# Computerized tutor support systems: the tutor’s role, need and tasks.

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## ABSTRACT

This paper identifies where software can support the tutor running computerized business simulations and so improve tutoring efficiency, effectiveness and consistency.

Traditionally, computerization has focused on the simulation model and, by eliminating manual calculation, this has improved tutoring efficiency. However, modern microcomputers allow the role of the microcomputer to be extended to provide timely and pertinent information that not only supports the tutor administratively but also facilitates and helps the management of learning.

Taking a ‘systems approach’, this paper starts from a discussion of the tutor’s role, needs and tasks. This discussion serves to suggest areas where software can support the tutor and based on this an architecture for a Tutor Support System (TSS) is described and discussed.

## ADMINISTRATOR, FACILITATOR OR MANAGER?

Rollier (1992) proposes that ‘facilitator’ is the most appropriate term to apply to the tutor’s role since he feels ‘administrator’ is too limiting and ‘instructor’ implies controlling and directing the learning process (teaching). In this context he suggests that the ‘facilitator’ should stay ‘in the background as much as possible’. Jones (1991) takes a more extreme view, suggesting that ‘contamination occurs when a teacher treats the event as a guided exercise and encroaches on the role autonomy of the participants’.

Undoubtedly, the simulation tutor’s role differs from that of the teacher in the lecture room. Although participants have to be free to make decisions and make mistakes, the tutor still must ensure that each participant learns. This is particularly important on executive short courses for otherwise the participants will view the session as a waste of their (valuable) time.

Hall (1977) describes the directing staff’s (tutor’s) tasks under the heading ‘exercise management’. In this context the student-centred nature of simulation can be discussed in terms of delegation where the tutor delegates the authority and responsibility of learning to the participants. However, in the context of managerial delegation, this does not mean that the manager (or here, the tutor) totally relinquishes managerial authority or responsibility (Durham and Pierce, 1989). The tutor is, still, ultimately responsible for ensuring that learning takes place and tutoring is a management process that is enhanced through an appropriate computerized Tutor Support System (TSS).

Although suggesting that the tutor should be viewed as a ‘manager’ of learning, it is reasonable to propose that this role involves:

- **administration,**
- **facilitation, and**
- **management**

### The administration task

The administration covers decision entry, making calculations, producing results and record keeping (for the end review and debriefing session).

For computer-based simulations the calculation task has been largely eliminated with the tutor reduced to machine minding (typing decisions, initiating the simulation, requesting reports, feeding and nurturing the printer). Generally, decision entry is still done by the tutor but this need is lessening, due to the availability of direct access games (Elgood, 1993), computer networks and Decision Support Systems (DSSs). Direct access games involve teams using their own computer with a stand-alone simulation. Networks allow teams to enter their own decisions to be extracted on disc for entry into the tutor's computer. Printers, with their inclination to jam, still present a problem. Record keeping is still necessary to ensure that the tutor is provided with information for the review sessions – experience suggests that one cannot rely on the teams keeping adequate, unbiased records for this purpose.

**The facilitation task**

Facilitation involves ensuring teams have the necessary materials and information to proceed with learning. It relies on the teams requesting support and therefore is a passive, reactive activity that does not interfere with the participants' autonomy. Information requests can be classified as follows:

- **rule clarification,**
- **simulation support, and**
- **knowledge support**

***Rule Clarification:*** Elgood (1993) discusses this as follows:

> *"The imaginary nature of a game or simulation always leaves scope for genuine misunderstanding about what the rules mean, where the game boundaries lie, and how the various figures are made up."*

Consequentially, the tutor must be on the look out for these misunderstandings and be able to correct them. If this is not done then participants will become demotivated and treat the simulation as a 'game'. Generally, the need for rule clarification occurs on decision entry.

