

# Retooling Information Technology Professionals

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## INTRODUCTION

Technological advancements in areas such as, object-oriented programming, graphical user interfaces (GUI), client-server and multimedia systems have resulted in a paradigm shift for IT professionals. Programmers familiar with the third generation languages such as, COBOL, PL/1 may find it difficult to code in object-oriented languages like, C++, Visual Basic and JAVA. Systems analysts may have to apply new methodologies to analyze and design client-server applications and multimedia systems. With the spread of end-user computing, IT professionals are working in close cooperation with users thereby requiring organizational skills such as communication, teamwork, understanding of business functions, and change management. Thus, there exists a tremendous need for retooling Information Technology (IT) professionals [5, 10].

This paper focuses on the identification of skills required for various categories of IT professionals to compete in the new environment. Alternative approaches for addressing the IT skill deficiency problems have been examined. A pilot study of the IT departments in Midwest region was conducted to collect data on skill requirements and the preferred retooling strategies. Section 2 discusses the skill requirements for various categories. Strategies for overcoming IT skill deficiency in organizations have been discussed section 3. Finally, the outcome of a survey on IT retooling has been presented.

## SKILL REQUIREMENTS

The skill requirements of programmers, systems analysts and information systems (IS) managers in the changing IT environment are discussed by Todd, McKeen and Gallupe (1995). In the new paradigm, programmers and systems maintenance personnel need to migrate from text-oriented procedural languages to object-

oriented environment. Systems Analysts need to acquire design skills for client/server and multimedia applications. Additionally, database and network administrators should have skills to manage distributed systems involving client/server computing and multimedia applications. Project managers and user support personnel are required to enhance their teamwork, communication and management skills [6]. The skills required by the above professionals can be classified as technical and organizational. The details of the major areas under each category are identified below.

**Technical Skills:** IT professionals must be prepared to accept the conceptual shift in a number of directions, such as: from text-oriented procedural languages to object-oriented programming; from character oriented mainframe applications to event-oriented Windows applications. Besides these conceptual shifts, IT professionals need to acquire diverse set of skills on client-server and multimedia systems. Client-server computing requires knowledge in relational and object-oriented databases, GUI tools, communication networks, and inter-process communications [8]. Multimedia based systems demand skills in the areas of multimedia authoring tools, multimedia database management system, sound recording, editing & mixing software, video overlay software, animation development tools, MIDI music production tools, clip media and CD-ROM production system [9, 11].

**Organizational Skills:** With the growth of end-user computing the information systems department in many organizations have been dispersed, and in some cases IT professionals have been placed in the user departments [4]. In such an environment IT professionals need to enhance their organizational skills in areas such as [3]:

- Teamwork skills ( ability to collaborate during the systems development and implementation.
- Business skills ( understanding business functions and devel-

oping customer orientation.

- Communication skills ( listening skill, interpersonal skill, writing & oral communication skill.
- Management skills ( change management skill and leadership skill.

### STRATEGIES FOR OVERCOMING IT SKILL DEFICIENCIES

Most common approaches presented in the literature [7, 1] to overcome IT skill deficiency are:

- Retraining existing IT professionals;
- Replacing technologically obsolete employees with new recruits trained in the recent developments in IT;
- Outsourcing all or part of IT operations.

The pros and cons of these three approaches are presented in the table 1 [1]. Retraining seems to be the most commonly followed approach. However, when the gap between the current skillbase and the required expertise becomes too wide, replacement of existing IT professionals with new recruits who have exposure to new developments in IT may be preferable [1]. Additionally, a major paradigm shift may cause difficulties in retraining. Another approach to overcome skill deficiency problem is to outsource all or part of the IT operations. In the short run, outsourcing may produce immediate results and infuse cash flow but there is concern about loss of control. Various strategies for retraining existing IT employees are discussed in next section.

Strategy	Pros	Cons
Retraining existing employees	Long-time employees are matured, loyal and knowledgeable about the business of organization.	If employees do not want to learn, the retraining effort is expensive and unsuccessful.
Replacing IT professionals having obsolete skills	Younger employees cost less; they are skilled in new technology.	New employees are unfamiliar with business; they may lack loyalty.
Outsourcing IT operations	Offers immediate results; may result in cash infusion.	Causes loss of control over system; results in dependency on service provider.

