AN INNOVATIVE 7-STEP 'O-A-K-I-R-E-V' ENGINEERING INTERNSHIP MODEL

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Abstract **-** Internship is a highly productive tool to shape and mould academicians into competent entrepreneurs. Since it is a significant part of any Industry – Institute linkage, many researchers have tried and tested various Internship Models to improve the effectiveness of Internship programs. An attempt has been made in this work to bring out an Innovative internship model, specifically tailored for Engineering interns, with due consideration to the holistic development of the intern which could render the transformation of the intern into a complete industry-ready professional. The strategic plan has been developed and detailed in this work with in-depth analysis of the generalized possible thematic areas of training for the engineering interns, irrespective of their branch of study.

Index Terms - Internship model, University-Industry collaboration, Interns, Research projects.

I. INTRODUCTION

Any Industry-Institute linkage is meant for knowledge transfer and experience sharing. Knowledge (technology) transfer has been defined as 'the process by which knowledge concerning the making or doing of useful things contained within one organized setting is brought into use within another organization context'. Research programs for university/industry must begin with knowledge transfer and be deliberately structured to encourage early, open and frequent communication among the interdisciplinary groups [1]. An important aspect of any Industry-Institute collaboration is Internship program, beneficial to not only the institute and industry, but to the participating interns.

There is a common conception that a wide gap exists between the 'academic world' and 'real world'.. A sociological analysis of internship programs found internships that function effectively as the link between formal education and practice [2]. Internship experiences also enhance the students' entry into the world of work by improving time management, communication skills, self-discipline and initiative [3]. Internship serves as a basis for various other modes of university-industry co-operation, since it provides a common intellectual platform between academic and business areas.

II. LITERATURE REVIEW

According to Furco, internships are defined as 'programs engaging students in service activities primarily for the purpose of providing them with hands-on experience that enhances their learning or understanding of issues relevant to a particular area of study [4]. On the other hand, McMahon & Quinn noted that internships are 'supervised work experiences whereby students leave their institutions and get engaged in work related programs, during which period they are closely supervised by experienced job incumbents'[5].

The American Institute of Certified Public Accountants has indicated that internship is 'work experience in industrial, business or government work situations that leverage the class guidelines experience through practical work experience [6]. Being a valuable component of higher education academic program, internship is believed to create win-win situation for the students, organization as well as the university [7].

2.1 Types of Internship

An internship is a job-training for white-collar and professional careers. Internship may be part-time or full time, with varying time duration, conducted in different times of a year like summer, winter or spring. Internships can be paid or unpaid and usually provides credit for work.

The other commonly preferred types of internships are:

- Cooperative Education (Co-op)
- Independent Internship
- Field Experience
- Practicum
- Service Learning
- Externship
- Apprenticeship

- College-sponsored

Cooperative Education

Some colleges and universities make arrangements with companies for students to work in conjunction with their courses. These experiences are often called 'Co-ops' but are usually paid [8].

Independent Internship

It is a kind of internship which is arranged by students and employer independently without the involvement of institute.

Field Experience

Work experiences, sometimes referred to as field experiences. Fieldwork is an opportunity, most commonly used by students pursuing careers in science or sociology, to develop skills by observing, recording, mapping, and interpreting data [8].

Practicum

Students work in teams or individually under the joint supervision of an employer and an academic adviser. Practica increase students' standing in the job or graduate / school market and facilitate networking with professionals in your field of interest [9].

Service Learning

Service learning means working in an organized service within a community, usually structured as a three-step process in which students outline their proposed service term and objectives, perform the service work and finally present their conclusions based on their experiences.

Externship

Externships are distinguished by their short duration. The student spends a short period of time - usually one to three weeks. Students experience a typical day on the job and observe the work environment and demands of the career. It aids in exploring a career field without making a long-term commitment. They are most common in the legal and medical fields and are unpaid.

Apprenticeship

Apprenticeships are meant for learning a highly skilled trade and are paid. Wages increase as the apprentice gains experience. Apprenticeships vary in length from one to five years. Some trades offering apprenticeships are horticulture, electronics, clothing design and plumbing technology.

College Sponsored Internship

For this type of internship, the concerned institute will pay for the research work.

2.2 Internship Models

To improve the effectiveness of Internship programs, various Internship models have been developed, tried and tested. Each model has a specific methodology, strategically planned to overcome the difficulties and fully utilize the available resources. Though the models are similar in some ways, each offers unique attributes. Three most popular internship stage models developed earlier are as follows [10]:

A. Inkster & Ross Model (1988)
B. Sweitzer & King Model (1994)
C. Kiser Model (2000)

A. Inkster & Ross Internship Model

Inkster & Ross's Model (1988) created their six-stage model based on an earlier archetype.

Stage I: Arranging and Anticipating - the students seek out & secure a placement.

Stage II: Orientation and Establishing Identity - initial arrival, learning new information & establishing a work-place identity.

Stage III: Reconciling expectations with reality – realizing that internship atmosphere is different in structure when compared to classroom and that their actions have consequences on clients, workers and themselves.

Stage IV: Productivity and Independence – fruitful contribution to the workplace and supervisor's recognition of intern's competence leading to independence.

