Applying Social Cognitive Learning Theory to the Application of Group Support Systems (GSSs) in Classroom Settings

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Abstract
This paper utilizes social cognitive learning theory to guide (and explain) the development of prototype educational experiences for information systems concepts. The paper applies the major framework of social cognitive learning theory, its recognition of the reciprocity and interaction among cognitive, behavioral, environmental, and physiological/affective influences. In this learning process, it is argued that people learn from a variety of experiences and from the observation of the actions of others.[9] This paper utilizes social cognitive learning theory to explain the structure for a MIS educational experience, and applies the GSS in a course module with specific learning objectives. Finally, the paper describes a MIS classroom experience (a module covering systems analysis [SA] methodology) which has been used to apply the GSS to prototype MIS problems (working scenarios with questions and organizational data).

Introduction
Many educators, politicians, parents and potential employers are concerned with the state of our schools. Their mutual desire to "improve" classroom learning supports the ongoing experimentation with a variety of techniques which hopefully will contribute to educational experiences. The experimentation has expanded to include the use of a variety of electronic media. A typical recent article by Winn [13] describes a learning experiment with students using an electronic medium, a virtual reality system, to explore the inside of an atom. The system also enables the students to play being T-cells that are trying to fight off the AIDS virus. [13] The kids don't learn (according to Winn) by inhabiting the virtual worlds, but by helping to build them. Winn's explanation is that the students "learn" and understand the AIDS problem by researching various risk avoidance techniques (condoms, bleaching hypodermics, zipping pants, etc.). Although the article is only a description of the project and offers no "theory" of learning to explain why the virtual system seems to help students, his idea is intuitively appealing as an explanation of the learning experience. In a similar fashion, experimentation has been ongoing with new classroom techniques that incorporate Group Support Systems (GSS) tools, and seek to improve students' knowledge acquisition and classroom experiences. The GSS technology employed in these classroom experiments supports group work, and encompasses systems and software that coordinate tasks that vary from group writing to voting and group decision support. A description of the characteristics of these tools may be found in McGrath and Hollingshead [18]. A discussion of the tools and their application in education environments is presented in Briggs et al. [3] Discussions of the research issues derived from the expansion of these systems to the classroom is generating requirements for comprehensive assessments of their impact on student learning experiences at primary and secondary levels. [4]

The research literature has broadly investigated how these systems function in many associative work settings by assessing on the performance of Group Support Systems (GSS) in meeting environments. Usage of the GSS tools has subsequently been expanded to many organizational meeting environments, but not in a wide variety of educational settings. Some research indicates that the tools have been applied to various educational environments such as communications and computer classes. These experiences have generate heuristic rules for successful experiences (define deliverables, appropriately framing critical questions, needling with piercing questions, front-and-center summary, plan for appropriate experiences for the class) that can be combined with successful class descriptions to plan an effective classroom presentation using a GSS. [3]

Although there are some other examples of GSS/educational experiments, at present there seems to be limited application and discussion of the use of these systems in MIS programs and courses. This may be attributed to several complex factors. First, the GSSs appear to be in an early stage of the overall GSS product life cycle. They must overcome apparent opposition from potential educators, students, and user organizations reminiscent of the early reactions to organization's adoptions of computers. Secondly, there may be unproven and untested hypotheses about GSS effectiveness, cost benefits, and return on the educational investment among MIS educators. In general, it appears that
the broad MIS community has had only a cursory exposure to GSSs implementation and application. Finally, the GSSs have been implemented using a variety of rapidly changing electronic technologies which may have placed unintended limitations on the ability of educational institutions to acquire and incorporate unique hardware and software technologies for application in MIS classrooms and laboratories.

The goals of this paper are to illustrate the application of GSSs in an MIS-course-level setting, and to assess the experiences of the class using the concepts provided by social cognitive learning theory. This paper will first describe a view of learning that will be used to develop the structure for a MIS educational experience. The learning theory will then be applied to the uses of the GSS in a course module with specific learning objectives. Finally, the paper will describe a MIS classroom experience (module covering systems analysis [SA] methodology) which has been used to apply the GSS to prototype MIS problems (working scenarios with questions and organizational data).

