White Paper On Digital Learning With Focus On AR/VR/Video

This white paper gives an overview of experiences gathered in the ISPT Innovation academy on the use of augmented and virtual reality as education tools. The experience was gathered in multiple projects and highly connected with the human capital agenda's of the topsectors energy and chemistry.

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Content

Summary

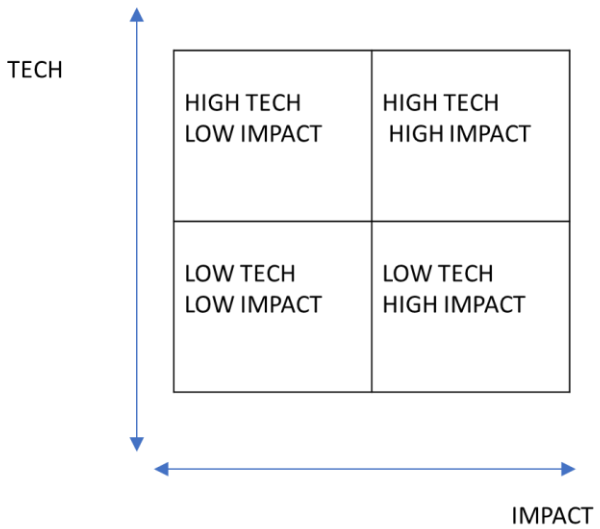
Using augmented or virtual reality tools can help improving reaching educational goals especially for training about spatial, 3d or morphological problems. Another very suitable application is to train for situations that are otherwise impossible to reach or simulate like maintenance at high or remote places and safety incidents in a chemical plant. Creation of high tech content is expensive so when possible opt for low tech tools that are affordable at

knowledge institutes and which do not require a high digital literacy. The tools must be used by all teachers and trainers not used by the early adopters that are highly digital literate. Start with the learning objectives and target group in mind and be careful to plan the complete creation and usage cycle. That includes scripting, recording, editing and publishing. Check the possibilities to publish the content and courses on the trainee's own devices like smartphones ,cardboard VR holders and tablets,. This will avoid high investment costs and upgrade costs to new software and hardware levels.

To create true digital platforms, the portability of created course and content across the different platforms is highly important so prevent a vendor lockin and investigate export possibilities. As search optimisation is important to webpages to turn up in google queries, the tagging of courseware and content is needed to enable that it content is accessible, findable and reusable.

The usage of a digital environment that allows self paced education without the constant need of the presence of trainer or teacher gives the possibility for differentiated learning and more efficient teaching approaches. In the future one expects that AI and new sensors will provide more sophisticated monitoring and tracking especially when the tasks to be trained involve manipulation of objects or persons like in maintenance or surgery.

Classification Of Learning Technologies



To classify available learning technologies one can use classification or dichotomy schemes to balance

- Low / high technology versus high or low learning impact

- Low / high technology versus teacher or student centeredLow / high technology versus low or high costs

Examples of low tech (&low cost) digital learning involve

- Video capture record and publish tools (eg: screencast-o-matic)
- Interactive video techniques
- Quiz tools
- Videoscribe tools: a tool broadly used by teachers of university of applied science

Figure 0-1 Videoscribe example

Other low tech video tools (use internet to find more info on the tools) are

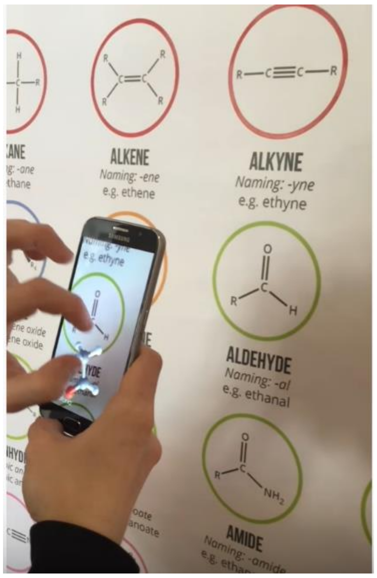
- Powtoon,
- Hippo Video
- animato
- flextime
- screenr
- Thinglink
- Tinytake
- iObserve

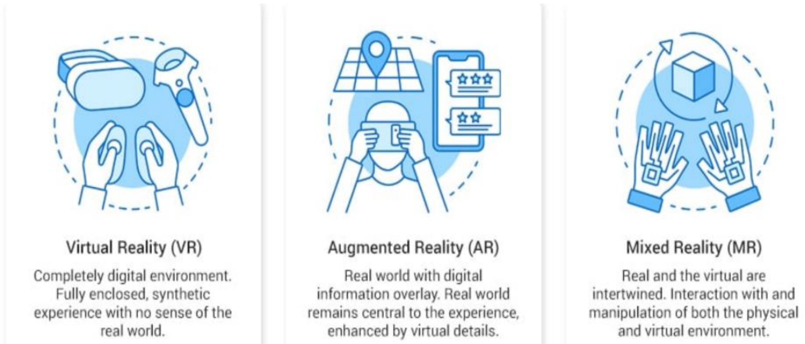
A special category is technology to help special groups of students like dyslexia or those with low vision including usage of tools like text to speech tools.