Stage V: Closure – clarifying and celebrating accomplishments.

Stage VI: Re-entry and Practical Application - re-adjusting to classroom atmosphere, decision regarding entering industry following graduation or pursuing further education and focusing on the benefits of the internship applying the experience gained for further course work, vocational preparation or graduate school applications.

B. Sweitzer & King Internship Stage Model

Sweitzer & King (1994, 1995) proposed a five-stage model and revised it later in 1999. It is more focused on student internship experiences with their time span in the industry premises:

Stage I: Anticipation - marked by mild to moderate morale, positive anticipation.

Stage II: Disillusionment - student morale & task accomplishment drops.

Stage III: Confrontation - overcoming existing barriers, helps to build confidence & independence.

Stage IV: Competence - marked in students' high morale, sense of purpose, high self-esteem & clearer sense of capabilities.

Stage V: Culmination - student's morale is typically based on their ability to provide closure with clients, co-workers and supervisors.

C. Kiser Internship Model

Based on her personal experiences as an internship supervisor, Kiser (2000), after reviewing various internship models, proposed a four-stage model:

Stage I: Pre-placement – occurs before conducting the internship, encompassing the process of identifying, investigating, interviewing & determining an internship placement site with input from the potential internship supervisor & academic director.
Stage II: Initiation – occurs when the internship experience actually begins. Students observe their new surroundings while supervisors assess students' strengths & weaknesses.
Stage III: Working – accomplishing company's tasks and learning goals.
Stage IV: Termination – closure to the internship, to execute the plans with learned experience.

III. O-A-K-I-R-E-V ENGINEERING INTERNSHIP MODEL

In this work, an innovative 7-stage engineering internship model was designed for a time span of 16 weeks (one semester), specifically for engineering undergraduates. The seven distinct phases of the newly formulated O-A-K-I-R-E-V Model is shown in Figure 1.

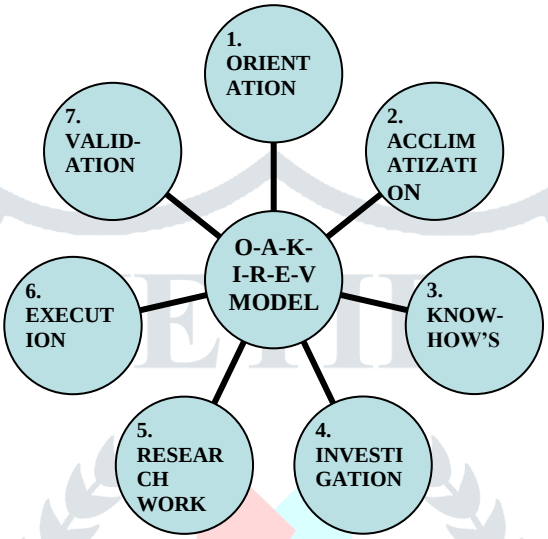

Fig. 1: O-A-K-I-R-E-V ENGINEERING INTERNSHIP MODEL

Stage I: ORIENTATION
a. Aims and Objectives
b. Motivation and Attitude building
c. Review of Instrumentation, Material / Product Testing
d. Industrial Standards

This stage is meant for preparing the interns for internships and shall be done at the institute level. The aims and objectives of the program shall be clarified and interns shall be mentally shaped to overcome hesitation and remove over-expectations. In addition, the highly essential industrial technical skills like instrumentation, calibration, material testing and industrial standards shall be reviewed. The necessity to have a positive attitude shall be thoroughly emphasized and lucid guidelines shall be given about how to communicate with higher authorities and workers.

Stage II: ACCLIMATIZATION
a. Overview
b. Socialization

This comprises the initial period of entering into an industry. Getting an overview of the industry, available facilities / machineries, various processes and types of products manufactured shall be the objectives for this phase, along with getting introduced to the managers and workers. By proper socializing, the interns shall create a congenial atmosphere for learning and for implementation of their research work.

Stage III: KNOW-HOW'S
a. Processes / Products / Machineries
b. Technical Know-how's

Third stage comprises of learning the technicalities of various processes / machines, working principles, operating conditions / parameters, product types / compositions, costs, maintenance schedules, etc., in detail. This stage provides a solid basis for correlating what they have learnt in academics to what exists in practice.

Stage IV: INVESTIGATION
a. Possible areas of Research work
b. Data collection and Feasibility Study
c. Interim Report

With a thorough understanding of the technical know-how's, the interns shall probe for the problem areas where they can contribute. Looking for various industrial problems, data collection and feasibility study are part of this stage.
Then the interns shall present a interim report at the institute level, witnessed by not only the teaching faculties, but the concerned managers from the industry. Each intern or each group of interns shall present three project options, among which one will be finalized by the panel of jury members which includes the officials from the industry, based on the worthiness and feasibility of the research work.

Stage V: RESEARCH WORK

a. Design / Development
b. Theoretical work
c. Analysis

This stage comprises the core part of the internship – research contribution. It will be mutually beneficial to the participating interns and the internship-offering industry. Effective research work not only bridges the gap between the academics and industrial practices, but provides an opportunity to upgrade the students into efficient entrepreneurs.