Learning Theory

This paper utilizes social cognitive learning theory to guide (and explain) the development of prototype educational experiences for students studying many information systems concepts. The major framework of social cognitive learning theory can be found in its recognition of the reciprocity and interaction among cognitive, behavioral, environmental, and physiological/affective influences. It postulates that the actions of a person in a situation depend on the interaction among the influences with a primary emphasis on social cognitive factors. The framework states that people learn from a variety of experiences. In many cases, this is from the observation of the actions of others. [9]

This explanation of learning does not require that a person's actions be dependent upon an individual's knowledge in the early stages of the learning about an action or entity. This robust learning theory has been applied to a variety of different learning environments that vary from gender development to career preferences. One specific area concerns gender development and the mechanisms governing the motivation and regulation of gender-linked behavior. Social cognitive theory postulates that gender-linked knowledge emerges from children's social and observational experiences. As children develop stronger gender-linked preferences, their knowledge of the various attributes linked to gender increases. This is but one of the many factors that influence their development including proximal social influences of parents, teachers, and peers as well as the mass media and cultural institutions. [5][2]

The theory postulates that initially, behavior is self-regulated on the basis of anticipatory outcomes mediated by the social environment. However, as children develop, their personal standards relating to gender-linked conduct are based upon increasing experiences, social knowledge, and cognitive development. Eventually, their conduct is motivated and regulated primarily by the exercise of self-reactive influence. In summary, during the course of development, the regulation of behavior shifts from the predominantly external stimulus and sanctions to a gradual substitution of internal mandates rooted in personal standards according to social cognitive theory. [2]

In a similar fashion, the theory and its concepts have been used to explain entrepreneurial career preferences through an assessment of the effects of observational learning vis-a-vis perceived parental entrepreneurial role model performance. The theory appears to be a viable conceptual framework for developing theories of entrepreneurial career selection. Research has demonstrated that individual's with parent entrepreneurial role models perceived to be a high performer were significantly different from individuals with an entrepreneurial role model perceived to be a low performer, and from individuals without a role model. [24]

Self-efficacy

Self-efficacy also serves an important function in this theory of learning. Research indicates that self-efficacy beliefs affect thinking patterns that may be both helpful and hindering. In general, the stronger the perceived self-efficacy, the higher the goals individuals may set for themselves and the firmer the commitment to the goals. [2] Social cognitive theory incorporates this concept by placing cognitive, vicarious, self-reflective, and self-regulatory processes in a central position when assessing the importance of human agency. The theory offered is one of emergent interactive agency. [2] Persons make causal contributions to their own motivation and action within a system of triadic reciprocal causation. Action, cognitive, affective, personal factors, and environmental events all operate as interacting determinants of human action. Self-generated influences may therefore be seen as a contributing factor.

The ways that self-efficacy functions are very broad. Thoughts may influence the way people predict the occurrence of events and create the means for exercising control over events that affect people's lives. Individuals perceive predictive rules that may require processing of multidimensional information that contain ambiguities and uncertainties. When developing predictive rules it requires a strong sense of self efficacy to maintain a task orientation in the face of demonstrated errors in judgement.

Individuals may draw on their general knowledge to generate hypotheses, develop weights, and integrate these data into complex rules, test judgements, remember what works, and what doesn't.

In addition, peoples' perceptions of efficacy influence the types of anticipatory scenarios constructed. Those with a high
Relating Learning Theory to Educational Goals

A concern for the design of educational experiences is how to explore the alternative ways to best influence the student while utilizing the GSS and developing an effective curricula.

Primary goals of the experience are to use the GSS technology to:
1. Initially demonstrate the application of systems analysis (SA) methodology, and its major components for the students.
2. Demonstrate various SA modeling techniques.
3. Provide opportunities for feedback and questions that address special circumstances and applications.
4. Permit students to "experiment" and begin to internalize the application of SA and its components.

Adapted from Flora & Thoresen [9] are examples of theoretical components (cognitive/affective, behavioral, environmental) which can be directly mapped to the different educational goals that can be found in the desired MIS educational experience. A typical class module (such as one for systems analysis) will contain all of these educational goals.

Cognitive - knowledge training and perception of systems analysis processes (goal 1 & 2).
Behavioral - Learning how to apply systems analysis techniques during a data collection effort (goal 1 & 4).
Environmental - Discussing with co-workers how to introduce systems analysis methodologies into a project or organization that is facing time pressures (goal 3 & 4).

