Enhancing Quality Teaching in Operations Management: An Action Learning Approach

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Abstract

Action learning motivates students to solve open-ended problems by 'developing skills through doing'. This paper reviews the concept of action learning and discusses the adoption of action learning approach to teach operations management at universities. It presents the design and delivery of an action-learning course at City University of Hong Kong. The course incorporates classroom lectures, tutorials and an action-learning workshop. The experience gained proves that action learning facilitates student participation and teamwork and provides a venue of accelerating learning where enables students to handle dynamic problem situations more effectively. The paper concludes that adopting action-learning approach can help lecturers to enhance quality teaching in operations management courses, and provide an alternate means of effective paradigm other than traditional classroom teaching and/or computer-based training at universities.

Key Words: operations management, action learning, teamwork

1. Introduction

Global competition has intensified companies' competitive struggles to survive and prosper. Both developed and developing nations should add their wealth by supplying quality goods and services in the expanding global markets. Production and operations plays a major role in producing or providing what customers receive from a company. If the company is to survive and prosper, the operations function (also called production function) must well integrated and coordinated with marketing, finance and other parts of a business [1,2].

There would have no ease turnkey solution for many problems related to integrating cross-functional operations, making timely decisions, and managing contingencies in a dynamic environment. For instance, the view that marketing and operations people must identify product developments and features at the beginning, then ensure that engineers do not deviate from specifications, may sound sensible but has serious practical limitations. An engineer and/or a designer cannot hypothetically toss over a design to be implemented by production without considering manufacturing capability and capacity [3,4]. Organisations are increasingly relying on sound operations management skills and knowledge to gain and sustain their competitiveness.

Responding to the increasing needs in managing operations function, universities have realised the need to re-design and enrich the curriculums and related courses in operations management. Conventional classroom teaching might not meet all new challenges and rapid changes in university education. Action learning involves learning about learning that enables people to handle dynamic problems. An action-learning approach that stresses teamwork and experimental learning is a feasible alternative to traditional classroom lectures [3,5]. This paper presents the approach to teach operations management at universities. It describes the design of and discusses the evaluation of an action-learning course based on the experience at City University of Hong Kong.

2. The Concept of Action Learning

The traditional, enduring view of learning has assumed that knowledge must be transmitted and received in the form of information, theories and research findings, and after reception learners can apply the knowledge to their own purposes [6]. In contrast to this, action learning is learning from concrete experience and critical reflection on that experience - through group discussion, trial and error, discovery, and learning from and with each other [6,7]. Zuber-Skerritt [6] regards it as a process by which groups of people (students or learners generally) address actual workplace issues or problems, in complex situations and conditions.

Action learning provides a flexible and systematic method to conceptualise learning from experience. Because action learning is concrete and concerned with learners' actual experiences, it is immediately relevant to their practical work [7,8]. According to Revans [7,8], this is an approach based on the premise that there is no learning without action and no sober and deliberate action without learning. Action learning can be used to great advantage when no one knows the solution to a shared problem, or when no one knows the way forward in a complex situation.

Teamwork is an essential component in the concept of action learning [6] and is important in many contexts for improved learners' performance by providing a satisfying, stimulating and enjoyable learning environment [4]. For team members (or students) to work and learn cooperatively, there must be a network of personal relationships linking them. Team building and development would help a team to speed through the stage to becoming a high-performing team, via stages of 'forming', 'storming', 'norming', 'performing' and 'reforming' [9].

Creativity is grounded in the experiential principles of action learning. It focuses on the nature of thought processes and intellectual activity used to generate new insights or solutions to problems [10]. Action-learning also stresses both process- and results-oriented evaluation for establishing the effectiveness of learning [4]. This is about the learning that arises from the process linked to the solutions to problem(s) [4,8]. The development of a solution would draw on the skills of identifying and analysing experience, reflection and feedback.

3. Incorporating Action Learning into Teaching at Universities

Traditional classroom lectures stress the theoretical aspects rather than the cross-functional processes of production and operations. A radical concept of action learning where learning requires programmed knowledge (i.e. routine knowledge in use) and questioning insight [11]. Action or experimental learning has long been held out by many researchers to provide a sound basis for working on problems, focusing on learning and implementing solutions [12,13]. This is learner-driven and centered the 'need' to find a solution to real problem. It is built upon According to Smith and O'Neil [14], the ability to think things through and de-brief experiences at non-trivial personal and contextual levels is increasingly recognised as essential to effective learning and performance.

