where someone offers nothing more than a time limit as a reason for us to do what he wants.	Mr: "Come on, why don't you marry me today?" Miss: "Oh, I can't make up my mind. I only met you this morning. Don't you think it is a little early." Mr: "I'm leaving tonight and won't be back for several years. If you don't marry me now, we may never have another chance."
Two Wrongs fallacy	Two wrongs make a right occurs when someone argues that a course of action is justified because the other person has done the same or would do the same if given a chance.	A father tells his son not to hit others, but that if they hit him first, it's okay. A clerk who steals money from her company justifies her actions by saying that the company has been overcharging customers for years.
Complex Question	A *complex question* is a fallacy in which the answer to a given question presupposes a prior answer to a prior question. Also known as (or closely related to) a *loaded question*, a *trick question*	"Have you stopped beating your wife?" is the classic example of the complex question Is your stupidity inborn?

Appendix B

Table: Inter-Rater Agreement for Holistic and Analytic Measures

Type of Measure	Pearson's r
It does not follow	.87
Personal Attack	1.00
Appeal to (false) Authority	1.00
False Analogy	1.00
Bandwagon Argument	1.00
Circular Reasoning	.86
False Dichotomy (either…or….)	.78
Hasty Generalization	.69
Post hoc (after this, thus because of this)	.89
Argument from ignorance	.72
Genetic Fallacy	.86
Appeal to Anonymous Authority	.76
Exigency/Emergency Fallacy	.75
Two Wrongs fallacy	.88
Complex Question	.75
Genetic Fallacy	.86
Appeal to Anonymous Authority	.77
Exigency/Emergency Fallacy	67