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Seven Basic Quality Tools Coursework for Textile Dyeing and Printing Industry Study

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Abstract

This paper constitutes the methodology of teaching the course of seven basic tools in quality control for textile dyeing and printing industries. The course usually starts with the control system for quality in general and its main components then the concepts and principle of the Seven Basic Quality Tools which initially taught through a series of traditional lectures which tend to be boring and ineffective. This work develops a new approach which aims to stimulate student's interest through mastery learning. The students, as an individual and in group, will be assigned to analyze a series of different cases using application of the different tools. The students attain to knowledge by accumulating, aggregating and studying information from various sources, then being asked to do the presentation and demonstration on their works in class both by hand and computerized. Subsequently, they are assigned to create sets of data to construct simulated quality condition cases which, eventually, be analyzed by the rest of the class using the Seven Basic Quality Tools. The coursework not only provides the positive meaning to practice of using and analyzing quality problems by the Seven Basic Quality Tools but also urges them to contemplate the production processes and promotes the utilization of industrial engineering in textile dyeing and printing manufacturing.

Keywords: seven basic quality tools, textile industries, engineering education

1. General Information

The current fiercely competitive circumstance of the textile dyeing and printing industries in the global market has made the industry engineering become a crucial ingredient in textile manufacturing enterprises. However, not only that the textile dyeing and printing processes in itself are very much complex, the engineers will have to be fully aware of the critical quality aspects, both of the materials received from up-stream suppliers and the products which will be pass-on to down-stream industries who produce the final products, the industrial engineers who have little accustomed to the industries might take a significant period of time to fully understand them enough to cope with the processes natures and problems. Therefore, the coursework presents in this methodology is mainly targeted to the students who are familiar with all relevant aspects such as materials, processes, and machineries in textile dyeing and printing manufacturing.

The traditional approach in drawing the attention and interest of the learner through series of lectures with a stand-alone lecturer as the center is obviously not an efficient practice. There are several methods of learning which evidently be more effective such as demonstration, discussion groups, practice by doing, and teaching others [2,3]. Therefore, the coursework is intended to optimize these techniques.

The course aims to widen perspective and promote skill both in term of theology and real practice, the students are assigned to work with several different cases which they will have to calculate and analyze both by themselves then debate and discuss among members in their study groups, eventually with the rest of the class. They will be able to construct charts and diagrams both manually and computerized and logically interpret the results, ultimately the most effective practice, teaching others.

The coursework has been exercised in the Quality Control (Textile Dyeing and Finishing) class in 2010 academic year. The class reactions, efficiency and effectiveness, and students' academic performances have been observed and analyzed for further improvement.

2. Understand the Textiles Industries Network

The students should have adequate knowledge of the industries' framework as shown in figure 1 and perceive of the important role of textile industries in the world economies.

The textile and apparel sector revealed itself to be one of the most diverse, complex, and fragmented industries with the great diversity of competitive combinations of factor mixes which no one unified textile manufacturing process, produces many products for a range of markets and households. The complex web transforms raw materials and intermediary goods into finished products with the continuous stream of value added and only 15% of products value comes from outside the sector, each segment of stream can be produced in separate sites. Despite the fact that contribution of textile and apparel to national economies of many countries was gradually declining relatives to other activities but it still remains considerable important as it still obtain almost 10% of total private consumption in most of the economies [5].

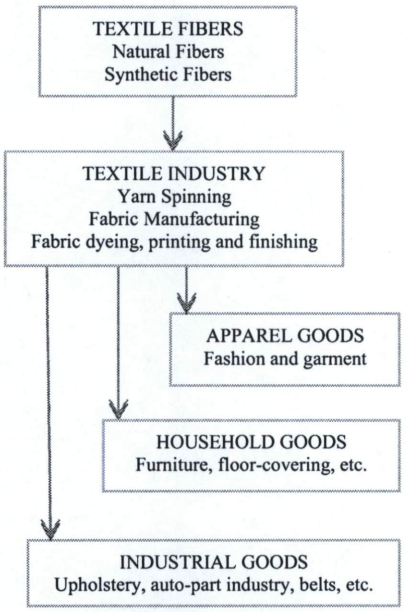

Figure 1 Textile and related industries.

Task: Each student is appointed a report assignment on a textile quality case from recent news and prepare for a short presentation for the class.

The expecting outcomes:

1. Ability to acquire a piece of specific information through various sources.
2. Understand more about the importance of the quality issue in textile industries.
3. Ability to organize the information into a report.
4. Ability to prepare the information for a short presentation.

3. Control System for Quality

Control is the continuing process of evaluating performance and taking corrective action when necessary. And Control system has three components: 1. a standard or goal 2. means of measuring accomplishment, and 3. comparing the actual results with standard.

3.1 Standard or goal.

Task: The class is divided and formed teams of students, each team is delegated with a research assignment on different cases of fabric defects, and required to find relevant information about its quality standards and specifications in company' and national' levels, also its implementation in textile trading aspect, and prepare for class presentation.

