

Quality Assessment for Thermodynamic Course for the Agricultural Engineering Program of Higher Education

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Abstract: Thermodynamic course was specified and handed to the accreditation unit. The course is being touch to the enrolled students of the Agriculture Engineering Program, Faculty of Agriculture, Suez-Canal University. To assess and measure the quality of the giving course, questionnaire was applied on the under graduate and post graduate students who attend the course. Thirteen inquires were addressed to cover the all the specification course syllabus. Feed back was drawn based on the analysis of the applicants responses which designed as strongly support and agree, moderate agree and denied (refuse) the inquiry.

Key words: Agriculture engineering program • Thermodynamic course specification

INTRODUCTION

Thermodynamics teaching course intended to thermal energy conversion to dynamical shape [1]; the course is coded as, 111 Ag. Eng. and it is a fundamental or basic for other courses like internal combustion engines, Tractors and tractors maintenance. The Agriculture Engineering Program (AEP) of the Suez-Canal University is based on the credit hours system. Agricultural Engineering has transformed agricultural practices from subsistence level to medium and large-scale production via mechanization in the developed nations. This has reduced the labor force requirements in agriculture; increased production levels and efficiency, product shelf life and product quality; and resulted into industrialization. Whereas, up to 70% of the African population is involved in agricultural production and there is no food security. Agricultural engineering is not well perceived in African countries [2]. Whereas, agricultural engineering practice include options such as farm power and machinery, storage and food processing, rural electrification, structures and environment.

Teaching thermodynamics for engineering students in general one often finds that they have difficulties to understand basic concepts like enthalpy or entropy and their use for concrete applications. Simulation programs can help them in several ways: They visualize the values of abstract properties during thermo dynamical processes, they allow for a more "experimental" approach complementing theoretical derivations in a lecture and they provide examples, which show the relation between the thermo dynamical state variables and energy forms in context [3]. Thermodynamics should be an attractive subject to learn:

Its topics are well defined and a lot of good books exist and available for the student hands. The needed level of mathematical sophistication is not too high. It provides well defined procedures for calculations (e.g. of cyclic processes). But at least for agriculture engineering student's thermodynamic course is one of the best hated subjects.

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This shows up in generally poor results of the final examinations. Jungles [3] suggested using a device to promote understanding is the use of simulation programs for performing “virtual experiments”. Their general usefulness is well established. They can provide insights into abstract concepts leading to better mental models and help to engage the students in active learning.

This study aims to identify and measure the good achieved and weakness points addressed in the thermodynamic course specification. Modify the specification course according to the obtained feed back from the study.

PROCEDURES

Course specification for thermodynamic course was handed to the accreditation unit of the Faculty of Agriculture. These specifications based on the reports of Armstrong [4], Beyer and Apple [5], Eisner [6], Sowell [7] and Smith and Ragan [8]. The specification course is being given to the enrolled students at the first lecture. It is giving as follows:

Course Overall Aims: Introduce student’s fundamentals of the thermodynamics concepts. Thermal energy conversions into dynamical form are discussed in this course from different sides. The first law with its applications either in the open and closed systems used in the agricultural engineering. The second law of thermodynamics, the heat engine and heat pumps. It aims also to determine the efficiency and performance for the heat-engine and heat-pumps. Entropy and the reversibility, the working fluid, gas equations and internal engines consumption cycles are involved. This content involves the phenomena that will consider in the following agricultural engineering courses.

Intended Learning Outcomes of Course (ILOs)

A- Knowledge and Understanding:

- To display systematic understanding of the obtaining dynamical energy from the different consumption fuels in the internal engines and heat pumps, also, enhance the student to search in the academic books for a specific and scientific thermodynamically information.
- Identify the role of the thermodynamics in building up the obtaining information and parameters resulted from the energy conversions. Decide when and which energy type is the matching a certain condition and know how he can design energy converting system.

B-Intellectual Skills:

- To be able to solve the mathematical formulae and analyze its components and its units.
- Suggest a resolution for some relevant problems in a thermodynamically point of view.