For industries, it turns out to be highly productive and gives an opportunity to have a competitive edge – like a new or modified design outcome or better facilities planning or inventory control or implementation of a new maintenance schedule.

Possible Thematic Areas for Research

For engineering interns, the possible research contributions can be from the broad thematic areas mentioned below (though not restricted to only these areas):

Arriving at a new design:
A new design to cater the current needs of an industry is always the best way of problem-solving, provided it proves economic and efficient.

Modifying an existing design:
Sometimes, design modification can make a big difference in reliability, agility and productivity. Even it can be a cost saver over a period of time. For example, providing a fillet or increasing a pin diameter may reduce stress concentration.
Preparing/Modifying Maintenance Schedules:
Preparing a proper maintenance schedule will increase the productivity. Proper lubrication will reduce downtime of machines for repairs. For example, interns can actively participate in the task of preparing a Preventive Maintenance schedule for a textile production unit.

Quality Control:
Statistical Quality Control can be a highly useful tool to know the quality level of incoming goods and outgoing products. Various tools like Variable charts (for continuous data), Attribute charts (for defects / defectives), 6-σ plots can be employed. An example being, ascertaining the sufficiency of process controls by examining the quality of products using a Double sampling technique.

Tools for Design Improvement:
Conducting Brain storming sessions, finding Cause and Effect relationships and using Fishbone technique, Failure Mode and Effect Analysis (FMEA) and Taguchi Approach are some of the prime tools for improving design and quality.

Inventory Control:
Piling too much of items or scarcity of spare parts – both are deemed to prove monetary loss and lessened reputation for the industry. Tools like Break-even analysis will reduce capital cost and decrease machine downtime.

Management Tools/Production Planning:
In consultation with the higher authorities, a suitable management tool can be implemented – like Total Productivity Management (TPM), Total Quality Management (TQM), Kaizen principle, 5S, Product life-cycle Management (PLM).

Work study / Time study:
Motion and work studies are highly useful in industries having mass production, since it is concerned with repetitive actions.

Optimization Techniques:
A suitable optimization technique like CPM / PERT will bring out the balance between cost-quality-time.

Stage VI: EXECUTION

a. Project Management / Implementation
b. Time Management

The validity of the theoretical research work done in the previous stage (technicalities, assumptions, calculations, software tools, etc.) shall be checked by a team comprising members from both the university and the industry. Any research work needs an implementation for realizing the goals. Thus a sound research work done shall be executed – through fabrication of a machine or execution of a new management principle. In short, this stage represents the practical part of theoretically laid documents of the

research work done. The skills of the interns in project and time management are highly essential for the successful execution of the project work.

Stage VII: VALIDATION

a. Final Report Submission
b. Modifications / Improvements
c. Lessons learnt and Directions for career.

After successful implementation of the research work, the interns shall present their final report which contains the company overview, existing problems, technical details of the work done, results and conclusion. The presentation shall be done in the premises of university. Copies of the report shall be given to the concerned authorities of the industry.

IV. TIME SCHEDULE FOR O-A-K-I-R-E-V INTERNSHIP MODEL

Depending upon the time necessary for the successful completion of each stage, a tentative time schedule has been prepared and shown in Figure 2 for O-A-K-I-R-E-V Internship Model. Due consideration has been given to increase the number of weeks for 'Research work' and 'Execution' stages.
The time schedule is only tentative, given the fact that each industry is different. But the authors wish to emphasize giving more weightage to research and its outcome.

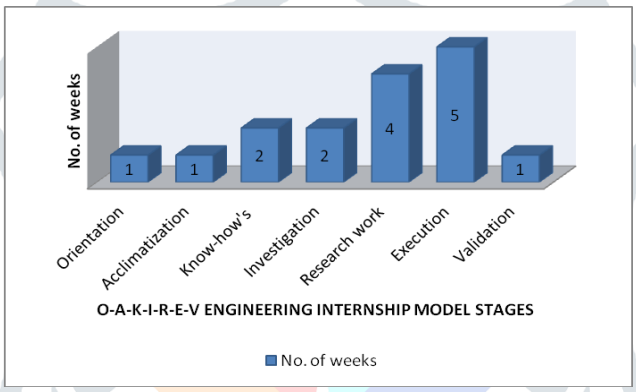

Fig 2: Tentative Time Schedule for O-A-K-I-R-E-V Internship Model

V. CONCLUSION

The existing Internship models address the psychological phases of an intern during the internship, with little focus on the categorical stages necessary to have a full-fledged and fruitful internship. This work attempts to fulfill this void, by developing a comprehensive, all-inclusive and holistic 7-step **O-A-K-I-R-E-V** Engineering Internship Model, specifically meant for Engineering interns at UG level, carried out for a semester (16 weeks), with clear demarcation of the stages. In addition, it throws light upon what is expected from each stage, possible internship research areas and the tentative time period required for the completion of each stage. If implemented properly, this innovative model will prove highly effective in building the overall potential of the engineering interns, transforming them into efficient engineering professionals with hands-on practical skills and problem solving ability.

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