
The Challenge Of Implementing an
**Enterprise Learning
Management System –**
The Singapore Armed Forces' Experience

ABSTRACT

A serviceman's training forms the bedrock for the development of his competencies and skills. Embracing emerging technologies in the educational sphere aids the Singapore Armed Forces (SAF) to train its personnel better, more safely and efficiently. Pedagogies for adult learning are also introduced into teaching methodology and infused into the design of the classroom.

The SAF has moved from A-frames and flip charts to Computer-Based Training, from classrooms to boundary-less training, and from being teacher-centric to learner-centric. Riding on technologies like learning management systems and island-wide Internet connectivity, the SAF can truly conduct training anytime and anywhere!

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THE SINGAPORE ARMED FORCES' THIRD GENERATION LEARNING MANAGEMENT STRATEGIC THRUSTS

As the Singapore Armed Forces (SAF) transforms itself into a third generation force, educationists are under increasing pressure to close the gap between the knowledge and skills that trainees learn in school today, and the knowledge and skills required for their success in their future communities and workplace. In 2005, the SAF and DSTA jointly embarked on the Third Generation Learning Management (3GLM) journey. Leveraging technology, the transformation initiative encompassed four key thrusts (refer to Figure 1):

a. Schoolhouse as knowledge hubs. In the Third Generation SAF, major training institutions and schools will be repositioned as knowledge hubs to serve as knowledge and information sources for the organisation. With access to electronic repositories, the major training institutions and

schools will be able to validate, summarise and manage content and structured thought for re-use and ensure that such information is up to date. Information technology will help translate the SAF training institutions and schools into dynamic knowledge hubs. This will enhance access and reduce knowledge transfer latency.

b. Faculty empowerment programme. Fundamental to the success of the entire system is the availability of relevant and appropriately structured content that is created in-house. To avoid high outsourcing costs, SAF instructors will be equipped with a user-friendly content packaging tool and will be trained to author and publish content in the new environment. Through this programme, the SAF will adopt the Sharable Content Object Reference Model (SCORM) as the eLearning standard for the organisation. This strategic move would also allow the SAF to better collaborate and integrate with other institutions.

c. Leveraging technology. With advancements in technology, the SAF will be able to provide a common platform across the organisation to host, organise and share the learning content among schoolhouses.