C. Professional and Practical Skills:

- Determine the constants of some gases i.e. c_v/c_p , R , etc.
- Using the model theory and apply it to find out the fluid thermodynamics.
- Find out relationships between energy and heat with its conversions.
- Investigations and determination of some concepts of C.O.P. in heat pumps and heat engine efficiency etc..

D.General and Transferable Skills:

- Writing a scientific report and how to manage to present it oral to small and large group.
- Discuss and work in groups either in the class or in a designated topic.
- Using the computer facility.

Table 1: Course contents

Topic	No. of hours	Lecture	T/P
Introduction to the thermodynamics, fundamentals and the S. I. system units.	2	2	-
First law of thermodynamics	4	2	2
Applications of the 1 st law of thermodynamic to the closed and open systems	6	2	4
Second law of thermodynamics, heat engine and its efficiency, heat pump and it c.o.p.	4	2	2
Reversibility and entropy. And third law of thermodynamics	8	4	4
Working fluid thermodynamics, liquid, vapor and gases	4	2	2
Ideal gases , ideal gases law and its processes	8	4	4
Heat engine cycles, internal consumption engine cycles.	8	4	4
Vapor cycles	8	4	4

(T/P: Tutorial and Practical)

Table 2: Course-assessment weighting

Assessment	Other types	Mid-Term	Semester work	Oral	Practical	Final	Total
Weighting,%	5	15	5	5	10	60	100

Teaching and Learning Methods:

- Field trips to visit, the specific workshops to stand up on the different internal engines constructions, the cooling workshop to find out role of the heat pumps in cooling. And different renewable energy research station and electrical power plants.
- Case study, to solve some problem related to the course.
- Lectures to increase and build up their knowledge in the field of the thermodynamics.
- Video sessions, from the DVD or CDs.
- Group discussions at a previously given date for 15 minutes.

Student Assessment Methods:

- Oral to assess the student knowledge and enhance him to do his best.
- Scientific report to assess the student ability to carry out, know, construct, investigate and practice the scientific report writing up.
- Home work problem: to assess the student aware of solving the mathematical problems.

Assessment Schedule:

- Assessment 1 on Week No. 3 from the beginning of the course.
- Assessment 2 (Mid term exam.) week No 6 from the beginning of the course.
- Assessment 3 on Week No 9 from the beginning of the course. Assessment 4 after 12 week from the beginning of the course (the final).
- Oral, quizzes and home-work: every week.
- Any formative only assessments: Question during lectures.
- Quizzes to assess how the student able to solve unpredicted problems.
- Un-graded questions.

Weighting of Assessments

Weighting of the previous assessments is given in Table 2.

List of References: References were given to the students as Course Notes, Recommended Reference and other related References.

Facilities used for Teaching / Learning: Computers, Video player/DVD, Data show and over head projector
The Assessment in the Current Research Was Composed the Following Considerations and Sequences:

- Questionnaire-instrument was prepared for the course.
- Choice of the factions' of applicants, the instrument will be applied on.
- Application of the questionnaire on the aiming factions.
- Statements of the questionnaire balanced.
- The statistical analysis for the statements.
- Results Extraction.
- Discussion of the results and its interpretation.
- Visualization and suggested for the proposed goals involved in the specification course based on the questionnaire.

Procedures Can Be Explained as Follows

Questionnaire Preparation:

- Preparation of questionnaire was complete, with the aim of analyzing the status/situation of thermo-dynamics, specifications according to Al-Gebali [9] and Kogak [10].
- The questionnaire included (13) inquiry items in order to determine the achieved indented goals from the content, teaching-learning resources, examinations compositions while questions 15 and 14 were specified for the member of teaching staff only whom touch the course. Each inquiry was directed to measure target goal of the course.
- Formation was complete all the single measure in form positive.
- In front of each inquiry in the questionnaire applicant have to choose yes I am agree, moderate agree and refuse (deny).
- Also, the questionnaire included open question, requires responsive to mentions opinions or recommendation and this feed back was analyzed.