Action learning is one of the well-proven individual, collective and organisational development philosophies. Incorporating action learning into classroom teaching helps education practitioners to maintain a balance between theory and practice, leading to enhance quality teaching at universities [4]. This facilitates student participation and teamwork to accomplish tasks of common goals, and in turn, create a satisfying, stimulating and enjoyable working environment. Smith and O'Neil [14] argue that action-learning programmes are typically based on the following tenets:

- Participants tackle real problems in real time;
- Participants meet in small stable learning groups;
- Each group holds intermittent meetings over a fixed programme cycle;

- Problems are relevant to a participant's workplace realities;
- A supportive collaborative learning process is followed in a learning group;
- Process is based on reflection, questioning, conjecture and refutation; and
- Participants take action collectively to resolve their problem.

Action learning has a flexible framework designed to draw out, capture and build on what is, rather than operate in a pure, detached, analytical and rational world of what should be. The learning process forces reflection and promotes insightful inquiry with perceptive partners and leaves responsibility for implementation of a solution in the participant's hands [14,15]. The process also empowers individuals by encouraging them to take charge of the identified problems. Using the action-learning approach in teaching can motivate students (participants) to conceptualise the solution and plan for feasible actions based on the learning gathered. This can bring out a positive team spirit to perform and achieve a shared goal. In this way, the students' mental models and future actions are shared and reshaped in continual developmental cycles. Students are able to solve long-standing problems that may not be solved by simple training, while developing their leadership abilities [4,14].

4. Teaching Operations Management: An Action-Learning Case

Teaching operations management is a complex educational process involving technical elements (e.g. equipment and technology) and managerial elements (e.g. planning, and control). The Department of Manufacturing Engineering and Engineering Management at City University of Hong Kong has introduced action-learning concept to enhancing the quality of teaching since 1992. Teaching operations management (OM) in the Bachelor of Engineering degree programme in Industrial Engineering and Engineering Management was one of the initiatives at the university.

4.1 Course Information

The syllabus of the OM course covers a wide area including production systems, forecasting, resources planning, aggregate planning, master schedule, requirements planning systems, scheduling, progress control and integrated production control systems. The course lasts for one semester, consisting of lectures, tutorials and a PAPLANE (stands for 'paper plane') workshop. The number of student enrolment in the course is normally less than 40. Students taking the course are in their second year of the degree programme. They will take a 2-hour lecture and

another one hour per week on tutorials and group activities for thirteen weeks.

A teaching team includes a lecturer and two or more tutors depending the size of the students enrolled in the course. Students will attend the PAPLANE workshop toward the end of the course in the campus. They are required to design and manufacture new products (i.e. paper planes) with given specifications and constraints, and to implement a production system that closely imitates a real competitive environment. The workshop is the experiential component and is a major part of the continuous assessment of the course. Brief descriptions of the course syllabus and schedule are given in tables 1 and 2 respectively. The course stresses action learning, teamwork, group decision-making and learning process evaluation.

Table 1. Brief descriptions of course syllabus

Core Areas	Descriptions
Operations Management	1. Managing Operations Function - System design and analysis; justification of operations needs; project management; other related issues (e.g. product design, process design, innovation, quality management, business process re-engineering, auditing and managerial reporting) 2. Managerial Skills - Self-appraisal, interpersonal skills, motivation, leadership, communication, change and conflicts, group and organisation profile analysis. 3. Group Process and Decision Making - Individual values, culture and background affecting group behaviour; role perception and team building; group forming and decision making; problem identification and diagnosis; logical thinking and other problem solving approaches.
Management Skills	1. Information Processing Skills - Include ways in finding, extracting, validating and assimilating information of both structured and unstructured nature. 2. Meeting Skills - Include group dynamics and skills in leading and controlling different types of meetings. 3. Peer and Coaching Skills - Focus on skills in maintaining peer relationships, building implicit contacts, networking and consulting skills. 4. Presentation Skills - Focus mainly on formal oral presentation, and report writing 5. Interpersonal Skills - Include persuasion in formal presentation, meetings and day-to-day communication.