The Learning Management

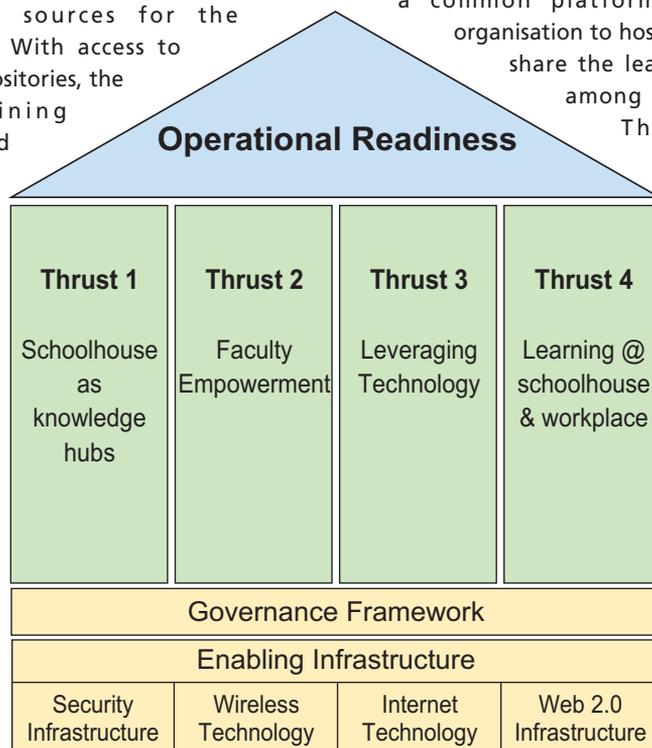


Figure 1 – The SAF's Third Generation Learning Management strategic thrusts

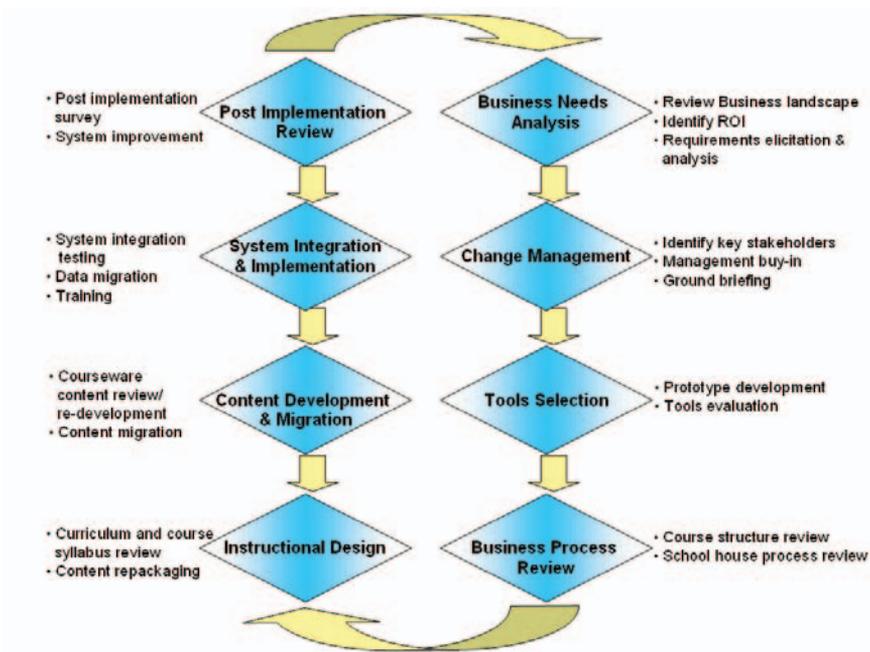


Figure 2 – The SAF's Learning Management implementation approach

System (LMS) will enable the intuitive harvesting of knowledge by learners, instructors and other knowledge workers through a taxonomy-based engine that will allow the systematic mining of contextual knowledge. The LMS will also enhance collaboration among learners, instructors and knowledge workers.

d. Learning @ schoolhouse and workplace. Upon graduation from schoolhouses, knowledge workers in the workplace will need to make frequent references to previously engaged learning content, in order to build upon their understanding. There is a need to reduce the latency between knowledge generated in the workplace and the parcelling of knowledge to audiences in the training institutions. In view of the anticipated immediacy of information and knowledge in the Third Generation SAF, training institutions will need to share the same information architecture as that of the workplace. Advancements in technology will help the SAF address this requirement.

This paper shares the SAF's experience, challenges and lessons learnt in our 3GLM journey, in particular the implementation of our enterprise LMS.

IMPLEMENTATION APPROACH

Our 3GLM transformation journey is a four-year implementation roadmap. Instead of a big-bang approach, selected schools were nominated to pioneer the experience of LMS application, and the redesign of curricula, work processes and course organisation. The following development and implementation phases were adopted (refer to Figure 2).

Business Needs Analysis

As the SAF transforms to a Third Generation force, training and education in the knowledge age have surfaced new requirements for learning, creativity and thinking. It was recognised that to maximise the time spent at training institutions and schools, the SAF has to optimise storage, access and delivery of learning content to meet individual and organisational learning needs. Our legacy eLearning application has reached its maximum shelf life and there is a need to re-invigorate the system to meet new business demands. LMS was identified as the platform to facilitate

the intuitive harvesting of knowledge by learners, instructors and other knowledge workers.

Identification of Return On Investment. As in all other projects, identifying Return On Investment for the project is a crucial step to solicit management buy-in and funding. Based on the study and results gathered from an LMS trial conducted at one of the advanced schools, the immediate and obvious tangible benefits of the LMS are a 20% reduction in course administration overheads and 25% cost savings from management of hard copy course content.

Learner Effectiveness. With the LMS, both SAF instructors and trainees would have continuous access to updated learning content anytime, anywhere (such as from the schoolhouse, workplace and home). The ability to pre-engage learning content before class and stay connected virtually would allow institutional time to be leveraged for instructor-student or student-student interactions and discussion. In terms of learner retention rates, the traditional methods of lectures and readings yield on average 10% retention. The use of audio-visual materials (through courseware), demonstration and group discussion will raise retention rate to 50%.

Change Management Plan

Stakeholder identification and support. It was recognised that simply buying software and training soldiers to use it would not work. Key stakeholders were identified well in advance, and a series of internal marketing plans with the senior management was established.