The hoped for class outcome is to have students internalize the use of SA. In this fashion, the social cognitive theory appears to have a potential explanatory capability for a curricula that would attempt to achieve the MIS learning goals. This application of social cognitive theory to a MIS classroom module appears to approximate mastery modeling, a technique used with success to develop intellectual, social, and behavioral competencies. [29] The method may include three elements: modeling approximate skills to convey basic competencies in applying rules and strategies to deal with specific situations; providing opportunity and guidance in testing the use of the skills in simulated situations (role playing) with corrective feedback; a transfer program which has participants try the skills on the job in situations where good results may be expected. [29] The MIS experience incorporates the first two elements, but does not enable the students to practice in a work environment. It attempts to approximate this by providing them with data drawn from real world problems and organizations which they may review and incorporate in their own work.

Setting Classroom Learning Objectives

This approach seeks to assist students in developing a clear understanding of the background and thinking involved in systems analysis methodology, its components, and the appropriate application of the methodology to the analysis and design of MIS systems. This will be accomplished by presenting the application of components of the analysis and design methodology to students. Students will then complete specific complex structured methodology tasks and specific types of group work, and hopefully "learn" when and how to apply the components of the methodology that are successful. A secondary educational objective is to help students understand the relationship between GSSs and the application of these tools in an MIS environment. Students will be indirectly experiencing how the GSS technology and systems function, and how environmental characteristics may interact with the GSS tasks and systems methodology to produce different task/group outcomes.

Understanding when and how to use the GSS is an important issue. The GSS literature documents many potential "benefits" for a task from the use of the GSS if the situation is appropriate. These benefits have been divided into several components (1) process support, (2) process structure, (3) task structure, and (4) task support. [20] It is important to incorporate this detailed view of GSS impacts into student study materials to assist the students in "sorting out" the confusing GSS research and understanding how applying information sharing and communication support technologies may potentially impact the outcomes of group efforts. This secondary educational objective is to help students analyze highly complex MIS situations, and identify significant variables that may suggest that the GSS will (or won't) be helpful, and when it should or should not be used.

The GSS literature indicates that it is important to rely upon explanations of the complex group processes and behaviors at very low levels of detail. Some aspects of the meeting processes which utilize a GSS improve outcomes (process gains), whereas others impair outcomes (process losses) relative to the efforts of the same individuals working by themselves or those of groups that do not utilize the GSSs. [12] [28] It is possible to say that the group outcomes are dependent upon the final contributions of these individual gains and losses. [6] The point to be made to a class is that situational characteristics (i.e., group, task, and context) establish an initial balance, which the group may alter by using a GSS. [21]

How the GSS Is Applied to the SA Tasks

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The GSS was applied in a two phase process. The first phase assessed basic steps of SA that were applicable to the MIS problem to construct detailed task experiences. The second phase used the task experiences to construct a prototype systems analysis project.

The goal of developing the building block tasks was to improve the management and communication of task related information. The literature indicates that the activities that must be performed during a task such as "define a topic" or "generate an idea" have an impact upon the positive and the negative outcomes that result for a group. [26] Therefore, one can examine the primary goal of most group activities such as the exchange of information among members [8], and conclude that the form of this information will have significant effects on the performance of the group. Zack and McKenney [30] identified three conditions which describe the task related states of information that may be encountered by the manager or MIS student. [7] They are:

- **Ambiguity**: lack of information and a lack of frame-work for interpreting that information.
- **Uncertainty**: lack of information, but a framework exists for interpretation when the information is available.
- **Equivoicality**: multiple interpretations for the information and/or the framework, and potential disagreement among the interpretations.

The tasks are constructed to help students analyze the requirements of a task to determine what the manager of a group must do to manage information flows under these varying states. Determining what a GSS supported group would need to do accomplish each task requires an understanding of the appropriate use of the various components of the tool.

For example, equivocality requires negotiation among group members to reach some form of group consensus or group understanding, and techniques which provide the capability for exchanges of greater and more detailed information are preferred. [6] Ambiguity and uncertainty require that a group member (or the entire group) find the additional needed information and the interpretative structure or context. A tool would be useful if it enabled the group to rapidly collect the data and develop some structure which enables the group to "understand" and use the information. The capability would be more important if members of the group supply different data, hold varying views, and develop divergent concepts about the meaning of the data.