4.2 Learning Objectives

The primary learning objective of the course is to facilitate student learning on concepts and practices of operations management in a competitive environment. Students would go through a team-building process to attain the learning goals. The course has four associated learning objectives that facilitate students to:

Table 2. Course schedule and requirements

Week	Activity schedules and phases	Requirements and assignments	Course descriptions
1	Introduction of the course and PAPLANE workshop	*Course briefing, workshop rules and guidelines*	- Course structure and schedule - Self-assessment exercises
2-3	Team composition procedure	*Formation and development of teams* • Forming • Storimg • Norming • Performing	- Individual 'Strengths-Weaknesses-Opportunities-Threats' analysis - Grouping of students - Group profile analysis - Meeting and report writing skills
4-6	Production system design, product idea screening, planning and prototyping phases	*Submission of task report 1* • Company mission, strategies and policies • Production system design • Product strategies and prototype design • Materials requirements and acquisition • Financial planning and budget	- Selection and assignment of individual tasks - Literature review and desk research on the areas of operations management - Oral presentation of tasks I (10-15 minutes each) - Submission of task reports I and feedback from members and facilitators
7-9	Production planning and scheduling phases	*Submission of task report II* • Capacity plan, production plan and schedule • Facility and process planning • Work and job design • Quality assurance and auditing	- Oral presentation of tasks II (10-15 minutes each) - Submission of task reports II and feedback from members and facilitators - Preparation of bidding documents - Design of new products and making of prototypes
10-11	Bidding, contracting, material purchasing and negotiating phases	*Submission of task report III* • Bidding strategies • Contract making and negotiation • Material procurement	- Participating the close and open bidding exercises - Preparation of contracts and purchasing orders - Preparation of contingency plan - Planning and scheduling for the production
12-13	The PAPLANE workshop (Production, flying test, profit calculations, and presentation phases)	*Submission of final report* • Individual files • Group files	- 15 minutes of production - Flying test, product audit and profit calculations - Coaching and peer evaluation - Oral presentation and submission of final report

1) Understand the cross-functional operations in an organisation;
2) Make timely decisions and manage contingencies in an uncertain environment;
3) Experience team building and group decision making; and
4) Solve open-ended problems by 'developing skills through doing'.

Students need to sit for a 3-hour course examination and participate the workshop held in the campus towards the end of the course. The workshop is contributing to major part of the continuous assessment for the course. To facilitate the learner-driven learning process, the course stresses student participation and stimulates team efforts and results. The workshop adopts an assessment scheme, as depicted in table 3.

Table 3. An assessment scheme of the course

Assessment Items:		**Individual**	**Group**
Attendance		10%	-
Individual Performance in the Team		10%	-
Presentation	• Interim Task Progress	10%	-
	• Workshop	-	20%
Reports	• Individual File	20%	-
	• Group File	-	30%
Total:		50%	50%
		100%	

4.3 Design of Action-Learning Workshop

For the action-learning workshop, three or more player teams and each team can have five to eight members depending on the number of students enrolled in the course. For instance, a 40-student class can form eight player teams with a minimum size of 5 members per team or five teams with 8 members each. Player teams will set up their business by developing their organisational structure and formulating their product-mix strategies. Individual members will take up different roles and responsibilities such as team leader, product designer/engineer, quality auditor, financial auditor, production personnel, negotiator, and observer in a team. The workshop proceeds through several phases, including design and prototyping, process planning, bidding, contracting, materials purchasing and negotiating, production, flying test, profit calculations, summing up and presentation. Player teams will compete with others for the champion of the workshop [4]. The design and delivery of the course is elaborated as follows:

4.3.1 Formation of Teams

The first two weeks are the introductory part of the workshop. It starts with the explanation of the course structure, workshop rules and guidelines, followed by the formation and development of teams. The facilitators (usually the course lecturer and tutors) will help with the formation of teams from 'forming' via 'storming' to 'norming', and then 'performing' stages during the semester. They will provide guidance of individuals within the team, and communicate teams in a timely manner concerning their weaknesses, strengths, and areas for improvement.