Consultative approach to gather ground requirements. Right after management's buy-in and support was solicited from the top, a consultative approach was adopted on the ground with the aim of instilling system ownership. The project team actively engaged representatives from the various military schools to understand and match their unique instructional environments. Each individual

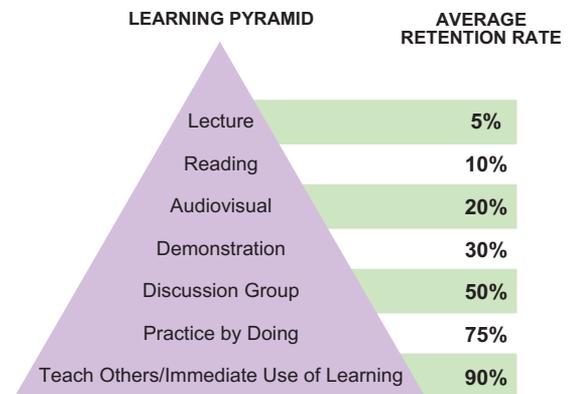


Figure 3 – The learning pyramid (Hofstetter, 2000)

school has unique business processes and requirements. Developing a system to satisfy all requirements would result in a highly complex system that may not be cost effective. A governance board was thus established to resolve inter-school challenges and make final decisions.

Acquisition of LMS Software

Prior to the funding approval process, the project team conducted a market survey. From the onset, we were aware that no single LMS product would be able to meet all the SAF schoolhouse requirements. The acquisition strategy is to procure a cost-effective solution that will meet most of the SAF's requirements, in particular the transformation to an eLearning methodology, with minimal customisation. This approach will meet the management's intent for speedy implementation and ease of maintenance and application support.

An open tender was released and industry players were invited to participate in the tender exercise via the Singapore Government Electronic Business System.

Evaluation process. For the purpose of LMS evaluation, an SAF Evaluation team co-chaired by Head Joint Training Branch and DSTA was established. Its members include key representatives from each of the schoolhouses. The following evaluation criteria framework was adopted (refer to Figure 4).

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	Criteria
LMS Features	User Experience, ease of use
	Course Structure
	Assignment Management
	Assessment/Quiz
	Collaboration
	Feedback Management
	Reporting
	Training Administration
	Search Functions
	System Administration
Systems Architecture	Aviation Industry Computer-Based Training Committee (AICC) and SCORM Compliant
	Able to support 128 SSL encryption
	Able to support 3-Tier architecture, ensure secured and scalable environment
	Platform (Operation system, database) independent
	Ease of configuration and customisation, support Open Scripting
Vendor Technical Competency	Implementation experience of systems integration team members, any large-scale (>10,000 users) implementation experience?
	Resource commitment. How many engineers have to be dedicated to this project? Over reliance on one or two people?
	How strong is the vendor's local customer service contact centre?
	Relationship between local systems integration and development team, back-to-back support between vendors
Product Strategy/ Market Presence	Installed base, how large is the vendor's installed base of customers for this product?
	Product roadmap. Sound product roadmap in the next two to three years?
	Technology partners. How strongly do the technology partners support this product?
	Revenue growth. How strong is the vendor's revenue? What is the vendor's year-over-year quarterly revenue growth?

Figure 4 – Evaluation criteria for enterprise LMS

After numerous rounds of product demonstration and testing, a Commercial-off-the-Shelf (COTS) solution provided by a local vendor was acquired. This solution has been able to meet most of our requirements with minimal customisation.

Business Process Review

Work process review. While the vendor configured and set up the system, the project team visited each schoolhouse to help review its course structure design and business processes. One of the uphill tasks was to convince and assist the schools to modify their business processes, instead of customising the LMS intensively. This process took much longer than originally planned, as most users were too comfortable with their old ways of doing things. As demonstrated in one of the schoolhouses, LMS brought along a series of changes and transformation to the school: the course syllabus was revamped, the printing office was down-sized, the training co-ordination department was re-organised and the instructors were tasked with new responsibilities. Without command emphasis from the school commander, these process changes would not have been possible.

Instructional Design

Instructional Design is the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. LMS equips instructors with a new set of tools like discussion forums, white board collaboration, instant polling and online quizzes. With these new functions, SAF instructors have to review current training methodologies and learning objectives and decide which tools and methods best meet the required learning outcomes. Once the instructional methodologies have been identified, the next step is to assemble the necessary instructional materials. The materials may be in various forms such as courseware, slides, documents, audio and audio-video materials. Although the necessary instructional materials may already exist, there is always a need to revise and integrate all

instructional elements. Our instructors were also sent to attend an instructional design course so as to equip them with new skills and a new thinking paradigm.