The expecting outcomes:

1. Ability to acquire pieces of specific information through various sources.
2. Ability to work as a team through contributing, communicating, discussing, and summarizing the assignment.
3. Ability to organize the information into a sequence form for presentation.
4. Ability to gain profound understanding of the assigned aspect.

3.2 means of measuring accomplishment

Tasks: the assembled groups of students are assigned a continue activity of the previous class-work by seeking to find test or measuring methods either established test standards or other accurate measuring means for the delegated fabric defects, and prepare for class presentation.

The expecting outcomes:

1. Ability to acquire pieces of specific information through various sources.
2. Ability to work as a team through contributing, communicating, discussing, and summarizing the assignment.
3. Ability to organize the information into a sequence form for presentation.
4. Ability to gain profound understanding of the assigned aspect.

3.3 compare the actual results with standard.

Tasks: to continue the previous class-work, each assembled group of students receives a set of delegated-defect data to be analyzed, discussed, and to make a reasonable quality summery compare to the standard, and prepare for class presentation.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, and summarizing the assignment.
2. Ability to gather scattered pieces of information and data and put them in a logical and sensible form of information.
3. Ability to organize the information into a sequence form for presentation.

4. Seven Basic Quality Tools

At the first session before the tasks in the Seven Basic Quality Tools begin, the class must be prepared according to the scheme of the coursework. The class is divided into seven teams - each team consists of 3-4 students. The tasks in this context are prearranged into an intended sequence which will be designated into each tool then allocated to each team. The tasks in each

tool are very much alike with minor alterations according to the tool's framework and nature.

The class then begins with a brief lecture on basic concepts and ideas of the Seven Basic Quality Tools and a few basic examples in each tool. The lecture is contrived to gain students' perceptions of these techniques and to guide them on how to obtain necessary information for the tasks. At the end of the session every team should have clear pictures of what the delegated task required and ready to work on their role in the team. All the teams must be ready to present their work to the class by the next session which should be one week after the first one. Each team is required to spend about fifteen to twenty minutes for the presentation – hence it should take approximately 2 hours for the presentations to be completed. The rest of the session is for the questions and answers and for receiving and attaining the new delegated task. The cycle goes on in the similar fashion until the last task has been completed, which should take at least five sessions, and every student has profound understanding and skill for applying every tool in the Seven Basic Tools of Quality.

The Seven Basic Quality Tools are simple and considerable accurate techniques in identifying product quality problems. They are such simpler methods that students with moderate statistic knowledge can exercise them with countless of quality related issues from very straightforward one to complicated multi-layer problems. The tools are: the cause and effect diagram, the check sheet, the control charts, the histogram, the Pareto chart, the scatter diagram, and the flow chart.

4.1 The cause and effect diagram (Ishikawa or fishbone chart)

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and its pros and cons. The team also receives two study quality cases - one is preventive-based while another is problem-based - to categorize quality causes, find critical causes, reveal key relationships among various variables, analyze, solve problem, evaluate, criticize, and create potential solutions, then prepares for the class presentation. The team constructs six different cases - one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to analyze, evaluate, criticize, and solving problem logically.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.2 Check Sheet

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and types and their pros and cons. The team also receives two study quality cases – one is quantitative while another is qualitative – to analyze and generate suitable documents that use for collecting data for the required information, then prepares for the class presentation. The team constructs six different cases – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to analyze, evaluate, criticize, and solving problem logically.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.3 Control Charts

Tasks: The represent team is delegated with research work on the tool's principle, purposes, types, applications, and their pros and cons. The team also receives two sets of data – one is for $\bar{x}$- and R-charts while another is for a p-chart – to analyze, calculate, and generate charts in accordance with the source of data - both manually and computerized - and analyzes them, then prepare for the class presentation. The team constructs six different sets of data – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to calculate and compute, generate and analyze the charts.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.4 Histogram

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and their pros and cons. The team also receives two sets of data to analyze, calculate, and generate accurate graphical representation for each set of data - both manually and computerized - and analyzes them, then prepare for the class presentation. The team constructs

six different sets of data – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to calculate and compute, generate and analyze the graphs.
3 Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.5 Pareto chart

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and their pros and cons. The team also receives a set of data to analyze, calculate, and generate two charts – one represents number of defective and cumulative percent while another represents percentage of defects and cumulative percent - both manually and computerized - and analyzes them, then prepare for the class presentation. The team constructs six different sets of data – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to calculate and compute, generate and analyze the charts.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.6 Scatter diagram

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and their pros and cons. The team also receives two sets of data to analyze, calculate, and generate charts and calculates the degree of correlation for each chart - both manually and computerized - and analyzes them, then prepare for the class presentation. The team constructs six different sets of data – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to calculate and compute, generate and analyze the charts.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

4.7 Flowchart

Tasks: The represent team is delegated with research work on the tool's principle, purposes, applications, and their pros and cons. The team also receives two process cases with its quality problems to criticize and create charts and analyzes relationship between inputs, process, and outputs, then prepare for the class presentation. The team constructs six different cases – one for each team in the class. The team, then, acts as mentors by advising, guiding, and demonstrating the other teams how to use the tool.