***Simulation Support:*** Although simulations are simplifications of the real world it is not reasonable or possible to provide totally comprehensive documentation, spoken briefing or computer printouts, especially since, for written documentation, experience suggests that these are not read. If the computer reports are too long then 'information overload' will occur. For the spoken brief, Greenblat and Duke (1981) suggest:

> *"Keep the introduction short! As questions arise later, you will be able to deal with them. Covering all points at the beginning is a poor idea, for players will forget those not seen as relevant because the questions have not yet arisen."*

Thus, as the simulation proceeds there will be *ad hoc* needs to explain the results and clarify the simulation. It is a major help if additional information is provided by the TSS to allow the tutor to answer routine questions quickly and completely.

***Knowledge Support:*** Besides supplying additional information explaining results, there may be a need to provide business 'knowledge' to stimulate thought. Keys and Leftwich (1985) address this problem by providing, in the participant's manual, readings on business policy and strategy. However, there is the risk that participants will not read such material or that it is insufficiently comprehensive to cover all knowledge needs. So the tutor will be required to discuss relevant management issues in a team's syndicate room. The purpose of knowledge support is to fill gaps in participants' knowledge rather than reprise the complete course and experiences, thus it is a focused task that differs from team to team and course to course. It demands the tutor either having suitable knowledge or access to it.

**The facilitation task**

As described at the start of this paper, I suggest that the role of the tutor is to manage learning. This involves a need to proactively determine barriers to learning, supplying guidance and support and thus ensuring learning objectives are met. This requires the tutor to:

- **manage the learning process, and**
- **continuously assess learning**

in a way that does not usurp the participants' authority but, rather, encourages learning.

***Managing the learning process:*** The management of the learning process (Figure 1) involves the tutor analysing the current situation, diagnosing learning problems and, if necessary, providing additional feedback to participants (Hall and Cox, 1993).

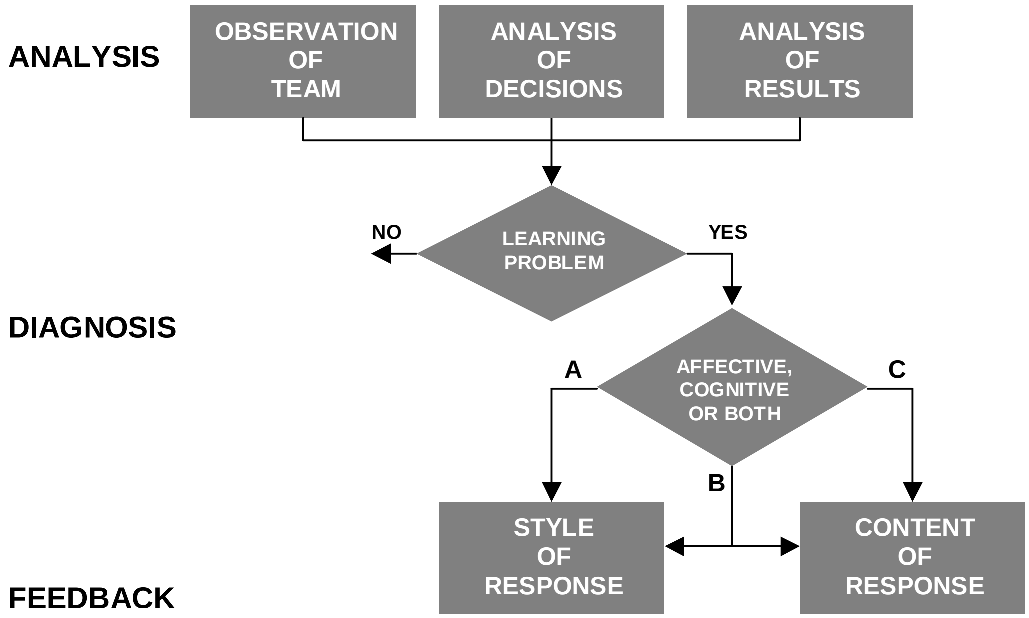


Figure 1: The Learning Management Process

Ideally, the tutor will gather information by observing teams, precautionally scanning decisions and evaluating results. Based on this, an attempt will be made to decide whether there are learning problems. If these exist it is necessary to decide whether the problem is cognitive (a lack of knowledge or experience) or affective (a motivational, team-working problem) or both. Based on this the tutor must choose the style of the response and its content.