4.3.2 Preparation for the Workshop

The preparation for the half-day workshop commences in the third week. Facilitators will clarify the rules of the workshop to students, and monitor the progress by imposing different milestones and submission deadlines of the game. Students are asked to prepare a short report and present their assigned tasks based on the findings from desk research. These tasks include the formulation of strategies, generation of product ideas, translation of ideas into products, and design of production systems (e.g. material requirements and acquisition, financial planning and budget, capacity plan, production plan and schedule, facility and process planning, work and job design, and quality assurance and auditing). The reports from students constitute the core components of individual player teams.

4.3.3 Contracts and Bidding

Two basic forms of designs are minimum 7-folds and minimum 9-folds paper planes. Their selling prices vary depending upon the complexity of the design and the use of different types of materials (e.g. flimsy papers, colour papers, white papers, paper clips and straws). Each player team needs to design three different types of planes on either minimum seven- or nine-folds. Despite having good aesthetic quality of their design, all designed planes are at least 21 centimetres in length and must be emblazoned with the team's logos (see figure 1). In addition, all planes must be able to fly in a linear distance of eight metres. The facilitators will provide limited amounts of test materials for player teams to make and test their prototype planes. Player teams need to demonstrate that their planes can meet the specified criteria. They also need to keep a completed set of prototype planes as production and inspection references.

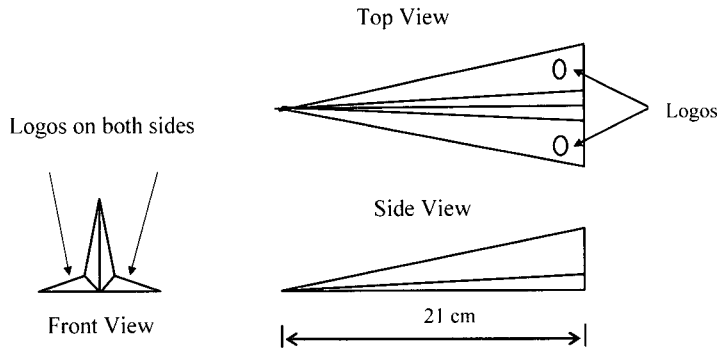

Figure 1. Basic specifications of paper planes

4.3.4 Monitoring and Self-evaluation of Performance

The game uses a selfmonitoring and cross-auditing mechanism that safeguards performance initiatives among player teams. The facilitators will serve as an arbitrator only if any disputes happen during and after the workshop. Each team will delegate one or two members as a financial auditor and a quality auditor to one another team. The financial auditor is responsible for checking and signing off the contracts, purchase orders and financial statements, whereas the quality auditor looks after the inspection of finished planes and other quality audit matters for that team. The auditors will stay with the teams where they are delegated to and monitor the team activities during the day of workshop. Besides, each team will also assign one member as an observer to 1) keep a repository of objective data for the analysis, 2) record the teamwork and behavioural processes in different stages, and 3) produce an observer report at the end of the workshop.

4.4 Delivery of the Workshop

The half-day workshop will be held during the 12-week of the semester. After signing the sales contracts with the buying company, player teams then proceed to the following stages:

Stage 1: Acquisition of Materials

Each team has given a line of $500 cash credits to purchase production materials from a sole supplier managed by the facilitators. All transactions of material acquisitions must be recorded. If the aggregate demands for certain materials are greater than the supplier's stock, these may be short in supply. Therefore, in case of facing material shortages, player teams need to plan for contingencies, and prepare alternative purchasing orders within a very limited time (say, ten minutes) with respect to possible modifications in product design and use of materials.

Stage 2: Production of Planes

All player teams need to design their production processes and operate a production line for making their planes. The production of planes begins once the acquisition of materials is completed. Each team can assign four members to produce their planes in 15 minutes. No extension of production time is allowed. Player teams need to produce at least 10 planes per each of their design types in order to fulfil the minimum requirements of sales contracts.

Stage 3: Testing of Planes

Once the production is over, the delegated quality auditor from other team will count the number of final products (i.e. finished planes) and inspect them with respect to the predetermined design specifications. Only those planes pass the inspection can proceed to the flying test. After the inspection, player teams can assign one or two members to fly the planes from a specified area. One attempt for each plane to pass the test is allowed. The auditor then records the number of planes that can pass the test (i.e. to fly over and/or more than a linear distance of eight metres).

