Visual Learning

Tools for Enhanced Organisational Learning

What is Visual Learning?

Visual Learning is an approach to workplace learning and training that blends rich multimedia tools, including accurate 3D models, with a flexible and realistic learning workflow to achieve better knowledge transfer within organisations.

The Challenges of Knowledge Transfer

As businesses, products, customer demands and supply chains all become more complex, knowledge transfer is increasingly important yet more difficult to achieve. Employees need to know how to do their jobs, not just adequately but safely and well.

Too often training is considered as an afterthought to the creation of the product or process. Products are created by engineering and design departments with marketing and sales providing input on customer needs. Detailed product knowledge often remains in the engineering and design 'silo' and is costly to extract.

However, shop-floor workers, salespeople and field staff 'downstream' from engineering need this knowledge in order to serve customers best. The need for updates does not stop there – customers and end users should equally be able to access quality information.

The frequency of knowledge transfer is also increasing. New models, new staff, inter-departmental collaboration and product localisation for global markets require regular updates. Corporate investments in continuous improvement, learning organisation and technology strategies often require training to deliver their promised ROI.

The Challenges Facing Learning at Work

Multimedia and eLearning have been suggested as useful tools for many years – and have had varying levels of effectiveness. Several common challenges of using these tools have emerged.

Learners want to be engaged on their terms

The Internet has been a catalyst for 24/7 learning. People can now access courses and information anytime it suits them, from PCs, mobile phones and a range of devices. They do this in a self-directed, voluntary manner without instructors.

Learners expect flexibility, self-direction and the ability to dip in and out of learning.

Workers truly have knowledge at their fingertips. Industry needs to leverage this and make their own learning available 24/7, such as via company intranets. For example, field engineers may want access while onsite with clients; when reviewing progress at end of the day; or when preparing for a day of customer visits.

Younger workers (such as the so-called 'Generation Y') are particularly demanding in how they consume information. Even multimedia tools from a few years ago (eg, Powerpoints and videos) may not hold their attention.

Learning needs to fit personal learning styles

It is important to take into account the variety of learning style preferences (such as visual, auditory, reading/writing or kinesthetic learning) that may exist in your workforce and provide training that fits. For instance, employees with lower reading literacy levels may respond better to visuals than large amounts of text.

When training is not personally engaging it is not effective, with a clear impact on quality and productivity goals.

The optimum "learning time" and situation needs to be accounted for. Learning may occur prior to engagement or on the spot. It may be done solo or in discussion with a group of colleagues.

Knowledge may be inaccurate or unrealistic

All too frequently, the reality of the shop floor is different from "the training manual". Training modules often contain idealised or simplified views of how products or procedures should work – spreading misinformation that will ultimately disappoint customers.

For instance, linear learning frameworks such as step-by-step guides present only "one right way". Learners can only see or do what the instructor wants them to – not necessarily what the learner wants to try.

Flexibility, even "randomness", is required to allow for experimentation, personalisation and feedback.

Training modules should capture preferred (possibly multiple) processes and allow experienced users to participate in their creation and refinement.

Conventional training is often done in unrealistic "perfect conditions". Effective training should consider multiple conditions, environments, locations, process variations and scenarios.

Creating learning modules can be costly

Putting together and updating training modules has typically been an expensive task. Often a senior member of the design team is required, working in conjunction with a technology expert and multimedia producer or specialist instructional designer.

Whole teams of people may be involved in creating technical illustrations of products when more efficient methods of extracting that product information may be possible.

Many learning tools have been developed in-house with no interoperability with other systems, so their content becomes outdated and requires manual updates.

Knowledge transfer may be too late

The cost and time to create learning modules can mean that modules are often not prepared until well after a product launch (with even two or three months' delay in some cases). Prior to launch, the key personnel holding the knowledge are focused on design and delivery, with training an after-thought at best.

Training delays can cause time-to-market delays which impact on revenue and market competiveness.