The problem facing the tutor is that of resources. It is not unusual for a single tutor to manage as many as six teams of six or more participants, each located in separate syndicate rooms which may be spread across a hotel or training center. Further, the need for learning efficiency means that there is continuous pressure to minimize simulation duration. Burgess (1990) states:

> *"Quite often operators of simulation games are caught up with the sheer mechanics of operating the simulation; these games typically operate on hourly cycles. The operators do not have time to consider deeply the player performance and the quality of the decisions made."*

Consequentially, the tutor does not have time to do all the tasks necessary to ensure learning effectiveness nor adequately concentrate on tutoring the weaker teams. Thus it is necessary to transfer routine work to the TSS, leaving the tutor free to concentrate on 'managing learning'.

***Assessing learning:*** Undoubtedly the choice and use of any andragogic or pedagogic device or method should be based on the need to fulfil defined learning objectives. However, the student-centred nature of simulations presents particular problems. Participant's freedom of action means that the pattern of progress and specific issues explored can, and often do, vary between runs of the same simulation. As discussed above in 'Knowledge support', the situation is further complicated by participants having different background knowledge and experience.

Yet despite this and the fact that measuring learning is, at best, a nebulous task, it must be done continually so that corrective action can be taken. Elgood (1993) suggests 'Interventions part-way through a game can have a dramatic effect on learning (and upon motivation)' However the delegation of learning authority to participants means that intervention must be minimized and only occur when absolutely necessary.

Thus part of the tutor's task is assessing learning and deciding when it is necessary to take action. Two indicators of learning are:

- **'business success', and**
- **reducing 'mistakes'**

***Business success:*** Although it is beyond the scope of this paper to discuss 'business success', its measurement by the tutor is important for two reasons.

First, it is reasonable to suggest that as a group learns it will run a more successful business (otherwise what would be the purpose of management education?) Consequentially, it is argued that learning correlates with business success and that by assessing business success one can judge learning.

Second, although 'learning' is the key (cognitive) objective, generally there is an affective need for competitive success. Lundy (1984) discusses competition and its undesirable affective effects. However, she does not differentiate between competition in terms of 'winning' the game and competition in terms of a natural and necessary real-world strategic activity. For strategy-level simulations, the competition between teams is vital. Smith and Walsh (1978) while discussing business strategy in general, state 'competition is so critically important in the determination of strategies that we have taken the liberty of listing it as a separate element and discussing it first.

However, this is not meant to discount the demotivating and counterproductive impact of 'losing'. It is argued that only by measuring business success can the tutor predict possible motivational problems and take appropriate actions.

In the real world it is the purpose of managers to be more successful than their competitors, so the results of successful companies will diverge from those of of unsuccessful ones. However, for simulations, divergence will cause motivational problems and suggest learning differences and difficulties. This suggests that simulations should be convergent (Figure 2).

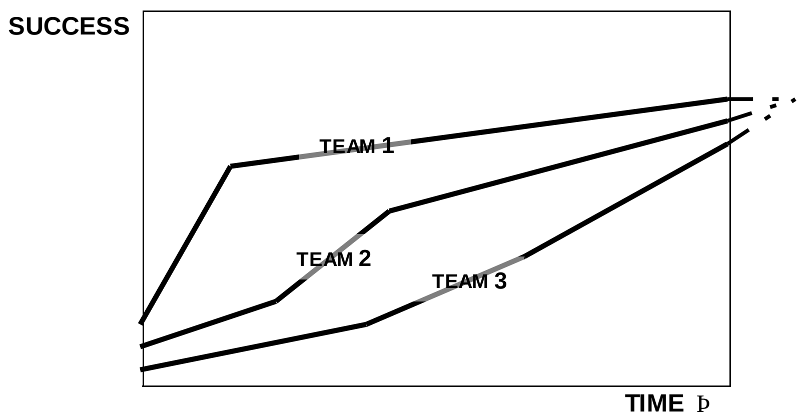


Figure 2: Success convergence

Convergence suggests that teams are reaching similar levels of (cognitive) learning. Further, teams will perceive equality in terms of competitive success and therefore convergence ensures affection.

