# INNOVATIVE APPROACH TO STUDENTS' ABILITIES DEVELOPMENT IN OPERATIONS MANAGEMENT

**[1]JANA MAKYSOVA, [2]JURAJ DUBOVEC**

(Ing., PhD.), Faculty of management science and informatics, (Department of managerial theories), University of Z|ilina, Zilina, Slovakia
(Ing., PhD.), Faculty of management science and informatics, (Department of managerial theories), University of Zilina, Zilina, Slovakia
E-mail: [1]jana.makysova@fri.uniza.sk, juraj.dubovec@fri.uniza.sk

**Abstract** —This paper presents and summarizes reasons and results of new way in which courses of operations management are held, advantages, that it brings to students, and mainly, characterizes home study work of students. The aim is to give students opportunity to "see and touch the real work" of one type of operations manager.

**Index Terms**— school Meals, Menza, Operations Management, Bill Of Material, Complex View, Planning, Technology, Students, Practice, Case Study.

## I. INTRODUCTION AND THEORETICAL BACKGROUND

The role of school and teachers is to transfer information to students that can be useful for them in their professional development and future employment. Of course, the course content must correspond to level of education where the course is timed.

Our course of operations management has its position in the 4th semester of bachelor study. Requirements imposed on course´s content are so of low and middle management level and not of the top management level. Even subjects of courses stay the same on all levels, important is point of view in which we develop them.

We adopted an approach better describable as production management. Although both terms (operations management and production management) are used as synonyms [1].

We develop area which correspond with tasks of operation managers specialized as hotel manager, supplier, production team leader, foreman, standardizer … The ability to name these professions emerge also from the way we prepared our courses. We just looked at web sites offering jobs and we have chosen required capabilities and developed them deeper on courses of operations management taking care of distinguishing between what is bachelor´s level and what is engineer´s level.

Using a lot of video demonstrations, students (besides good basis of knowledge) got a better vision of a real contemporary functioning of activities operations manager has to accomplish.To straighten the effect of getting capabilities of operations manager "beneath the skin" we prepared for students very demonstrative and real exercises.

## II. TASK AND SAMPLE

### *A. Task in general*

It is not unusual, that students have some work to do during the semester – projects, semestral works with or without presentation, homeworks…
We decided to adopt a laboratory problem solving processing (typical from chemistry for example). Students had to prepare defined final product. It´s up to them to identify (1) everything they need, (2) operations that lead to the result, and (3) basic information about financing and cost-effectiveness.

### *B. Task in details*

Students' task was to take care of the running of the university´s catering establishment called Menza during one week. Their role was to act as a restaurant manager taking care of many details (not all details because some of them require engineer level knowledge) but was given a possibility to them to try cope with this kind of problem solving, too.
The reason of choosing Menza was multiple.

*a)* Ease of understanding whole transformation process as many of students can observe or participate to this process in smaller version – home kitchen. For this reason it is considered as one of best practice teaching case,
*b)* Personal contact with restaurant manager permitting to get some detailed information,
*c)* Possibility to get historical data,
*d)* Possibility to modify receipts if needed,
*e)* Sufficient number of modification by reason of attaching to each group different data.

We organized their work as follows.

*a)* Students had to work in groups of 3.
- To students was given the possibility to self creation of groups or teacher creation of groups. This second was presented as one more training area for students as none of companies will employ them with their friends and they will have to

acclimate to people already working in those companies.

- The formal division of group´s members was defined as 1 supplier, 1 technologist and 1 scheduler, all operations management employments. Of course students again could decide either they will work each one on each position or they will work each one on one position only.

*b)* The work was divided into 3 parts, and students had to work and give accomplished work to teacher continuously during whole semester,

*c)* Students got some real information that we received from the actual Menza restaurant manager and they had to perform their work taking in consideration these information correctly,

*d)* Final evaluation of the project was given to a group whichever method of work they adopted. This was to straighten their motivation to participate and so to train more than one position.

Before starting to work on a core of project, students were asked to prepare a list of receipts mentioned in their cooking week. Because it is not possible to find the majority of receipts as they are mentioned on Menza menu list, students had to find some similar receipts. And those receipts had to be "usable" for project´s purpose, so it had to have well defined information about quantity. Correctly chosen receipt was the one containing metric data for all ingredients and patchable to a defined number of portions. It was due to a possibility to make norms and conversions to a different number of portions. However "horse sense" was also needed when deducting number of portions out of number of chicken legs, or chicken breast.