In order to reduce sales cycles, product knowledge needs to be shared with sales teams well in advance of the product launch.

Product references need to be available quickly where they are most needed – such as via a handheld device on the shop-floor or online for travelling field staff. In these cases, staff and customers can't afford to wait for the next scheduled team training session.

The Visual Learning Approach

Visual Learning tools use a "blended learning" approach that can fit with existing learning programmes and technologies including face-to-face instruction and eLearning.

Visual Learning tools use:

- an easy to access online user interface
- a flexible and realistic learning methodology
- accurate 3D models of products and processes
- current product data updated from ERP, Product Lifecycle Management, Document Management or other corporate databases.

The diagram below shows Visual Learning tools being used within an organisation, from creating learning content to staff applying their knowledge.

Visual Learning tools deliver learning content in a flexible and engaging manner using online interactivity (Step 3 in the diagram below), and uses a flexible learning methodology that helps the learner convert this content from information to knowledge that can be put into practice (Steps 4 to 6).

Users preview incoming information (Step 4), such as a 3D model of an object they are studying along with other documents. This is where they see it for the first time, scope it and compare it to their existing knowledge.

When reviewing (Step 5), the user can practice and explore the information at will. This is where the user starts to unpack the information and transform it into knowledge.

Visual Training tools include templates to rapidly develop training modules. Digital media such as video, documents, webpages and diagrams, as well as 3D models can be used. These reference documents and the model are pulled together in an interactive user interface so everything can be accessed from one place.

Documents and instructions can be annotated to the 3D model, even attached to a specific part so learners can visually and accurately see how it fits without complex CAD software.

Visual Learning tools in action

Benefits of Visual Learning

Easily accessible

Visual Learning tools can be accessed via a web-browser anywhere, anytime by staff, trainers or customers.

Research has shown that learning is enhanced and better retained when the topic is relevant to current needs, or better aligned with employees' own optimum 'learning time.' This may be online from home, on site during induction, prior to a test, when showing site visitors safety precautions, in the field, or via a handheld device while visiting customers.

Traditional training seminars are often dependent on experienced operators being available, and written manuals are often stored in one location and can only be accessible by one person at a time.

Online accessibility makes it easier to train entire teams, who may be spread across multiple locations, time zones or shifts. Visual Learning tools reduce language barriers, encourage cross-team collaboration and reduce travel time and costs for instructors.

Advances in 3D model compression technology mean that 3D training tools can be viewed via web browsers on standard PCs. Very large models based on the source engineering CAD data can be compressed without any loss of integrity. For instance, individual bolts on a large aircraft model could still be visible and interacted with.

Multiple 3D models, including the environment and other nearby objects can be included. A street, a house, its construction materials, wiring and the appliances inside can all be included. Details and all-important context are not compromised.

Accessible on the job

Knowledge in a Visual Learning system is also accessible anytime – not just when learning something new, but also when details need to be referred to or products are updated.

Visual Learning is integrated with company databases and intranets to ensure that the latest and most relevant information is available. Users can view support documentation and review their own

learning from the 'Interactive Knowledge Archive' at a later stage.

These resources can be accessed via handheld devices such as iPhones or iPads from client sites or the shop-floor where they are most needed. Tasks could be rehearsed or reviewed immediately prior to performing the real thing.

Teams of field engineers in different locations could also use it to maintain a knowledge archive of known problems or common issues. They would regularly update links to video clips, documents, forms and 3D diagrams.

Visual Learning technology can be synchronised with manufacturing change processes, so learning objects are updated automatically as engineering changes are made to product data.

These features get key information into the field quicker. In key cases, such as product recalls or major upgrades, response times may be critical.

Customers as well as field staff could log in and view changes, the explanation for change and visually compare the old and new models. Reporting and assessment tools can track which staff and customers have seen and understood the information, and provide follow-up support if necessary.