*'Dans ce meillure des mondes possibles'* (Voltair); the design of the simulation should facilitate convergence. However, in practice it is necessary for the tutor to take actions to ensure convergence, although it is not necessary for this convergence to occur during the simulation provided participants perceive that convergence will, eventually, occur. Therefore the TSS should not only measure success but provide facilities to support convergence.

***Reducing 'mistakes':*** Besides measuring success there is the possibility of measuring failure – the propensity for teams to make 'mistakes'. These mistakes can be measured in terms of costs or lost profit. The simulation GLOBAL OPERATIONS measures lost profit so, for instance, if a team mismatches demand and production capacity this either leads to lost sales (and profit) or idle plant (and unrecovered overheads).

A tutor experienced with a particular simulation is often able to scan a team's decisions and predict problems. The experienced tutor will assess relative business strengths and weaknesses from team results. Inexperience and time pressures mean that the identification of 'mistakes' is often not possible. The TSS should provide a means of measuring and tracking 'mistakes'.

## THE TUTOR SUPPORT SYSTEM

There is a need, therefore, for a software-based tutor support system that provides:

- **audit reports,**
- **commentaries,**
- **decision screening, and**
- **success measurement**

### Audit Reports

At the most basic level, the TSS provides reports to explain how team results were arrived at. These 'audit reports' help the tutor answer team questions and therefore facilitate simulation support. For example, TEAMSKILL (a complex production management game) was run as a national contest in 1978. This involved over 100 teams with wide-ranging production knowledge, experience and skills who submitted decisions and received results by the post over several months. To support teams and ensure learning, a telephone help line was provided. For this to be viable, besides normal team results, an audit report detailed the operation of the factory, why production targets were not met, why machines broke down, why set-ups were late etc. Consequentially, it was usually possible to answer questions immediately without the tutor having to spend time re-analysing the problem, re-running the model or performing additional, *ad hoc*, calculations. This not only saved time tutoring time but the rapid authoritative response increased the participants' trust in the learning experience.

### Commentaries

Commentaries take the approach forward. Audit reports are, largely, passive. They are designed to support response to team-initiated questions. However, they can be used more proactively. Here, the tutor uses the audit report to identify team learning needs and problems. Based on this diagnosis the tutor, without being asked, discusses the matter with teams. For instance, in TEAMSKILL, if production targets were regularly missed because of stock shortages, the tutor might discuss inventory management and budgeting with the team. This proactive use suggests a second TSS processing need. Here data from team results and the model are refined further.

For instance, INTEX (an FMCG SBU strategy-level simulation) produces, for the tutor, a series of reports that treat each market sector as a profit centre. One report shows whether a sector made a profit or a loss and a second provides information on profit and contribution margins and promotion as a percentage of sales income. Not only does this allow individual sectors to be assessed but also, by comparing factors, it is possible to assess whether strategy is consistent between sectors. These commentaries involve further processing of team data. Use, by the tutor, is to diagnose problems, to provide feedback and to provide a basis for the simulation review. Feedback is in two stages. First, the appropriate report is supplied to teams without comment to stimulate thought about markets and to encourage analysis. Later, if necessary, a general discussion on profit margins and promotional strategy is initiated to encourage teams to look at these issues.

### Decision screening

Decision entry is a key point in the decision-making cycle with conflicting tutoring needs. Teams await the results of their decisions with anticipation and therefore rapid input and turn-around is vital. However, it there is a misunderstanding of the rules or poor management thinking, a ‘bad’ decision may be entered and processed (with catastrophic results). Even if this does not demand re-running it will be disruptive and demotivating.

Decision screening is necessary and, in terms of basic data processing theory (Hall, 1979), is well established. Yet, as late as 1990, in a critique of software it was stated that ‘There are many improvements that should be made to these input programs’ (Teach, 1990).