The laboratory and field research conducted by the researchers at the University of Arizona (and replicated by others) provides some support for this general set of hypotheses regarding the impact of task uncertainty. Laboratory experiments of idea generation (a task used to reduce uncertainty), found that an interactive style was more satisfying and generated more ideas than verbally interacting groups. ([11] cited in [14]) Similar results have been achieved with groups in field studies which used interactive styles to generate ideas, options, and analysis perspectives but used a supporting or group assisted approach to address states of equivocality. [21: 142]

**Incorporate SA Methodology Components**

This second section focuses on clearly linking the pedagogical elements (of the SA methodology and task uncertainty) to the tasks that appear in MIS class situations. There are many portions of the SA methodology where the management of information (in varying states) is important. Students may observe this importance during:

1. **Support to enable a group to sort or complete the categorization of a groups ideas, and clarify underlying concepts, assumptions, or understandings related to the ideas.**
2. **Support for identification of problem causes and consequences by listing, and analysis by sorting and categorizing.**
3. **Support to enable a group to generate, fully describe, and synthesize a course of action or an alternative; and to generate probable impacts of the action or alternative.**
4. **Support to enable a group to sort or complete the categorization of a groups ideas, and clarify underlying concepts, assumptions, or understandings related to the ideas.**
5. **Support to construct statements of systems purposes and objectives for systems, processes, modules, and functions.**

These activities were assembled, sequenced, and specifically tailored to represent the steps in a structured exercise that incorporate the use of the GSS in the classroom. This was accomplished by first addressing the concept/exploration of an idea, and then reviewing issues related to ambiguity or uncertainty in contrast to those of equivocality. One may ask, on which tasks do the group (MIS class) members work on divergent activities, and therefore work individually. In contrast, tasks that require organizing and sorting ideas, achieving agreement on a specific grouping of the ideas, setting up some systems of categories, or understanding the meaning in the data to achieve agreement are primarily tasks of equivocality. Under these conditions, the group (MIS class) will concentrate on the same concepts and data at the same time to come to some uniform agreement or determine the sources of differing opinions.

**Classroom Experimentation**

During the Winter/Spring of 1993 the exercise was used in MIS instruction in classroom situations (an introductory course that provided graduate students with an overview of MIS, a systems theory and project management course, and a course covering systems analysis and design and the use of Computer Assisted Software Engineering (CASE) tools). The course setting were all at the graduate level with student enrollments varying from 8 to 20 students. The Introductory
MIS course presented students with SA and related decisions making and problem solving theories for the first time. Students in the other two courses had been exposed to SA, and were expected to apply it during discussions and exercises.

The systems analysis methodology and concepts assist the MIS student in developing an understanding of organizations as complex systems, composed of flows of data, processing activities, and interrelated business activities which can be analyzed using a specific methodology. Students:

- Analyze and document the problems and business activities of specific organizations with environmental constraints in terms that can be used to develop sophisticated information systems to assist in solving problems.
- Analyze and select system development approaches and methodologies that "fit" organizations and business problems that may be addressed or solved by information systems.
- Recognize and describe: objects and elements that may be portions of the logical and physical (essential and implementation) aspects of information systems designs; and design database structures.
- Complete definitions of data elements and attributes, model data flows, and model data structures.
- Develop an ability to plan, and conduct systems analysis and design projects, understand project management, project risks and coping strategies, and develop models for use in information systems.

Systems analysis is closely related to the four phases that managers go through in solving a problem (intelligence, design, choice, review) [25: 46]. The systems approach presented to the students contained ten steps grouped into three phases of preparation, definition, and solution. [19] Detailed procedures for the analysis of the standards, outputs, management, inputs, information processor, and transformation processes occurs during step five in McLeod's presentation.

**The GSS Experience: Applying Systems Analysis**

Students were presented with a packet of information that described a company's information systems and major business areas (in advance of the class). Students were required to review the system analysis related materials and the company background materials prior to the class. The MIS students then participated in a two hour class exercise using a GSS. The exercise encompasses seven instructions that incorporate the GSS technology (tool abbreviation - EB: Electronic Brainstorming; TC: Topic Commenter; CA: Categorizer; AE: Alternative Evaluator). The systems analysis exercise is presented in chart form below.