The problem showed up with water, salt, pepper and spices. Because in regular kitchen receipts dosage of salt, pepper and spices is defined as "pinch of" or "tea spoon of" or "knife-point"… students were asked to create their own norms for this ingredients. As for the water, different possibilities were estimated among which was chosen the one taking in account for cooking only water necessary for soups. All other water will figure in "energies" in calculation form.

Consequently, we defined tasks to do as follows.

*a)* Bill of material – the main part of whole project. This part cannot be deluded neither overpassed. It is a starting point, for good future continuation of whole project. Students were asked to summarize all essential raw materials, indicate quantity per unit and indicate price per unit (as a preparation for calculations part).

*b)* Technologic process – first, students had to name all technologic processes needed during their one week food preparation, even those not mentioned in the receipts if there are any. Here is one more good reason why to choose a known transformation process. Consequently they had to ensure each of these technologic processes´ by different devices (important for "calculations" part).

*c)* Preparation for order – students were also asked to make something like schedule for delivery of different shipments. Scheduling depended on a kind of material. In Menza, there are some materials, that are coming every day, and there are materials that come once per week. Students got this information presented on the exercises. The main result could be represented as 6 tables, 5 for daily delivery and 1 for weekly delivery.

*d)* Inventory – for project purposes we considered having inventory = 0. Students had to purchase all raw materials for their cooking week. Just what they needed rounded to whole units (for example order 250 kg of flour instead of 249,3 kg of flour; this was possible due to students´ knowledge of packaging if it exists or due to ease of getting information about packaging sizes.). They did not need to buy as a reserve.

*e)* Suppliers – find suppliers on the internet or among "brick-and-mortar stores" for each raw material named in bill of materials. Add a reason of such decision.

*f)* Planning / scheduling – we ask students to organize work in kitchen. They already had picked out different operations from their technological processes

*g)* Calculations – to take in consideration everything that has to be bought. This task was divided into 2 types: (1) setting-up costs calculation and (2) operating costs.

*h)* Standardization – as already mentioned while talking about salt, pepper, spices. It means standardization of material consumption.

*i)* Layout – one another domain that a good operations manager has to manage if s/he wants the transformation process work effectively. Students had to realize the fact, that the catering establishment cooking for a big number of diners work in a similar manner as an assembly line in automobile factory, for example. Finally, they were asked to organize physically kitchen as they would construct it on a green field. This part was kind of voluntary, because it more corresponds with engineer level of study. The aim was to make them think about all details necessary for next parts of project (refrigerators, ovens, cooling chamber, dishwashers, kitchen stoves…).

Students were not given the form they had to fill in. We leaved the students the area for a creativity. Or they could find an existing system on the internet and fill that one or get inspired by it.

Students were of course encouraged to contact teachers by mail or personally in the office in case of any questions or problems occurred during the work elaboration.

### *C. Work evaluation*

We decided to evaluate the work by attaching percentage to each project stage. Because the work was divided into three parts students could get three times 100%. Percentage depended on.

*a)* Number of answered tasks in the project stage,
*b)* Completeness of each task in the project stage and,
*c)* Representativeness (logical organization and lucidity).

When all three parts were given to teachers and after their evaluation, calculation of final evaluation is very easy. Final evaluation is a percentage average (calculated out of each project part) multiplied by 10 (maximum points obtainable per project).

As mentioned before, all members of group got the same evaluation.

## III. REPRESENTATION OF RESULTS

Students created 21 groups where 20 consisted of 3 members and 1 of 4 members. To make this much work would be difficult, so to divide this last group into 2 groups with only 2 students would not be desirable.

This good decision was confirmed during the semester when one group lost one member of the team and this fact had an evident influence on the work quality of two remaining members.

### *A. Part one of students´ project*

The first part of the project consisted of conditional tasks.

*a)* Find receipts correspondingly to the week menu,
*b)* Choose a number of diners from the scale 2000 – 7000, (this represents a variation through the year of a real amount of portions per day) The main tasks were.
*a)* Create bills of material (or one complete bill of material) indicating type of material, quantity per unit and price per unit,
*b)* Choose real suppliers for Menza and justify this decision,
*c)* Prepare information for order making, that means calculate total quantity needed per day or per week and assign it to a particular supplier,
*d)* Pick out operations from technological process, such as to peel, to wash, to cut, to stew… everything that needs to be done by cookers and needs several time to be done.