Stage 4: Calculations of Profits/Losses

After the flying test, each team needs to calculate the profits earned and prepare a financial statement. Only those planes meeting the design specifications and passing the flying test are counted towards the fulfilment of either a normal sales contract or a bidding contract. Those planes failed in the inspection or the flying test will be treated as scraps with no value. Any works-in-process and finished planes awaiting their flying test can be valuated as unused materials. Besides, for any failure plane from the bidding contracts, the penalty per plane will be 100 percent on its bidding price. The delegated financial auditor from one another team will check the correctness of calculations and figures presented in the financial statement.

Stage 5: Judging of team performance

A group of academic staff members will be invited as the judges for the workshop. Player teams will present the consequences of their actions and decisions and evaluate their performance in the game. The judging criteria for the champion team include: 1) profits plus the cash on hand, 2) the quality of the documents submitted, and 3) the presentation made by teams. Besides, a list of contributing factors (such as product design, product mix, the quality and reliability of the product, bidding strategies, the response to the material shortages, production efficiency and team commitment) also determines the performance of player teams.

4.5 Post-workshop evaluation

One week after the game, each team needs to submit an observer's report and a group's technical report. The observer's report explains the teamwork and processes addressing the group structure, communication, leadership style, student participation and coordination. The technical report includes a group file and members' individual files. These files contain the records of group activities, members' performance, and other relevant materials. Students will evaluate their own achievements as well as other members' performance with respect to a list of 25 learning/evaluation elements as depicted in table 4. These elements are grouped under five categories, namely 1) leadership, 2) communication, 3) identification and analysis of problems, 4) making decisions, and 5) planning and scheduling solutions. The evaluation helps students to evaluate their own achievements, and to build positive attitude, knowledge and skills in managing operations function.

Table 4. Learning elements in self and peer evaluation

Categories	Learning/Evaluation elements
Leadership	L1. Able to provide team direction. L2. Commit to group solution and assumptions. L3. Able to make or shape plans. L4. Able to schedule team activities. L5. Receptive to ideas generated from others. L6. Willing to give feedback to others. L7. Able to facilitate the group decision process.
Communication	C8. Able to communicate ideas, information, and plans. C9. Willing to share and exchanges information. C10. Able to acquire presentational skills. C11. Able to listens to ideas, thoughts, and facts from others. C12. Able to write in a logical and clear manner. C13. Rank not inhibiting idea flows.
Identification and Analysis of Problems	I14. Recognise problem situations and identify underlying issues. I15. Collect relevant information to analyses problems. I16. Generate alternative solutions to problems. I17. Analyse factors affecting the selection of solutions. I18. Analyse solution options and makes changes if needed.
Making Decisions	M19. Able to voice out opinions on making decisions. M20. Work together as a team. M21. Identify appropriate solutions to problems M22. Evaluate potential problems or risks of solutions.
Planning and Scheduling Solutions	P23. Schedule solutions considering priorities, workload and time. P24. Plan and organise resources to make thing done. P25. Monitor the effectiveness of solutions.

The workshop has been implemented many times with encouraging learning results. Many students reported that they have learnt to adapt changes and to strive for the best performance. A typical self and peer evaluation record of a participant selected from a five-member team is shown in table 5. The record is self-explanatory in which the participant attained an overall performance of 188 scores out of 250 and is slightly higher than the peers' weighted score (i.e. 179 out of 250). The standard deviations of peer scores