Low cost tools include usage of open source platforms , freeware like Augmented reality apps that display your own imported picture or model on a marker that can may select or create.

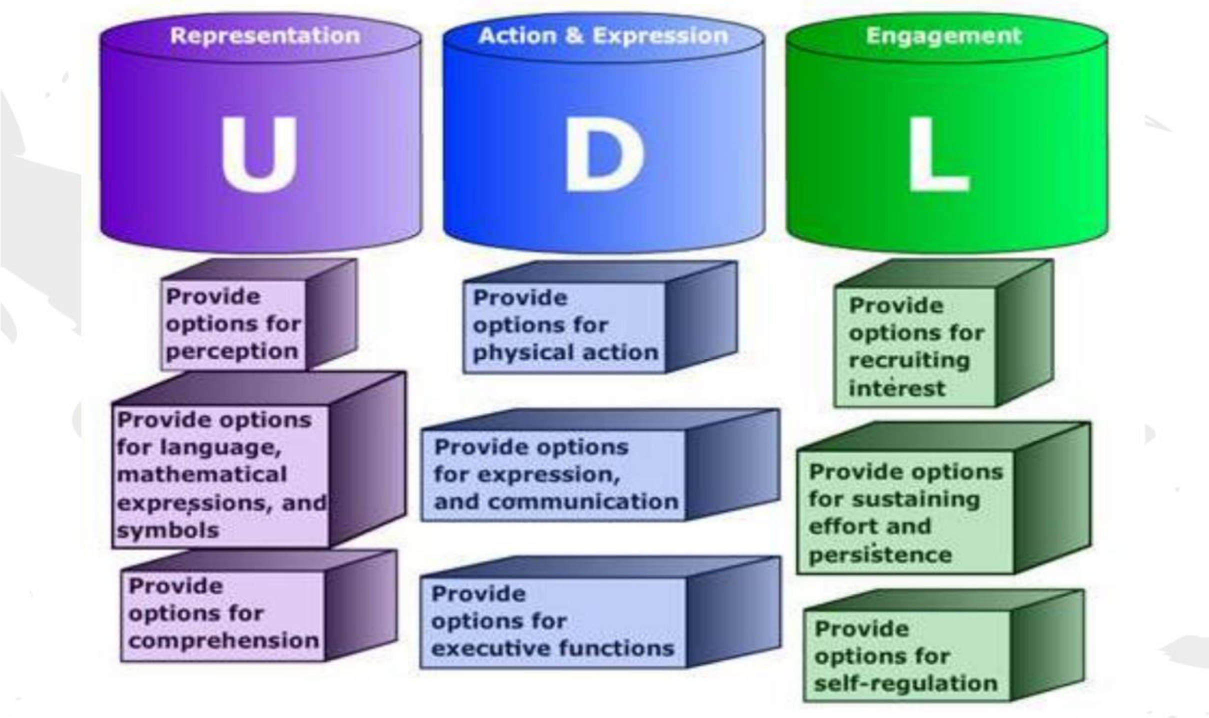
- 360 degree publishing environments like roundme

Example of AR assisted organic chemistry as created by ISPT (video is accessible [here]





Another classification scheme of teaching tools:



Best Practices On Educational Goals

- AR is proven to be best suited to get insight in structures and morphology, examples are 3D molecule structures or 3D building layouts
- VR and Mixed reality are best used for:
    - Virtual tours that are otherwise (almost) impossible to visit: like a chemical plant for youngsters to promote chemistry, nuclear plants to train operators, windmills at sea for maintenance training, crime scenes for forensic chemistry
    - Training on incidents and safety , in which incidents can be simulated like a fire

For teachers that like working with Blooms taxonomy to create structured learning goals : they can find digital tools to assist them formulating and applying learning objectives at the site of teachtought