Document with all tasks summarization was given on the course web. Students got 2 weeks to work out this first part of the project.

All students gave the finished work to us on time. So all accomplished the first condition leading to receiving the total on evaluation.

3 works were done excellently (+100%), 7 were done very well (100%), 5 were good (95%) and 6 had at least one task forgotten (85-50%). Usually forgotten task was picking out operations from technological process. Students considered task done by inserting the whole technological process of the meal preparation.

Bill of material of each group was different, not only by its composition but also by its presentation. However, it was always kind of table or a set of tables. The simplest version consisted of separate tables for each meal, so students finally had 30 tables. Making one table per day produced 5 tables and one table per week needed 1 table. Detailed view of students´ choice of bill of material presents fig. 1. The advantage of more complex tables (per day or per week) simplified next work such as calculating total needed quantity of each raw material.

Concerning type of bill of material table, one more interesting index showed up. Students, who have chosen to create complex tables gained at this part of project better average evaluation (95%), than students with simpler tables (83%). Also, all 3 excellent works fall into students´ group with more complex tables, by contrast to students´ group with easier tables also 2 works with lowest evaluation belong. Also the rate of students producing complex tables with 100% evaluation for this first part is 64% (versus 36% of others). It appears that students seeing things more complex (indispensable for operation management) used the approach with more concentrated information.

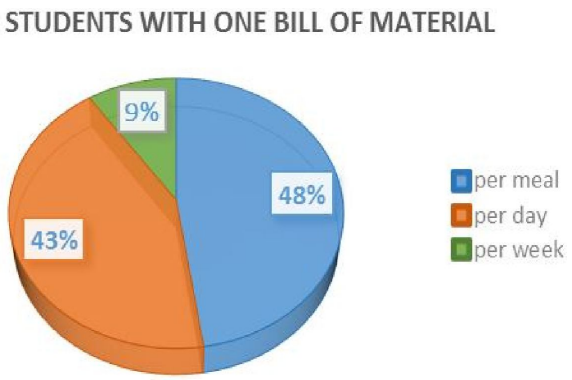


**Fig.1. Distribution of students accordingly to method of bills of material tables representation.**

Another fact is, that students with more complex perception of reality did not forget to complete some tasks (2 groups out of 11 have forgotten small part of 2 tasks or 1 whole task) as often as students with simpler tables elaboration (4 groups out of 10 did not accomplish one or more tasks).

The task concerning summarization of raw material needed for kitchen through the week during which each group of students is responsible for kitchen´s run was often forgotten (29%) or incomplete (29%). There is again difference between groups of complex tables and simple tables, forgotten 5 times (out of 11) and 7 times (out of 10) respectively.

Very similar it is with picking out different types of operations from their technological processes. Six groups have forgotten this task or made it

insufficiently (they only copied whole receipt). From the point of view we developed previously – students with complex view and students with simple view – two of them consist of students with complex view and four of the others.

Finally, only two groups have forgotten task concerning defining suppliers. Bought are from simple problem view. Students have chosen from 1 to 4 suppliers. One supplier was considered as a good choice for 8 groups, 6 groups have chosen 2 suppliers (1 for bakery products and 1 for other raw material), 3 have chosen 3 suppliers (usually for meat, for bread and for others) and 2 groups think that 4 suppliers should be involved in supplying Menza.

One another relation with bill of material tables showed, that only groups working with complex tables divided the need of raw material among 3 or 4 suppliers (except one). Groups with simple tables for raw material used only 1 or 2 suppliers (except one mentioned).

### *B. Part two of students´ project*

In this part students only had to develop main tasks, conditional task were not demanded. Tasks were required to be done per day. Main tasks were.

*a)* Divide all operations from technological processes into 3 groups.
   *i.* Operations that have to be done one day in advance, because technological process needs it (water the bean for example).
   *ii.* Operations that can be characterized as preparation for cooking (pealing, cutting, work dough e.g.).
   *iii.* Operations that can be named as Flameproof finish.