### Strategies for retraining

Most organizations have ongoing IT training programs generally conducted by consultants and vendors. However, the wide range of changes occurring in the information technology in recent years makes it imperative that the entire population involved with IT undergo some form of training. This results in substantial increase in training cost. Additionally, training conducted by vendors/consultants does not usually provide enough depth.

Another approach is to develop a "core" group of IT professionals who will acquire skills on new technologies and subsequently apply their expertise to going projects and help other IT professionals undergo on-the-job training. This approach has a disadvantage of relatively slower pace of training and using the scarce time of expert employees.

Yet another approach is to conduct ongoing (4-6 weeks) training programs in collaboration with local universities and/or professional organizations. These programs will expose employees to the new concepts in IT. This approach has an advantage of relatively low cost and improved knowledge retention and depth enabled by its slower pace. In some cases these programs can also be customized to meet the specific requirements of organizations. This approach does require longer commitment on the part of the organization and the employees and may not be feasible in all geographic locations.

With recent advancements in multimedia technology, Computer Based Training (CBT) is becoming quite popular. CBT has the advantage of relatively lower cost and convenience in terms of scheduling. Recent advancements in video servers, CD-ROM servers, high-speed networks have made multimedia broadcasting possible. This enables users in many locations to view training modules at the same time [2]. However, there is a high initial cost associated with the development and implementation of multimedia training programs. Also, multimedia based training can not totally eliminate the need for having human instructors.

An organization can follow anyone or a combination of these approaches depending on its specific retooling needs and budget constraints.

### SURVEY ON RETOOLING ISSUES

In order to have a better insight into issues relating to retooling, a pilot study was conducted using a questionnaire. Twenty-five senior IS executives of the companies belonging to the MIS Consortium at the University of Wisconsin Milwaukee were selected for this questionnaire based survey. The member companies varied from fortune 500 to medium sized corporations and represented various sectors of industry such as, service (9), manufacturing (5), consulting (6) and others (5).

The questionnaire was designed to collect data on the current and the expected future skills required of various categories of IT professionals. The percentage of various categories of IS professional reported by the organizations are shown in figure 1. The respondents were also requested to express their preferences regarding different strategies for overcoming IT skill deficiencies in organizations. The areas for retraining and various approaches used for retraining were also identified.