Interactivity leads to greater engagement

Research as long as 40 years ago highlighted the contribution that audiovisual materials can make in increasing the effectiveness of learning. It does this by reducing passive learning and increasing interaction with the subject matter.

3D models not only accurately display products but allow them to be interacted with and key processes practised.

Numerous studies have found that interactivity (the mutual action between the learner, the learning system and the learning material) has a strong positive effect on learning[1]. As an example, Bosco (1986) reviewed 75 learning studies and found that learners learn faster and have better attitudes toward learning when using interactive multimedia.

Visuals improve comprehension of complex equipment

Many products and processes include complex, moving and inter-linked equipment that can be difficult to understand at a glance from a 2D blueprint or plan.

Visuals are intuitively easy to understand and modern audiences can move around 3D images more quickly than cross-referencing 2D diagrams. There are fewer language barriers.

Interactive models can also be taken apart, components explored, processes animated, cross-sections viewed and step-by-step instructions included.

[1] Bosco, J. (1986). An analysis of evaluations of interactive video. Educational Technology, 25, 7-16.

Fletcher, D. (1989). The effectiveness and cost of interactive videodisc instruction. Machine-Mediated Learning, 3, 361-385.

Fletcher, D. (1990). The effectiveness and cost of interactive videodisc instruction in defense training and education (IDA Paper P-2372). Alexandria, VA: Institute for Defense Analyses.

Users can rehearse procedures without the real thing, add information, update objects to reflect the latest designs or product lines. During this process, group discussion is often sparked, with visuals facilitating the process faster and more accurately.

Rich information caters for multiple learning styles

While the 3D model forms a central and highly-effective way of communicating training information, it is rarely viewed by itself.

In addition to 3D models, Visual Learning combines other learning media – documents, manuals, video clips, diagrams – in a blended learning solution from the one user interface. These can be annotated to the 3D model, even attached to a specific part so learners can visually and accurately see how it fits.

The use of visuals with annotated illustrations for training has been shown to be significantly more effective than text alone[2].

Interactive models can be animated to show step-by-step instructions. The models themselves need not be approximations, but can be sourced from actual production plans, engineering CAD data.

The self-paced flexibility, use of various rich media, mix of visuals and traditional teaching tools mean that Visual Learning suits a range of individual learning styles. Visual, audio, written and kinaesthetic or tactile learning styles are catered for.

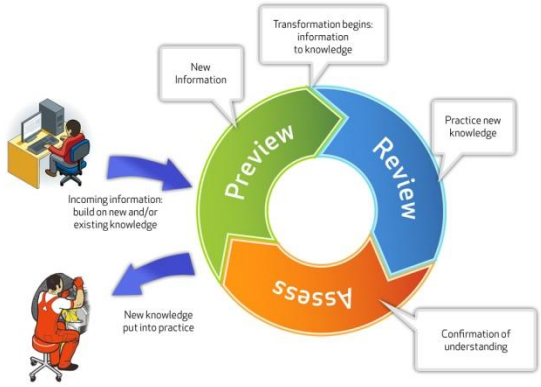
[2] Mayer, R.E., Bove, W., Bryman, A., Mars, R., & Tapangco, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. Journal of Educational Psychology, 88, 64-73.

Randomness and flexibility to repack information as knowledge

Interactive 3D can be viewed from any angle, and the mechanical workings of an object can be simulated in detail – providing much greater freedom.

In traditional elearning, often only limited options are presented – such as multichoice. This assumes that there is only one correct answer, but also presents only a limited number of ways to make mistakes. Limited options remove true free thinking, and encourage "multi-quess" not comprehension.

3D tools in particular allow a greater number of "errant pathways" as well as "correct pathways." Users can rotate and manipulate parts in any direction and distance, providing much greater room for experimentation – and the mistakes that inform learning.



The flexible nature of Visual Learning's preview phase acknowledges learners' prior on-the-job-experience, and avoids 'turning them off' by forcing them to sit through information they already know. The assessment phase still tests them on necessary information, so it cannot be skipped.