<table>
<thead>
<tr>
<th>Step</th>
<th>Question</th>
<th>Tool</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Develop project definition and scope, major problems to be solved, etc.</td>
<td>TC</td>
<td>Visualize the organization's future and assess its environment, technologies, applications requirements</td>
</tr>
<tr>
<td>2</td>
<td>Generate ideas on conversion risks/benefits to the organization, jobs, and departments</td>
<td>EB</td>
<td>Generate ideas and apply/assess the impacts of the environment, technologies on topics.</td>
</tr>
<tr>
<td>3</td>
<td>Sort and group ideas (from step 2 above)</td>
<td>CA</td>
<td>Define, consolidate, reorganize ideas to clarify risks and benefits.</td>
</tr>
<tr>
<td>4</td>
<td>Assess benefits and risks and the importance of the risks and benefits.</td>
<td>AE</td>
<td>Determine the Business Clients, IS Dept., and top Mgt importance for each risks and benefits</td>
</tr>
<tr>
<td>5</td>
<td>Define the alternatives or strategy to be taken (for the conversion)</td>
<td>TC</td>
<td>Describe a major strategy that could be used to implement the conversion</td>
</tr>
<tr>
<td>6</td>
<td>Develop the criteria to assess the success of the project</td>
<td>TC/CA</td>
<td>Review benefits and risks, and define criteria to evaluate the approaches</td>
</tr>
<tr>
<td>7</td>
<td>Rank the alternatives according to the criteria</td>
<td>AE</td>
<td>Rank the conversion strategies against the criteria</td>
</tr>
</tbody>
</table>

*At this point in the class exercise, students revised real world data collected during a previous GSS session by adding their own thoughts and ideas to the real world data.*
Results and Findings

The exercise appeared to result in a learning that is was predicted/appropriate given the theory of learning discussed in this paper. Open ended class surveys were used to collect student comments on the GSS exercise, and on the application of systems analysis methodology. Feedback on the systems analysis methodology components was very positive. Students reported that they could see how to use the methodology to define a problem, analyze the environment, collect data, and generate alternatives. The key question is did the students actually internalize the SA methodology and improve their performance, or were they simply attempting to please the instructor with positive statements? The exercise did not collect data which could be used to clearly answer this important question. (Students did very well on their answers to an essay question on an examination which required use of the SA methodology. However, comparative data from previous classes and examinations was not available.)

Students also indicated that they could see how to use the GSS tool to decompose the problem, plan meetings/sessions, and apply many of the GSS components to collect data or reach agreements that facilitate group work. They reported that the GSS tools which collected divergent ideas would be used where they did not possess enough data or understanding of a problem. Students commented that this experiment did not really seem to be an "exercise". The use of the GSS appeared to resemble the application of a systems meeting and communication support tool to a real world problem. Students reported that system appeared useful (and powerful using the student's term) when task information required by the group is not clear or complete. Additional support was receive for the SA methodology during another class meeting. One group of students (in the project management class) rejected the use the GSS tool for the analysis of a client server/mainframe system comparison exercise because there was general and unanimous agreement regarding the answer to the problem by the members of the class. They verbally observed that the technology would not be efficient/effective when it is too much work to set up (and plan for a brief meeting), or when general agreement exists about the solution, information is already available, and definitions are clear and well understood.

Conclusions

In general, the GSS tool appears to have strong and practical classroom value. The effects experienced in the classroom exercise appeared to be consistent with the framework of a social cognitive learning theory explanation. However, this experiment, like many others leaves many key questions about the uses of the GSS and the learning which occurs to be explored. First, it is important to obtain structured, reliable, and validated data on the outcomes of GSS educational experiences to answer several questions.

1. Can objective measures of the impact of the GSS be shown to simultaneously improve MIS classroom systems analysis learning and performance when compared to traditional teaching methods?
2. At what level can the researcher obtain measurement data to assess the impact of a GSS on the class learning experience? Should you prepare experiments and tests at the task level, develop a survey (or objective test) for each exercise and class assignment, or attempt to collect aggregate data to assess the learning achieved at the module or course level for an entire group of students?