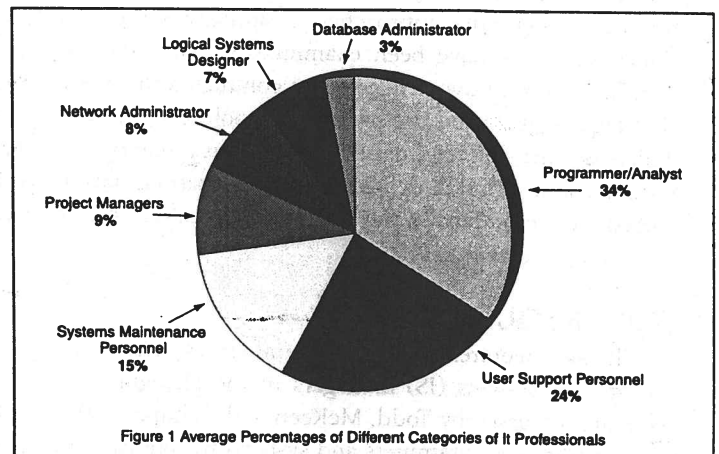
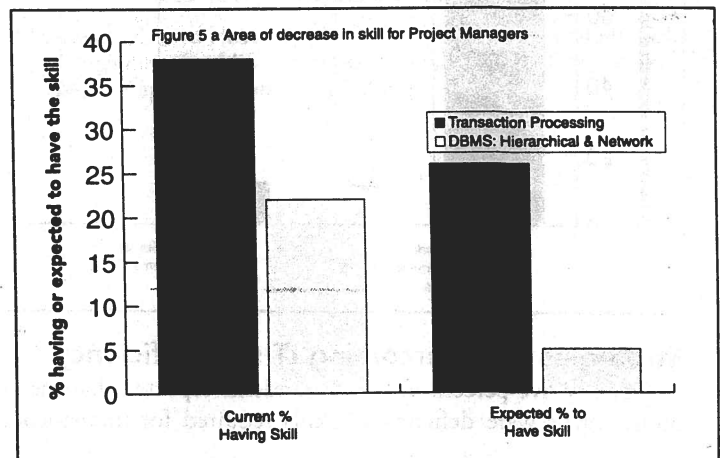
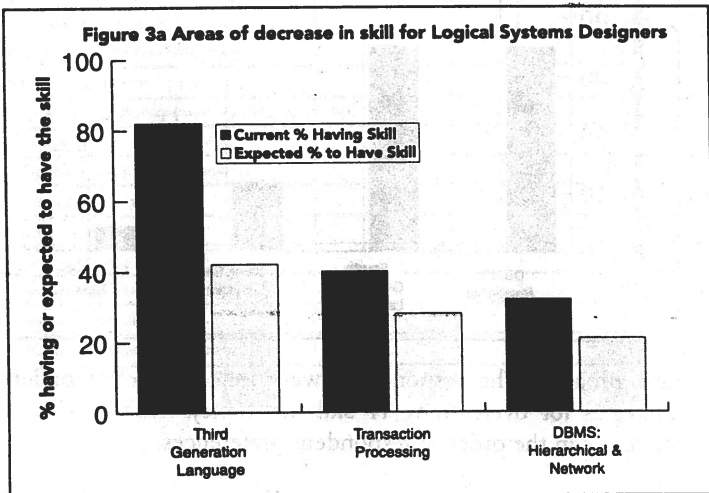
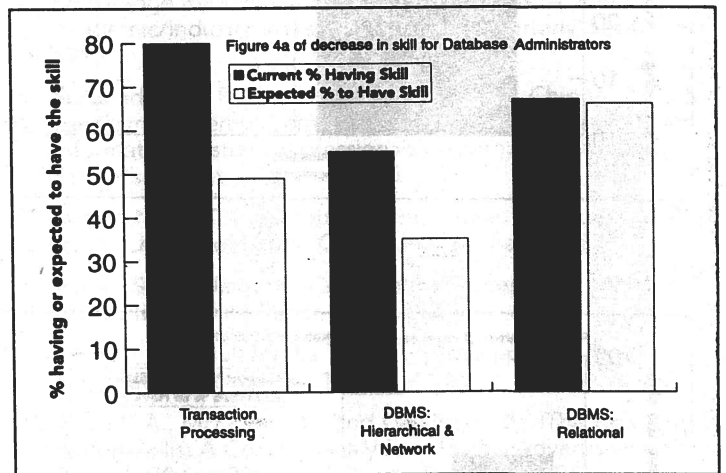