When reviewing, the user can explore the information at will, and explore key objects freely in 3D. Tasks can be practiced and rehearsed virtually.

This is where the user starts to unpack the information and transform it into knowledge.

There may be situations when the end user doesn't have the chance to practice the new knowledge immediately or may need a refresher before doing the live task. In these cases, the user can dip into an Interactive Knowledge Archive created during the preview stage, which bookmarks modules for later use.

Unfortunately many assessment frameworks test memory not actual knowledge. Visual Training asks the user to put their new knowledge into practice through a variety of assessment tools, including interacting with 3D models to simulate the working of an object.

Greater feedback and assessment

The assessment phase allows the user to confirm their understanding of new knowledge, and managers to track the spread of knowledge.

Assessment and reporting tools could also be used on key customers accessing reference documents and refreshing their own training. For a variety of reasons, customers may not alert customer service representatives that they have an issue or require extra information. With the reporting tools, customer service staff can gain valuable insights into issues customers are experiencing, questions they have, high-use features and the effectiveness of customer training. More proactive customer support will be possible, and opportunities for positive customer engagements created.

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Visual Training's assessment feature visually simulates the workings of 3D objects. Assembly and operation can be animated in steps, and procedures can be defined that only allow parts to operate in the correct sequence. Users can attempt to assemble or operate the objects virtually and gain instant feedback.

The end result is an extremely visual, easy to interact with test that simulates the real-world task.

Traditional quizzes, multiple choice and written answers can also be used. 3D and visual prompters can be included and interacted with while answering these questions.

Formative assessments can be conducted throughout to check understanding of each learning module and provide timely feedback to aid learning during the training (rather than after it is finished). User interactions and performance can be monitored and exported to a Learning Management System. The time users spend on topics during the preview phase can be monitored as an indicator of their prior knowledge.

Summative assessment can be carried out at the conclusion of a course or project, for instance, to assign a course grade.

Visual Training's learning objects comply with the Sharable Content Object Reference Model (SCORM) standard, an international specification for web-based e-learning. This integrates Visual Training with organisations' Learning Management System (LMS) software.

Reduced content creation costs

To date, the cost of creating multimedia training materials has been a significant barrier.

Fortunately, the costs of creating 3D are decreasing. Free online libraries of common objects are available, and 3D models can be imported from a variety of sources.

Visual Training can re-use 3D assets from existing CAD or Product Management databases and Enterprise Resource Planning solutions. When used with Right Hemisphere's Visual Enterprise software, it can coordinate and manage organisations' 3D product information libraries. This can allow changes made to original designs in the engineering department to automatically 'flow' through the organisation – making updates to training material much less time intensive.

The richness and extra interactivity of 3D learning objects means that the return on investment is significant when compared to the costs of traditional instructor-led or classroom training and the benefits of effective organisation-wide training.

The process of creating new learning modules can itself create knowledge. Often the act of defining a process and gathering reference materials identifies assumptions and alternative practices. Training programmes may be the catalyst for teams of experts to agree and develop best practices, and modules can be updated as innovations are introduced.

Manage workforce competency

Visual Learning can play a key role in organisational knowledge management in addition to knowledge transfer.

Visual Learning's management tools allow managers to assess the competency of entire teams on key topics and schedule upskilling needs for a workforce.

Physical assets and human resource asset tracking can be integrated, to identify what competencies are necessary for the operation of particular machinery or stations. In a 3D model of the plant or product, the competencies and skills required to operate them can be displayed inside the 3D model with links to employee training records and corporate Learning Management System.

The 3D model is also an effective way to navigate a business process and access the relevant Visual Learning training modules. The information and skills required to build, maintain and repair can all be stored in the same place with an easy-to-access 3D interface.

Taking the Next Step

To evaluate how Visual Learning could help your business and for information on solutions available contact:

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