Selection for the Aiming Factions:

- Undergraduate Students of the agricultural engineering in college of the agriculture - comprehensive, where addressed to fulfill the questionnaire with total of 124 students: 40 of the 2nd level, 40 of 3rd level and 44 of the 4th level of agricultural engineering students.
- Post-graduate Research scholars (8 persons) ranks assistant lecturer, demonstrators and post-graduate students were considered to complete the questionnaire.
- Members the teaching staff whom touch the course are the target for the questionnaire. But the specialists in that branch are few so, it was built on one who is providing such courses (author).

Taking the Questionnaire Place: The given course specification before was not provided to the applicant when the questionnaire was taking place. Meanwhile, it was given in English at the first lecture of the course. It should be noted that, the course is been given in Arabic language with equations and its nomenclature in English format. The questionnaire was completed, under supervision of the author who encouraged student to answer all required items addressed in the questionnaire in frankness and objective. Applicants were noted that their comments will be treated confidentially and will be used only for the course development.

- Questionnaire was carried out on the second level of undergraduate students on Thursday, 10 - 12 -2009 at 9.30 morning for (30) minute time.

- The questionnaire was Applied on the third under-graduate students on Monday 7 - 12 - 2009 at 1:30pm, for (30) minute.
- Questionnaire was applied on the fourth level of under-graduate students on Sunday 13 - 12 – 2009 at 9.30 morning, for period last of (30) minute.

The Questionnaire Balanced: Positive response was obtained and analyzed by mathematical mean as well as for the denied responses. Responses that strongly agrees beside moderate agree were considered as success for the course goals. The analysis considered moderate agree as >50% agreement.

Data Statistical Analysis: Accounting was completed for the responses items within the questionnaire using SPSS.

RESULTS AND DISCUSSION

Table 3 represents distribution of the course assessment by the undergraduate. Percentage of positive Viewpoints responses i.e. for the achieved goals based on under-graduate students also the post-graduate whom enrolled to the given course are represented Table 4. Average of under graduate and post graduate view points are given in the table in percentage. The correlation coefficient between total responses i.e. for undergraduate and postgraduate student using person correlation coefficient with value of 0.78 this indicates at 0.01 confidence. This gives trust and confidence of the obtained results.

Figure 1 represents the achieved points from the course goals and based on the questionnaire tools and from viewpoint of undergraduate students, this was plotted against disagree. The achieved goals was considered as the sum of the agree and moderate agree. Meanwhile it is given in Figure 2, for the post graduate students who enrolled to the course. Table 5 represents the percentage of agrees for both of undergraduate and postgraduate. In Figures 3 and 4 a representation for the classification of total agree (Figure 3) and disagree (Figure 4) for both of the under and post graduate student.

Table 3: Distribution for number of response for each inquiry by the undergraduate applicants

Items	1	2	3	4	5	6	7	8	9	10	11	12	13
Agree	31	25	45	39	40	12	14	25	17	23	31	29	27
M-agree	46	37	28	38	26	46	41	35	30	42	19	39	29
Dis-agree	10	25	14	10	21	29	32	27	40	22	27	39	21

Table 4: Percentage of achieved goals from the view point of the undergraduate and post graduate student

Inquiry number	1	2	3	4	5	6	7	8	9	10	11	12	13
Under-agree,%	88.5	71.3	83.9	88.5	75.9	66.7	63.2	69.0	54.0	74.7	69.0	66.7	75.9
Post-agree %	100	71.4	85.7	100	71.4	57.1	14.3	71.4	71.4	71.4	71.4	85.7	85.8
Medium%	94.3	71.3	84.8	94.3	73.6	61.9	38.8	70.2	62.7	73.1	70.2	76.2	80.8

Table 5: Priority developing points based on the questionnaire assessment

Inquiry no.	7	6	9	12	11	8	2	10	5	13	3	1	4
Ratio %	38.8	61.9	62.7	67.2	70.2	70.2	71.3	73.1	73.6	80.8	84.8	94.3	94.3
Grade	P	A	A	G	G	G	G	G	G	VG	VG	E	E

(P: Poor; A: Fair and accepted; G: Good; VG: Very good and E: Excellent)