Secondly, it may be important to assess how similar work may enable the application of the GSS to be extended to other course/content environments. Many other fields have existing rule-bases similar to the steps and procedures in SA in the form of regulations and rules or laws. The standards, and formats may even be more important than the content. Some problems can be solved by executing checklists, while other must be analyzed, modeled, and understood. For example, teaching in the arts might not lend itself to a requirement for understanding of rules and procedures, where engineering principles might be taught successfully using this methodology.

Thirdly, it may be important to determine if a portion of the analysis should be focused on the identification of students who can really be helped with this technology, as well as those who may not find it useful. Frayne and Laytham [10] use social cognitive learning theory to explain why specialized techniques (training persons to come to work) may be effective for some students and not for others. It was noted that high outcome expectancies alone are not effective (in supporting coming to work behavior) if the employees judge themselves to be ineffective in overcoming their personal and social obstacles in coming to work. Therefore, it may be useful to concentrate on understanding how to structure experiences that positively support students assessment of their self efficacy at achieving the learning goal or experience. Prior preparation in following a systematic analysis method, and belief in one's problem solving capability could be expected to be moderators of the success of the GSS in the exercise described in this paper. It is relatively easy to hypothesize additional success moderators such as acceptance of the electronic tools and experience with computers.

Selective success findings for different student populations could lead to the development of courses or learning experiences (based upon social cognitive learning theory) associated with social marketing. [16] [9] The major focus of such programs would be on understanding the perspectives of the information systems students and ascertaining how they differ in attitudes, values, and behavior with respect to their
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use of the systems analysis approach. The social marketing concept would be used to carefully tailor programs to different target student populations (e.g., no experience in the field, managers with ten years of experience, programmers, functional experts). This work could be combined with the application of specialized electronic tools to develop a library of experiences/exercises to address the specific needs of a special student populations. The most important advantage of this type of research approach would be to include the students as active participants (valued consumers according to Flora & Thoresen[6]) who must view their educational experience as valuable and socially desirable.

Finally, the research perspective adopted must strive to resolve any uncertainty regarding the "objective" purposes of GSSs and the possible conflicts of interest from the research community that is assessing their impacts upon organizations and individuals. Unfortunately, confusion can be created in the mind of the user (or student) by a situation that appears to have researchers and teachers in the field concurrently "constructing", "selling", "researching" and "explaining" a variety of GSS functions applicable to many different environmental settings.

MIS Implications for GSS Technology

MIS programs broadly address the management, design, and development of information systems. Unfortunately, the uses of a GSS are specialized, and simply not well integrated into texts dealing with systems analysis, software engineering, design, and development. (See for example [17][22][23][25]) The topics which must be covered (at the task level) are typically included in introductory MIS texts. Students receive limited exposure to the operation and application of these GSSs. When the students reach the more advanced courses, the methodologies and instructional media are "assumed" to be known. The MIS students who might employ the technology are not typically trained in the use of the tools, adequately prepared to design work or tasks using the tools, or trained to recognize the possible conditions where positive communication and work group support benefits could be derived from the use of this technology. It would seem that these gaps in student preparation are not equipping the MIS graduates for tasks in organizations that are increasingly dependent upon networks, E-mail systems, collaborative and team work, and requirements for the integration of information and ideas from diverse organizational work settings.

One potential direction for GSS product development associated with MIS might be productive given this experience with the SA classroom exercise and trials. The process of developing materials with "real problems" adapted to classroom usage (and refining the exercises through critical student review) may support some additional GSS product specialization, commercialization, and tailoring directed toward the MIS (or some other) student environment. Product improvements or training/methods enhancements such as structured exercises or prototype problems (working scenarios with questions and data) could be effective additions to GSS tools, and might relieve the instructor of extensive materials development and preparation tasks. The work could also incorporate organization specific exercises as "drivers" of the topics addressed in the classroom setting. For example, one could use the GSS when analysis and requirements collection activities are required, and tailor the case situation and scenarios to provide examples of database development. In either case the producers of the GSSs might package and provide the data needed to load questions and concepts into a GSS with the system. This could expand the application's ability to train and educate MIS students in how and when to use these tools in the work environment.

Reference List