*b)* Allocate instruments and material to each operation. That means everything that cook needs in the kitchen to be able to perform each operation. This instruction was cleared out to students adding the information that they have to mention everything that finally do not appear on diners' plate or is not desired to appear on diners' plate (fritting oil for example).

*c)* Organize all operations of the day in the way that everything is ready at 11 o'clock. Students had to identify critical time for each meal that means time when the flameproof finish has to start in order to be able to start serving at 11 o'clock. They had to do this for each day.

*d)* Finally, they had to assign the work to do in the kitchen to cooks. Minimal number of cooks was set to 12 persons.

Document with all tasks summarization was given on the course web. Students got 3 weeks to work out this second part of the project.

Even we considered this second part more difficult than the first one, students elaborated this part better. So the evaluation of this part was also better. 13 works were done very well (100%), 6 were good (95%) and 2 had some task insufficiently developed (80-75%). This time, students did not forget any whole task, but sometimes they did not finish it.

Most frequent shortage in this part was the identification of critical times. Sometimes students just did not mention this times sometimes they put it in schedule illogically. That means that identification of the time when cooking should start was not incorporated to the cooking schedule respecting the fact, that it cannot be cold at 11 o'clock. Illogical was for example the case, where students had their rice cooked at 9 o'clock and the diner would get it cold at 11 o'clock.

In some cases (2), students also did not correctly assigned some operations to groups, such as pouring the meat in the oven (accorded to preparation group). In the same number of cases students did not mention all utensils or kitchen equipment.

Another mistake considered cases (2) where organizing work in kitchen did not respect the order, in which they had to be done. For example there was a work, where students decided to cut the carrot first and then to peal it. Obviously that could be the mistake caused by distraction, but the work had to be evaluated respectfully to what was given to us and not to what was mentioned to do. Prepare a time organization of the work for KIA (for example) with mistake would lead to malfunction of car production.

Presentation of main mistakes is summarized and visualized in fig. 2. These mistakes usually appeared in different projects. In two projects, there were more than one mistake (there were 2 mistakes – more mistakes in one project would lead to worse evaluation). That is the reason, why we used another type of chart.


**Fig.2 Number of projects where particular mistake(s) appeared.**

Also we found in these second project parts some interesting approaches. In 6 projects (out of 21) students decided to organize work into groups. Each group had to take care of one meal. Of course, in the beginning, they started to work commonly, such as pealing and cutting vegetables because of large amount and slowness of this work. Then employees got charged by a particular meal and they had to finish it on time. In these 6 projects 5 were developed typical team work. In 1 out of these 6, students decided to name the chef per meal and these could count on some help staff.

It was also very interesting to find out, that some students prepared very specific timetable for each day, and some students prepared more universal timetables. This second seamed on the first view (1st day of the week) like quickly done but after seeing whole week it showed up their version is very simple and easy to understand by employees. Their timetables could lead to standardization of operation and better self-time management of cooks without necessity to compare too often the real state of work done in the kitchen with plans.

There was no relevant relation between 1st and 2nd part of the project.

### *C. Part tree of students´ project*

The third part of project contained of calculation development. Because students did not study deeply calculations in any lesson, we prepared for them a long presentation about requirements of the third project's part. We explained them the main role and importance of preparing calculations. We informed them about existence of calculation list, where are summarized all relevant costs of production. We referred them on the third lesson of operations management, where this list was mentioned. In addition, we explained some details in calculation list which should be incorporated in their works, such as do not forget existence of depreciations e.g. To be able to incorporate some particular costs such as water, electricity and gas, we should have values from consumptions meters. But there was no possibility to get this information. So we launched a norm for water consumption: 1 meal = 1 l of water (soup, potatoes, washing dishes, cleaning…). To show the way of electricity consumption, we asked students to choose 2 electric appliances and count the price of their running.

As the objective of this last calculation part, we preferred the importance to have a good overview on entrusted process rather than to be able to elaborate a perfect calculation list or Menza budget. In this level of studies it is an adequate demand.

In this last part students only had to develop main tasks, conditional task were not demanded. One task was global and one task was required to be done per week. Main tasks were.

*a)* Elaborate calculation to which we gave the working name "operating costs". The aim of this part of the project was to make students think about everything necessary for cooking that finally has to be counted towards food price for diners. Students were also asked to quantify all values able to calculate.