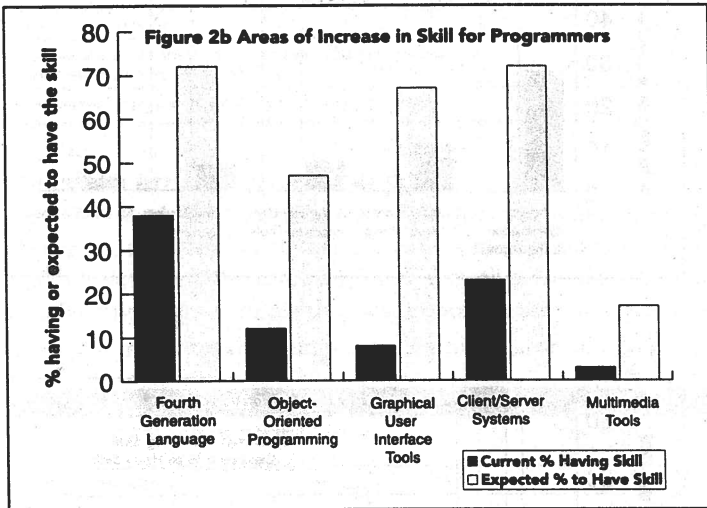
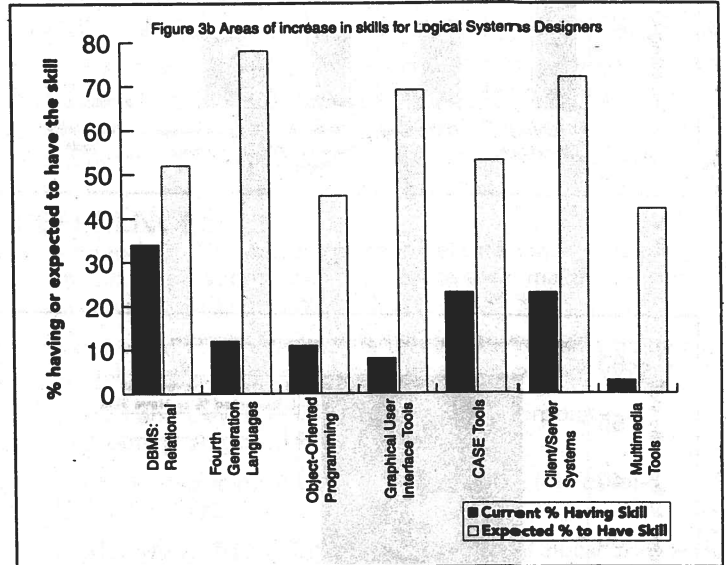
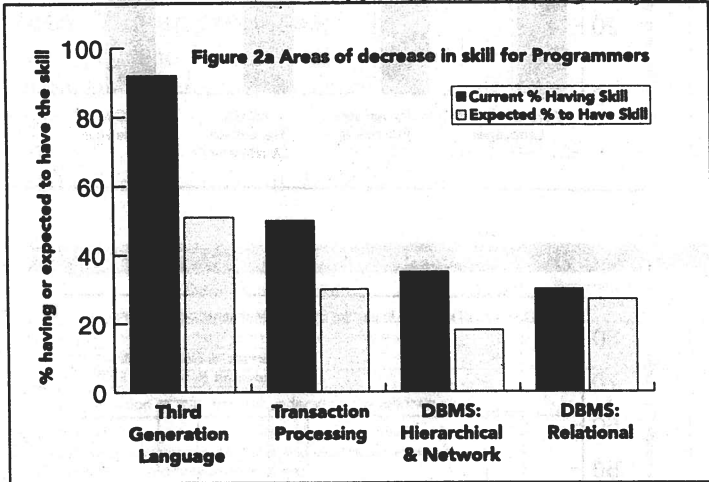