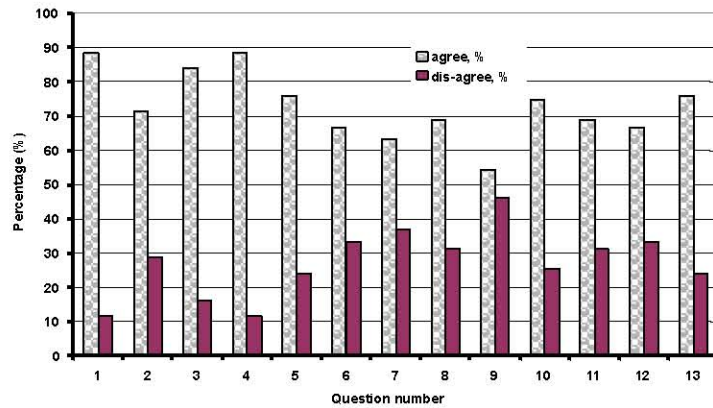


Fig. 1: Comparison between Averages of achieved goals (%) as agree/disagree from the view point of under graduate students

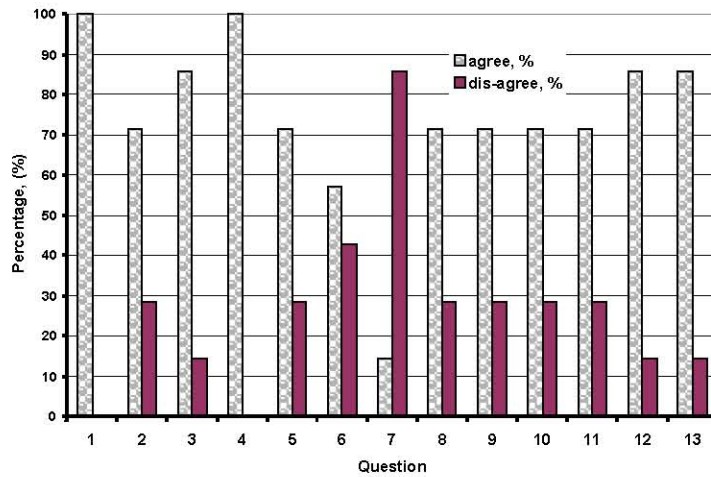


Fig. 2: Comparison between Averages of achieved goals (%) as agree/disagree from the view point of post graduate students