*b)* Elaborate a "foundation calculation". It was again only a working name. The aim of this task was the same like the previous one. Think about everything. Name as much things to do in Menza as they can. Initial information was: "You only have a clear building with plastered walls, with windows, finished roof, stairs construction and outside doors." Students were not asked to quantify material value. Make a list divided into circles of activities or places was enough to succeed this task.

Document with both tasks summarization was again given on the course web. Students got 2 weeks to work out this last part of the project.

Evaluation of this last part was a little bit different from the other parts. This time, students' works were also compared reciprocally. This last part's evaluation even we considered it as the easiest one, did not get better average evaluation then the second part.

11 works were done very well (100%), 1 was almost as good as 11 previous (99%), 4 were good (95-90%) 4 had some task insufficiently developed (85-75%) and 1 was missing many details (60%). This time again, students did not skip any required task.

Concerning the task about operating costs, students did it usually as it was required and they usually put very necessary costs. However some students (2) paradoxically forgot to include depreciations of kitchen equipment mentioned on exercises. Students also forgot to include maintenance and reparation of kitchen appliances (2). In global summarization, this task was well done. In one case, the calculation list was filled over the required level, even it was very complete

Second task was to prepare Menza for running. All students adopted the method to divide work on space preparation and then space arrangement. Next, they divided Menza on particular areas and prepare each one of these. They should not forget like this any activity and any space. But they did. They forgot space preparation (all or some spaces) (2), administration area for Menza's operations manager (3), space for cleaning lady (1), arrange spaces with necessary tools (4) etc. Arranging kitchen with kitchen tools was not well done 3 times even students had mentioned all necessary appliances and tools in 2nd part of the project. Sometimes (in 2 cases) students duplicated some material (in the kitchen) to make enumeration of tools longer.

The main reason of forgotten spaces or material was a bad work organization. Those who did not forget divided work as mentioned previously. In addition to space and activities groupment, they also mostly respected logical time stream.

### *D. Total project evaluation*

Each group received 3 evaluations from which was created an average. Results are represented in fig.3 and table 1 below.

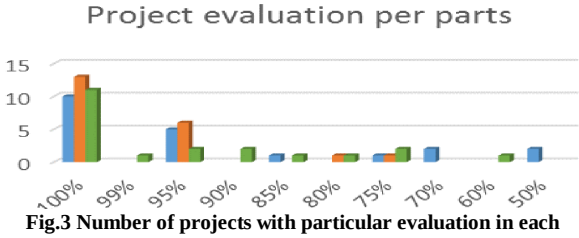


**Fig.3 Number of projects with particular evaluation in each part of project**.

**TABLE 1 FINAL EVALUATION OF PROJECTS PER GROUP**

| *Average evaluation* | *Number of projects* | *Points obtained* |
|---|---|---|
| 100 % | 7 | 10 |
| 99,7 % | 1 | |
| 98,3 % | 3 | |
| 96,7 % | 3 | |
| 91,7 % | 2 | 9 |
| 90 % | 2 | |
| 81,7 % | 2 | 8 |
| 78,3 % | 1 | |

Here, once again we made a comparison of final evaluation with complexity of problem view development in "part one of students' project". Final evaluation was converted on points where 10 was maximum. It is interesting to mention that our initial observation concerning the comparison of evaluation with table complexity was confirmed again. Students who saw the basic problem in context, they finally got better evaluation (96,2% - final transformation to 10 points). Students seeing problems separately received a little bit worse evaluation (93,1% - final transformation to 9 points).

## CONCLUSION AND DISCUSSION

Operations management is a discipline in management which needs managers with the capacity of seeing problems, situations, and activities from birds' eyeview. That means to not only perfectly understand particular problems, situations and activities but also to see relations between them and towards other company's activities.

Another information leading to the choice of this kind of projects comes out of job offers in Slovakia research. There were many positions requiring this kind of ability – no matter if the working position is in automotive industry, textile and fashion industry, chemical industry or other.

In this point of view it looks like the project was well chosen. It represents a good production which needs to be organized, managed and controlled – all work which needs to be done by operations manager.

Event it is the first year of project's life some attended results already showed up. The main results for us is the fact that distribution of evaluation correspond to expectations.

One year is not enough to make a definitive conclusion. We wish to continue in this project next years, too. We will see then how the level of work will increase (or decrease) and how it will confirm (or repulse) initial expectation.

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