Besides character checking (to protect against typing errors), range checks serve to define the range of permissible values. Yeo (1991) suggests a single permissible band. However, A MANAGEMENT EXPERIENCE draws on statistical quality control theory (Grant, 1952) with two levels of range checks. The wider ranges defines permissible entries and serves to protect the simulation model from extreme entries (such as negative prices) while not constraining decision-making freedom. The narrower, warning limits are advisory. They suggest to the tutor that a problem may exist that should be investigated, and where action may be necessary.

Beyond this basic data verification, there is the facility to check against the database (Hall, 1979). In A MANAGEMENT EXPERIENCE, the decision screening software includes a ‘sophistry screen’ that looks for conflicts between decisions, historical trends, team assumptions and their objectives. This software traps sophistic decisions where, for example, prices are raised, promotion cut while there is over-capacity and, long term, sales demand is falling.

Besides helping simulations where the tutor enters decisions, decision screening becomes essential where the simulation is network-based or direct access.

**Success measurement**

Success measurement attempts to measure and predict cognitive (learning) and affective (motivational) problems. Its purpose is to provide the tutor with information about trends in relative business success and the incidence of poor decision-making (mistakes). Its use is *not* to ‘choose a winner’ and, arguably, teams should never know that it is occurring. Because of this it is, perhaps, immaterial which measure or measures of business success are used. Further, since it is usual for teams to start from the same position, running businesses in the same market, with the same financial structure, there tends to be a correlation between different measures.

Besides providing a measure of total business success (such as ROI, earnings or market share) there are opportunities to output from the commentaries and decision screening to measure weakness. Thus, A MANGEMENT EXPERIENCE not only measures profits lost due to lack of business efficiency but also the incidence of weaknesses and sophistic decisions.

Because of the need for team results to converge, the measurement of team success must not just involve measuring on a period-by-period basis but also the projection of trends and the identification of teams whose performance is either extremely bad or extremely good.

## A PRACTICAL EXAMPLE

Although TSSs have been evolving over several years it is only comparatively recently that large, powerful microcomputers have become commonly available. This availability provides the impetus to add a comprehensive TSS to an existing, established, business simulation.

A MANAGEMENT EXPERIENCE was originally developed in 1976 to run on the GEISCO computer time-sharing service. In the early 1980s the initial FORTRAN version was rewritten in BASIC for Tandy III microcomputers and subsequently transferred to IBM-compatible microcomputers. In this form the program consisted of 833 statements and of these 209 statements were the core simulation model (with the rest for decision entry, report printing and file handling). In 1992 this version was updated to include a comprehensive TSS and has been run regularly since. This update did not change the core simulation model and basic I/O. Commentaries and success measurement were added and audit reporting and decision screening were very extensively expanded. The extent of the software expansion is illustrated by the size of the new version that consists of over 3000 statements. This represents a nearly fourfold increase in size. However, since the TSS is driven by the simulation model it is more meaningful to compare the TSS code with the core simulation model. For every statement in the core model the TSS requires ten statements.

Runs of the new simulation on courses and discussions with experienced simulation users suggest that the TSS provides significant help. But, since the investigation has been on an informal basis and the simulation has not been used by inexperienced tutors, there is still a concern that the additional data provided to the tutor may be overwhelming.

## CONCLUSIONS

In encapsulating the tutor’s routine job in software, the TSS ensures that business simulations are used more effectively, efficiently and consistently. More time can be spent by the tutor on strategic learning issues. The TSS serves to reveal more of the simulation model and its dynamic response to the tutor. For the experienced tutor this provides opportunities to enrich the learning experience. For the less experienced tutor the TSS provides the facility to answer questions authoritatively. For new users of simulations or those new to a particular simulation, the additional information provided shortens the time required to become familiar with the simulation.

Philosophically, the TSS assumes that the tutor is and will remain a key catalyst for learning. Yet intelligent systems and distance learning may reduce or eventually eliminate this role.

Certainly. the TSS and the overhead that it adds to a simulation means that design is not a matter of concentrating on the simulation model but of building a complete learning ‘system’.

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