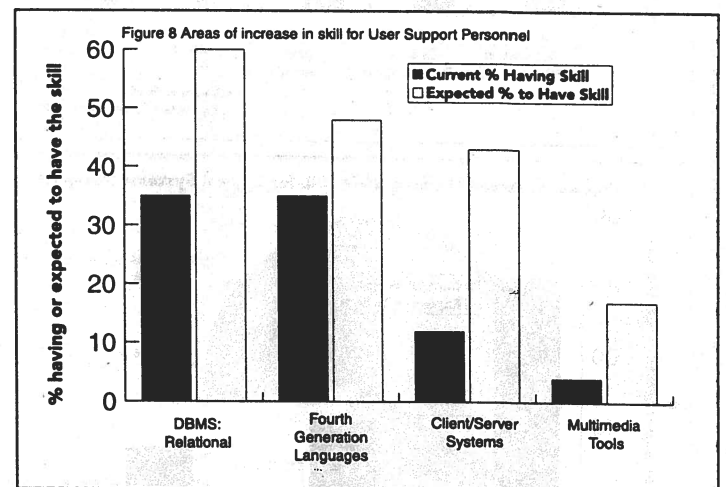
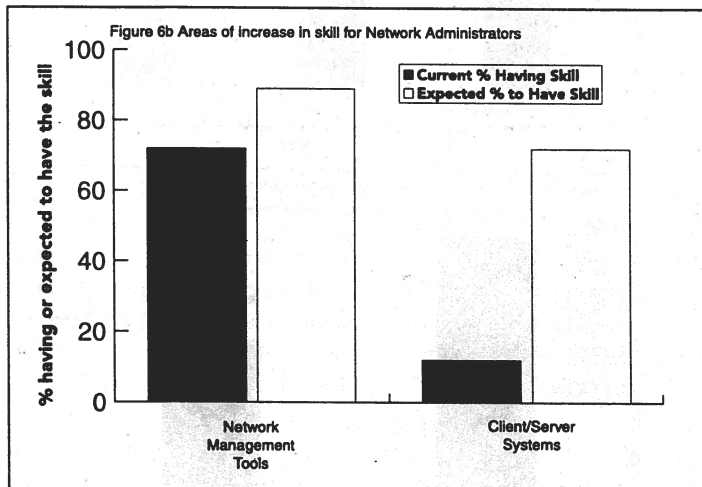
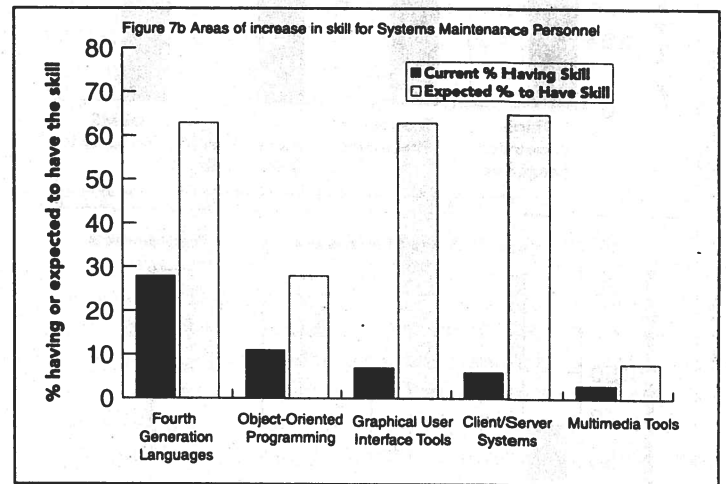
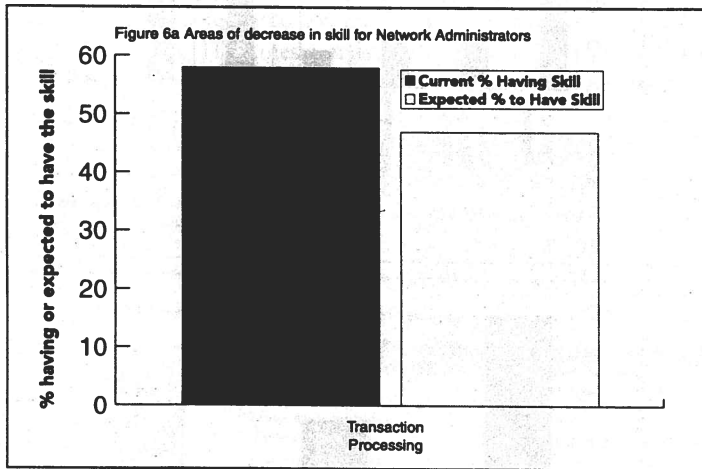
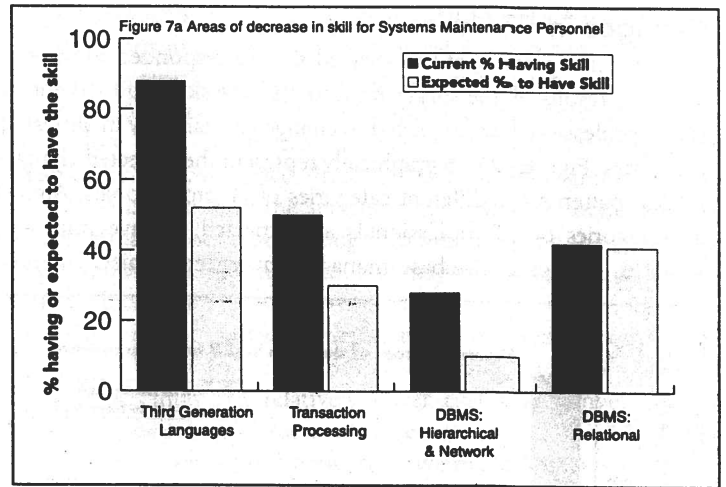
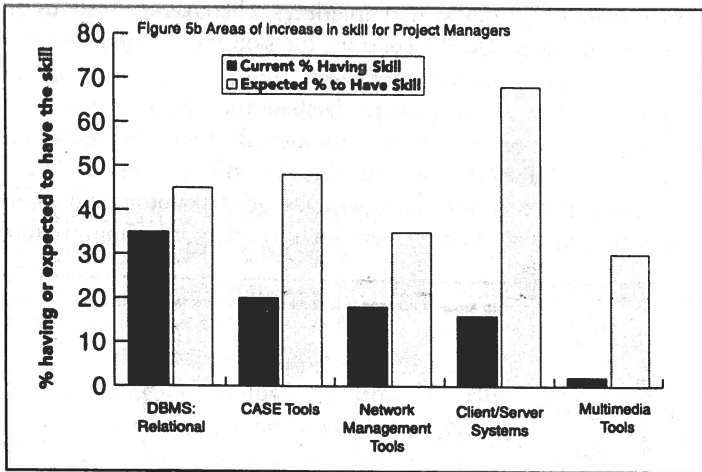
Figure 1 Average Percentages of Different Categories of It Professionals