Content Development And Migration

Content upgrading of legacy courseware and faculty empowerment. Over the past 10 years, the SAF has accumulated more than 2,500 hours of courseware. Most of these legacy coursewares are not web-enabled and do not conform to any eLearning standard. In tandem with the LMS initiative, we also initiated the content re-purposing programme, whereby infocomm-literate Subject Matter Experts (instructors/faculty) were empowered with a user-friendly content packaging tool, training and mentoring programme to develop Computer Based Training courseware more quickly and cheaply. Content that needed to be migrated from the old system was also reviewed and refreshed to ensure that they are web-enabled and SCORM compliant; the SAF also made use of this opportunity to adopt SCORM as the eLearning standard within SAF. This strategic move helps to eliminate system compatibility and migration issues in the future.

Implementing The System

System configuration and integration. The SAF has a legacy eLearning application that has existed since 1995. To avoid any disruption to the conduct of courses on the ground, the old system co-existed for 18 months with the new LMS until the new system was fully tested and certified operational.

The technical team did a thorough study on the centralised and the decentralised system architecture models. Due to our small geographical location, a centralised LMS was adopted. Interfaces between the LMS and other management information systems, in particular the manpower database, were thoroughly reviewed.

Training. A 'train the trainer' concept was adopted in the deployment of LMS usage skills.

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Figure 5 – The enterprise LMS homepage

Each school provided a LMS 'champion' who was trained by the vendors in a one-day training programme. They then provided the necessary cascaded training to their instructors on the use of the LMS. The enterprise LMS was successfully commissioned in November 2005, supporting 6,600 users.

Community of Practice. Three months after the commissioning, the project team established a virtual LMS Community of Practice (CoP), where members could exchange ideas and tips on using the LMS. A CoP forum was organised once every six months for members to interact and for project teams to provide periodic updates and share best practices. The CoP has proven to be a very effective platform for communication as faculty members who were early adopters relied on this platform to help educate the next tier.

Post Implementation Review

One year after the implementation, a Post Implementation Review (PIR) survey was conducted. A total of 1,099 responses¹ (51%) were received. Key findings from the PIR survey are summarised as follows:

a. Features of LMS. More than 67% of the respondents felt that the features were useful and adequate, in particular, the TimeTable,

Content Repository, Online Assignment and Online Survey tool. However, 38% also highlighted that the user interface could be further improved.

b. Response time and performance of LMS. 50.9% of the respondents were satisfied with the system performance. Most of them highlighted that the system was slow especially when there was high concurrent access of courseware and downloading of lecture notes at the schoolhouse.

c. Operational Support. This was provided by school instructors, co-ordinators and DSTA. Students were generally satisfied with the means of getting help from all parties and the responsiveness of the Directing Staff and supporting engineers to their queries and feedback.

d. Self-paced eLearning. 76% of the students generally subscribed to the idea of self-paced eLearning via Internet. They valued the opportunity to pre-engage with learning content before class and agreed that they had more valued-added classroom discussions.

e. User Interface. Despite a rigorous evaluation process involving users, it was observed that initially, the user interface elicited comments that were unsatisfactory. The user

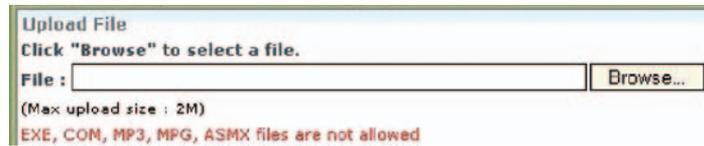


Figure 6 – Enforcing the policy via strict control measures at application level

interface of common operating systems, such as MS Office and Explorer, were used as a benchmark for the LMS. This led to less than desired initial user satisfaction. As the system was used frequently over two or three weeks, trainees' acceptance of the interface grew, but they were overall inclined towards the more common icons and page layouts available on the Internet.

f. Infrastructure. The initial implementation at each school reinforced the LMS dependency on the network access infrastructure. For example, once the wireless connectivity stability issues at a particular camp were resolved, the LMS usage increased by 30%. Thus, adequate network infrastructure directly affected the LMS experience and must be addressed upfront at the start of the project.

RELATED FINDINGS AND OBSERVATIONS

Importance of Command Emphasis. The emphasis of the School Commander contributed significantly to the success of the project. This was clearly demonstrated by some schools like the SAF Command Staff College and the Air Force School. While business processes were reviewed, the school's organisation structure was also re-organised so as to reflect the key roles required to support the LMS. This resulted in better usage of the system at the command, staff and trainee level.