The expecting outcomes:

1. Ability to work as a team through contributing, communicating, discussing, summarizing, and brainstorming sessions for the assignment.
2. Ability to generate and analyze flowcharts.
3. Ability to teach others.
4. Ability to gain profound understanding of the assigned aspect.

5. Observations and Results

The first few sessions which students only obligate for the tasks assigned directly for themselves or their team to do the research, which mainly gathering information from sources and arrange them into logical and sensible sequence for the class presentation, which the students tend to be fairly familiar with this common exercise, hence the quality of their works differ from student to student and group to group, and during the presentation the rest of the class pay little attention to the on-going occurrence. Therefore, to draw their attention to the presentation, the instructor should have a few relevant questions to ask the audiences randomly, rewarding with a small extra mark for the correct answers. While the assessment of team assignment is the team-base performance, it is also clearly that not every member in the team contributes the same amount of effort to the work they do, the assessment as an individual attainment is then also taken into account. However, as soon as the task becomes to be more mastering learning, where only the students that thoroughly understand and able to demonstrate proficiency in the current task are able to advance to the subsequent learning objective [4], every student becomes more attentive hence the quality of their works and participations are significantly improved.

The class becomes more dynamic and apparently more interesting when each team constructs their own illustration cases or sets of data, they also seems to pay more attention to their audiences and put great effort to clarify their points. The class even becomes more constructive when each team hands out different cases or sets of data to other teams and mentoring their

fellow students to use the tool to analyze, evaluate, and summarize the quality prospect. A noticeable advancement is that the cases that student initiates to be solved are more complicated one after another. Besides, every student appears to be enjoyed playing the active role, as a mentor, the rest of the class also shows marked enthusiasm to learn from their fellow student.

The students' performances are evaluated by the result of the assessment marks students earn from an examination on the Seven Basic Quality Tools, which counts for total of forty marks - the marks earned during the sessions are not included here. The marks are calculated and analyzed into Histogram and Pareto diagram formats as show in figure 2 and figure 3.

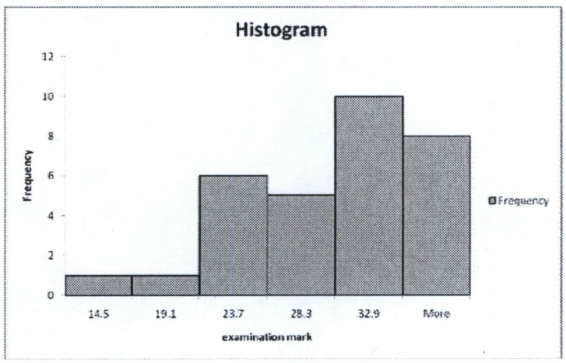

Figure 2 Histogram: Students' performance in the final examination for the Seven Basic Quality Tools.

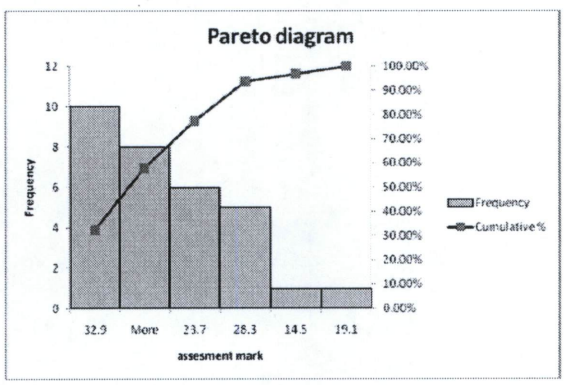

Figure 3 Pareto: Students' performance in the final examination for the Seven Basic Quality Tools.

6. Conclusions

By encouraging students to find knowledge by themselves, the instructor could simply find that most of the students are potential talents. Apparently that the prominent achievement can easily compile by adequate sequences of challenge tasks appoint to them with consent of decision making power to correspond. Another noteworthy benefit is the cooperative learning through team assignments.

This learning approach seem to be an easy job for lecturer or instructor who tend to play insignificant role in the process, it is not. The instructor should not just give the students assignments then quietly sit and observe their performance in the back corner of the classroom. Instead, the instructor plays a very important role in this kind of approach by conducting the class in a pleasant, positive, and interactive environment, and definitely not sitting in the back of the class where the possibility of eye to eye contact with every student is minimal. Moreover, the instructor obligates with competency in the topic to be able to suggest and make correction when needed, and, in this case, should have abundant stock of different study-cases and sets of data. Despite the students are newer to the topic, instructor usually learns many new things and gain wider perspective from them. The leaning experience through this approach is not only allows students to take ownership of their proficiency it also impel them to be more appreciate and respect each other.

7. References

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