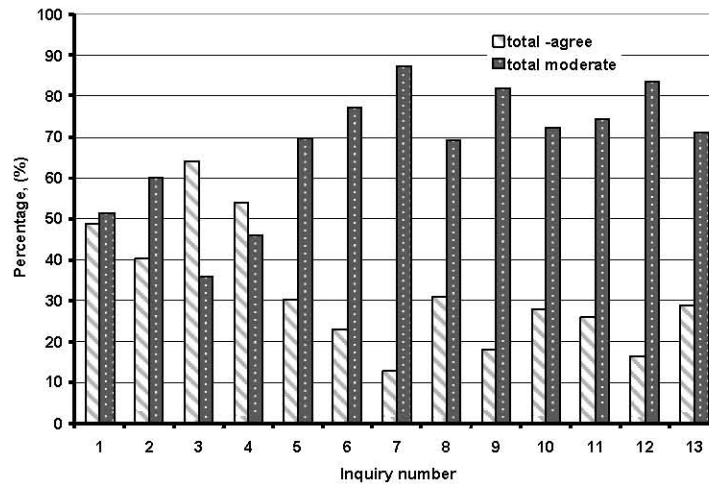


Fig. 3: Total Agree classifications (%) for all applicants' students

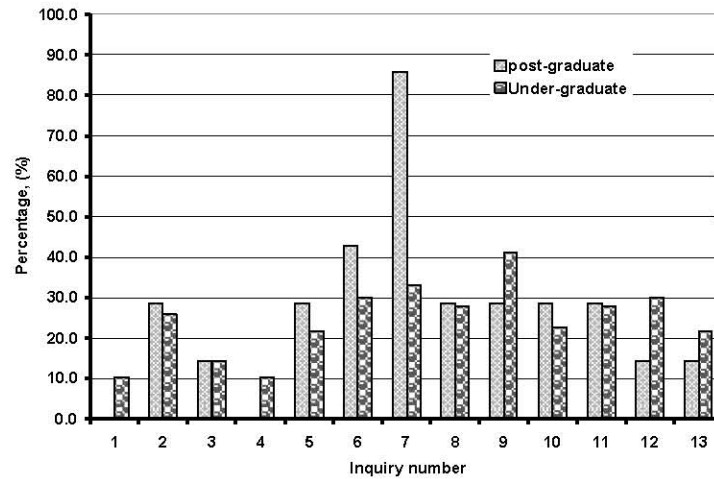


Fig. 4: Total disagree classifications (%) from the view point of all applicant students

Commentary on the Obtained Results: Extracted comments from the questionnaire results were considered. The achieved goals within the course 13 inquiry are given in Table 5 sequentially with its grade. From the table weaken point was highlighted by inquiry as number 7 as it achieved only 38.8% with graded (poor). Meanwhile, inquiries 6 and 9 were graded accepted as it scored 61.9 and 62.7%. Inquiries number 12, 11, 8, 2, 10 and 5 were good achieved with score of 67.2, 70.2, 71.3, 73.1 and 73.6, respectively. The beginning of proficiency achievement began from inquiries number 13 and 3 as they graded Very good as it achieved 80.8 and 84.8% (within a ratio = 80% requested ratio level for the proficiency). The 1st and 4th inquiries obtained excellent grade with 94.3 and 94.3%, respectively. From the table also the priority for concentrating on developing and course amendment should be focuses consequently on inquiry 7, 6, 9, 12, 11, 8, 2, 10 and 5.

One of the most priority for the given course is modernity of the content is highly demanded for development of the course. The content in requirements tied with the labor market of the work and the practical life. The applicants suggest constructing thermo-dynamics lab to carry out some tests and lab experiments for the practical. Also, Increase the field visits.

CONCLUSIONS AND RECOMMENDATIONS

The study revealed that, some goals were achieved to the limit of satisfied teaching the thermodynamic course to the agriculture Engineering program, while others still not reach the satisfaction (considering that at 80%).

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APPENDIX

Questionnaire for the Realization from Extension of Goodness the Thermo-dynamic Course: The giving questionnaire is specified to measure quality of thermo-dynamics course. The course is being touch students of the agriculture engineering department. The questionnaire Includes group of phrases could you mark each phrase either agree limited agree or disagree.

Thanks for your cooperation.

Statement of the Essential Inquiries

Applicant Name (Desirable):

College:

Section:

Position:

Specialization:

Inq-No.	Statement	Agree	limited agreement	Dis-agree
1	Indented learning outcomes are differ, included knowledge and the skills and the directions			
2	The academic subjects mentioned be characterized the contemporary reporter in the modernity and its accompaniment for science developments and life requirements.			
3	The subjects of academic course provided to students is well- arranged sequential and logical.			
4	No Repetition (does not create) or confuse between subjects the between the course curriculum and other academic courses.			
5	Subjects relate the designated course with it practical applications.			
6	Subjects involved in the curriculum match with the needs and requirements labors market of the work.			
7	Subjects contents of the course relate to the society needs for development and its needs and try to contribute prevents resolve it.			
8	Subjects comply with the decided zealous student is claimant and needs demanding instructional.			
9	Derivation of course goals is fulfill the student needs and inclinations and interests demanding.			
10	The graduate benefits practical blessing the decided zealous student domain did him.			
11	Modern teaching methods and assorted use for teaching the designation course (programs of computer the numerous means - field visits - offers ppt -...).			
12	Assorted sources of learning benefit from teaching of subjects the decided zealous student (specialized experts - sites of Internet - worldwide returns).			
13	Different Evaluation assessments to be assorted for evaluation the goals achievements on the students..			
14	Review extension of investigation is complete decided for goals his in periodic characteristic, with the aim of his modification calculated what requires him the situation.			
15	Proposals or opinions aims and assist in the course development, worth to be mentioned here. Proposals or last opinions desires mentioned her with the aim of development decide.			