### Changes in IT Skills

Forty five percent of the selected sample responded to the survey. The results of the survey indicate that the skill requirements of the IT professional are expected to change substantially in almost all categories. Figures 2 to 8 graphically represent the expected changes in skill patterns for different categories of IT professionals. Almost all categories of IT professionals are expected to have improved skills in, relational database management system, object oriented

programming, graphical user interfaces, client/server systems and multimedia tools. On the contrary, the skill requirements for third generation programming languages, transaction processing software, hierarchical and network database management systems are expected to be on the decline. Additionally, there may exist some category specific needs for other types of skills such as, CASE tools for logical systems designers, database administrators and project managers, network management tools for network administrators.





**Strategies for overcoming IT skill deficiency**

Seventy five percent of the respondents reported that their IT professionals were deficient in skills required for implementing

new projects. The respondents were asked to select preferred strategies for overcoming IT skill deficiency. Table 2 lists the strategies in the order of respondent preferences.

TABLE 2: PREFERRED STRATEGIES FOR OVERCOMING IT SKILL DEFICIENCIES

Strategy for overcoming IT skill deficiency problem (ordered according to no of respondents preferring it)
1. Retooling of existing employees
2. Adding new employees with required skills
3. Replacing existing employees having obsolete skills
4. Outsourcing IT activities
5. Other strategies

### Retooling approaches

Respondents were also requested to express their preferences on different approaches for retooling IT professionals. A 5-point Likert scale was used to get respondents preferences (1- not preferred, 5- most preferred). The preference ratings for various approaches are shown in Table 3.

TABLE 3: RETOOLING APPROACHES

Retooling Approaches	Preference rating (Mean Score 1-5 scale)
Sending employees to attend short duration technical seminars organized by consulting firms or vendors	3.78
Making technically obsolete employees work with experts / specialists in the organization so that they can undergo on-the-job training	3.33
Organizing on-going (4-6 hours/week) programs in collaboration with universities / professional organizations to expose employees to new developments of Information Technology	3.33
Encouraging employees to undergo computer based training and video training sessions	3.22
Encouraging employees to attend programs offered by professional organizations such as, DPMA, SIM	3.00
Encouraging employees to enroll in university degree programs	1.89

### Possible areas for retooling

A 5-point Likert scale was used to collect respondent's rating on the importance of IT retooling areas (5- most important and 1-least important). The results indicate that client/server, GUI and collaborative/team skills are the most important areas for retooling. Table 4 summarizes the ratings assigned to the areas of retooling.

TABLE 4: AREAS OF IT RETOOLING

Areas of IT Retooling	Importance rating (Mean Score)
Client / Server Concepts	4.67
GUI development tools	4.33
Collaborative & team skills	4.33
New systems analysis techniques	4.11
Project management techniques	4.11
Object-oriented programming and system design	3.89
Business process redesign skills	3.89
Database design and management	3.78
Vendor specific packages	3.78
Change management skills	3.77
Writing and oral skills	3.67
Network operations	3.50
Network management	3.50
Multimedia development tools	2.88

### CONCLUSION:

The pilot study clearly demonstrates the need for retooling of almost all categories of IT professionals. Retooling existing employees was the most preferred strategy for addressing the IT skill deficiency problem. The important areas for retooling are client/server computing, GUI, collaborative/teamwork skills, new systems development approaches, project management, and O-O programming. Short training courses and on the job training were the most preferred approaches for retooling existing employees. It should be noted that the sample of the study was very small and it was conducted in only one geographical area. Therefore, it may be difficult to arrive at generalized conclusion from the results of this survey. The findings of the study are expected to motivate IS researchers to conduct detailed, nationwide study on IT retooling.

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### **STATEMENT OF PEER REVIEW INTEGRITY**

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