Table 5. A self and peer evaluation record of a selected participant

Evaluation Category[1] - Elements	Self Score[2]	Peer[2] 1	Peer[2] 2	Peer[2] 3	Peer[2] 4	Peer Score Mean[2]	Peer Score SD[3]	Self-Peer Score Difference
L-1	6	3	5	7	7	5.50	1.91	0.50
L-2	7	4	7	9	8	7.00	2.16	0.00
L-3	8	5	8	8	8	7.25	1.50	0.75
L-4	6	4	3	9	5	5.25	2.63	0.75
L-5	9	6	8	10	8	8.00	1.63	1.00
L-6	8	6	8	10	8	8.00	1.63	0.00
L-7	9	5	5	9	9	7.00	2.31	2.00
C-8	6	8	6	9	7	7.50	1.29	-1.50
C-9	7	7	7	9	8	7.75	0.96	-0.75
C-10	5	7	7	8	6	7.00	0.82	-2.00
C-11	8	5	7	9	8	7.25	1.71	0.75
C-12	10	8	7	9	9	8.25	0.96	1.75
C-13	9	9	4	9	9	7.75	2.50	1.25
I-14	8	7	4	9	9	7.25	2.36	0.75
I-15	5	5	5	8	5	5.75	1.50	-0.75
I-16	7	7	5	7	8	6.75	1.26	0.25
I-17	5	7	6	9	6	7.00	1.41	-2.00
I-18	8	7	6	9	8	7.50	1.29	0.50
M-19	10	8	8	10	9	8.75	0.96	1.25
M-20	10	10	8	8	9	8.75	0.96	1.25
M-21	9	5	8	8	9	7.50	1.73	1.50
M-22	9	5	7	8	9	7.25	1.71	1.75
P-23	5	8	3	9	5	6.25	2.75	-1.25
P-24	5	7	3	8	5	5.75	2.22	-0.75
P-25	9	7	4	8	9	7.00	2.16	2.00
Total Score:	**188**	**160**	**149**	**216**	**191**	**179.00**	--	--

Notes:

[1] The categories of evaluation elements are L: Leadership; C: Communication; I: Identification and analysis of problems; M: Making decisions; P: Planning and scheduling solutions (For a brief description of evaluation elements, see Table 4)

[2] A '10-point' scale is used, i.e. 1 = Strongly disagree/Extremely poor; 10 = Strong agree/Extremely good

[3] SD = Standard Deviation

range from 0.96 to 2.75, and the difference of self-peer scores ranges from -2.00 to 2.00 among twenty-five evaluation elements. It is also shown that the participant is comparatively strong in the areas of making decision, but is weak in planning and scheduling solution. The post-evaluation exercise is an invaluable part of the workshop that helps individuals and teams to understand their strengths and identify their weaknesses objectively and collectively. The course works well with selfmonitoring and cross-auditing process to monitor the performance of player teams and individuals.

5. Discussion and Conclusions

Incorporating action-learning concept in teaching operations management, the described course at City University of Hong Kong integrates seamlessly various ingredients of multi-disciplinary operations processes, teamwork and group decision-making. The action-learning approach helps lecturers to instill the operations management skills and knowledge to students with a balance between theory and practice. Differing from simulation or case studies, the delivery of the course makes use of collaborative inquiry with students (or learners). This helps students to develop problem-solving skills and stresses the elements that may be missing in conventional classroom teaching. Students can benefit from the cross-fertilisation of ideas, experiences and practices that inevitably emerges from their teams. This is a performance-driven and learner-centered approach around the 'need' to find a solution to real problem.

The course provides a 'safe practice field' for students to acquire management skills and make operational decisions in a competitive environment. It involves carrying out team objectives and embodies the organisational functions from product design to auditing and managerial reporting. The action-learning workshop allows students to experience the cross-functional activities in production operations, and facilitates individual and group learning through applying and integrating knowledge and skills. To be the champion team is the result of team efforts towards common objectives, where individuals assume their responsibilities and perform their tasks with the support from others. The self, peer and facilitators' evaluation of student performance at the end of the workshop suggests that the effects measured are enduring, and that the workshop is a key ingredient to successful team building in the course.

Accompanying with the recent development of IT and Internet-based teaching, it is anticipated that the action-learning approach would motivate students to solve open-ended

problems by 'developing skills through doing', and allow them to have a face-to-face contact with their peers, lecturers and tutors. Nevertheless, resource constraints, bias, lack of time, and control would always disrupt the course in some way. The robustness of the course design and delivery needs to be tested. Future research would identify various performance metrics for measuring the effectiveness of the action learning approach and comparing students' learning performance in classes of varied sizes within the university and/or amongst different universities. The findings would help practitioners and researchers to determine the efficacy of the approach for enhancing quality teaching at universities.

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