Importance of system load test and Content Governance. Courseware had traditionally been delivered in classroom settings over the local area network or distributed via CD-ROMs. With the proliferation of the LMS, schoolhouses started to ride on the LMS to deliver content over the wide-area-network (WAN).

Unsatisfactory system performance was reported during the initial phase. Load test results showed that the slowdown was due to a combination of three key factors: poor content control and design, inefficient application code, and limited WAN bandwidth.

It was thus essential to proliferate and enforce a guideline on courseware creation quickly so as to facilitate smooth delivery over the WAN. After detailed study on the WAN, the courseware creation guideline was promulgated to the ground. To help enforce the policy, the LMS application was further customised to build in the necessary control measures such as file types and file size.

Concurrently, the COTS application algorithm and database queries were further reviewed and optimised. The WAN bandwidth for key camp sites was also upgraded progressively.

The system performance has since increased drastically, and 81.4% of the population is now satisfied with the system performance. This improvement was made possible by taking a multi-pronged approach involving collaborative effort by multiple agencies.

Continuous training. While the "train the trainer" concept is an effective approach during the initial implementation, it is not sustainable in the long run, especially in an environment where officers and instructors rotate appointments every two years. A core team has to be maintained to provide refresher courses for new instructors regularly.

Multimedia and Instructional Design Support. While instructors were able to create basic CBT packages containing instructional content and basic interactivity, additional resources were required to create the illustrations, animations

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and supporting media to complement the text or image information. Multimedia works took up a large portion of the conversion time and would lengthen the total conversion time considerably if done improperly. For the creation of new courseware, instructional design is an important skill required. The SAF is currently reviewing the curriculum of Instructional Design Courses in the Specialist Diploma in Learning Science Programme, and will ensure that vacancies are sufficient to meet demand.

Facilitation and mentoring skills sets of Instructors. As more lessons are conducted online via eLearning, instructors are able to spend more time interacting with the class and facilitating classroom discussions. Current instructor development training focuses on classroom facilitation. With the LMS, the instructor needs to be equipped with the skills of mentoring and virtual facilitation, so as to augment and supplement his classroom efforts.

CONCLUSION

Progress and momentum have been achieved under Phase One of the SAF's 3GLM initiative. The efforts of our instructors, administrators, and students, together with the command emphasis from the school commanders have been instrumental in moving the project forward. Riding on this success, we will complete the 3GLM implementation by FY2009. Future efforts will focus on providing seamless access, mitigating military security concerns, establishing framework for reusable learning objects and adapting to the wave of open source solutions.

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Project Manager, DSTA

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ENDNOTES

¹Out of 6,600 LMS accounts, 2,010 accounts were active during the month of September 2006.

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BIOGRAPHY



Lee Hwee Ling is Principal Engineer and Project Manager (Knowledge and DSTA Systems). She assisted in the conceptualisation of the vision and master plan for the Singapore Armed Forces' (SAF) eLearning programme. Hwee Ling also has extensive experience in the development of the SAF's various eLearning initiatives, which include the implementation of the enterprise Learning Management System and Content Authoring programme. She was also involved in knowledge management projects, overseeing the development of the knowledge audit framework for the defence headquarters. Hwee Ling graduated from the National University of Singapore (NUS) with a Bachelor Degree in Information Science.

MAJ Jaiganth Arumugam is currently a Directing Staff at the Army Officers' Advanced School in SAFTI MI. He was previously Staff Officer, Joint Training Branch (JTB), Joint Operations Department of the SAF. JTB steers the SAF's future learning needs to develop the Third Generation SAF, with eLearning as the engagement platform to provide "Anytime Anywhere" learning. During his tenure as Staff Officer at JTB, MAJ Jaiganth was involved in the conceptualisation, masterplanning and implementation of the Joint services training development and SAF training policies. He holds a Bachelor of Science Degree in Economics from NUS.



MAJ Chua Kok Siang is Head Instructional Design and Development at the Instructional Technology Centre, SAFTI Military Institute of the SAF. He oversees and manages Instructor Development programmes for more than 2,500 instructors in the SAF as well as the eLearning courseware conversion, development and training efforts at the SAFTI Military Institute. He was actively involved in the conceptualisation and implementation of Smart Learning Rooms at the SAFTI Military Institute. MAJ Chua graduated from NUS with a Bachelor of Civil Engineering. He obtained his Masters of Science in Instructional Technology from Utah State University, USA in 2003.