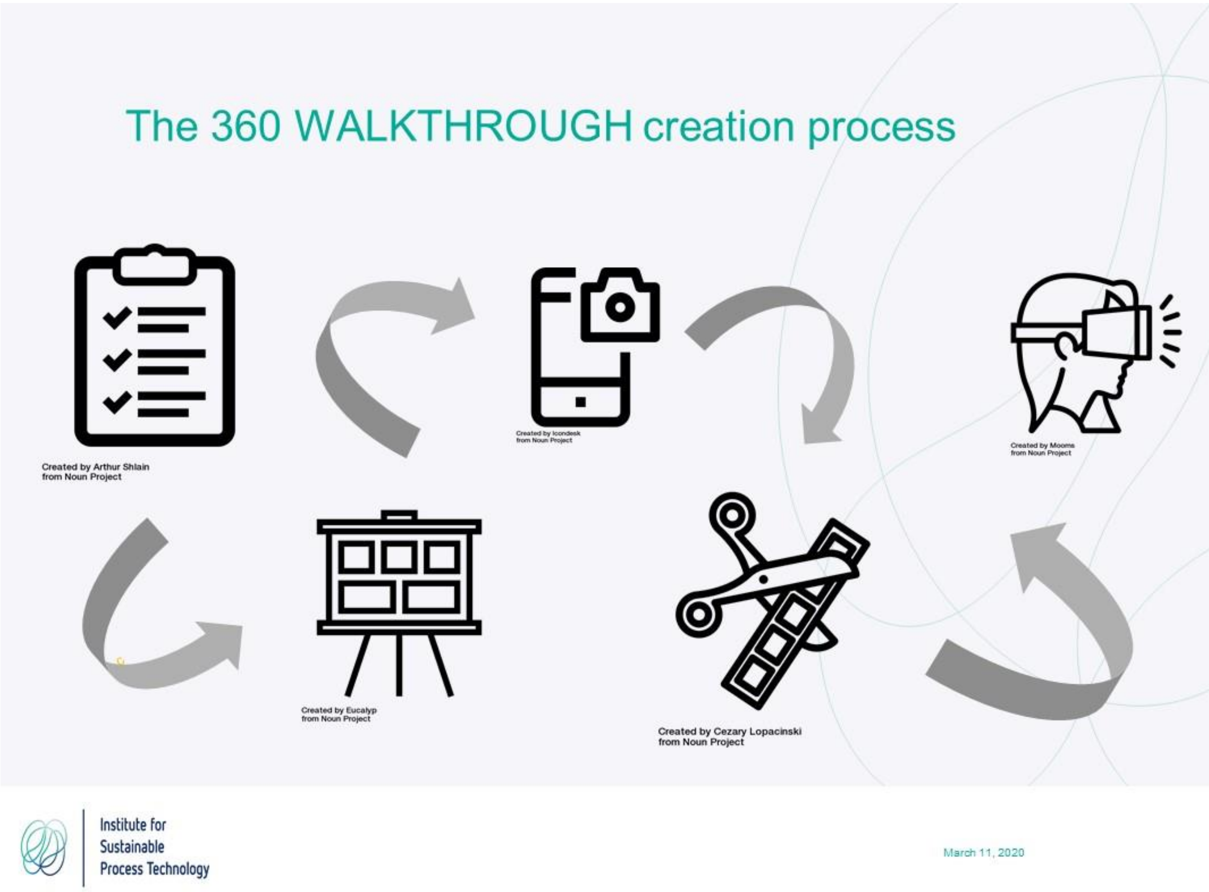
https://www.teachthought.com/pedagogy/50-resources-for-teaching-with-blooms-taxonomy/

Creation Chain For VR/AR/Video Content

For the creation of digital content for teaching purposes one has to consider the complete creation process which resembles the steps one has to go through when creating a movie:

- Establish target group and educational goal
    - Operators, engineers, management, postgraduates, undergraduates etc
    - Bloom taxonomy, link met curriculum, ETS requirements etc
- Script writing
    - Using elements like story boards or digital scripting tools per scene

- Recording/ create content
    - For lowtech 360 videos you may use a free app on the smartphone to create a 360 picture
    - For AR you might use existing 3d models from engineering companies or buy models from available libraries
    - For VR it involves a VR creation company including programming or scanning at location
- Editing of course
    - Think about possibilities to add text, screenshots, interaction with trainee, branding info etc
    - On line or offline editing might be possible and version control is a great help
    - Use the Possibilities for trainee monitoring to create completion criteria
    - …
- Publishing
    - Think on which platform you like to use like pc, tablet, online, offline, operating systems (Android, IOS, Windows,..)
    - Consider the Maintenance costs & licenses (per view, per platform, per GB, per year , etc)
    - Investigate the streaming possibilities: can the content be streamed to multiple trainees/observers/teachers?
      Please check the roundme environment as publishing tool for 360 videos, see here for demo tours published by ISPT



Electronic Learning Environments

A number of low and high tech online electronic learning environments have been investigated, namely Google Classroom, Google Drive, Dropbox, Blackboard and Moodle. These are all described in the MOOC Blended Learning from Leeds University on the Future Learn platform. What these platforms have in common is that they solve version control problems and also offer options for so-called "Collaborative writing" where multiple trainees can work on the same document. Through integration of these platforms in the curriculum opens the door to new (online) working forms.

The platforms that we investigated can be divided into three categories.

The first category is the "file repository" category. Dropbox belongs to this category. The file repository is a location where teachers and students place or retrieve their files. Dropbox, however, adds automatic notifications of version changes, notifications that new files have been uploaded, and is finally accessible on all devices (from computer to smart phone). You could therefore call it a "smart file repository".

The second category adds "collaborative writing" in addition to "file repository". This is possible in the Google Drive environment. Students and teachers can use tools such as Google Spreadsheet, Google Documents and Google Presentation to create spreadsheets, documents and presentations together. The platform adds a dimension towards blended learning.

The third category is an "online learning environment" which is the category of Blackboard, Google Classroom and Moodle. These environments offer more than just a "file repository" or l"Collaborative writing". In these online learning environments, students can:

- Communicate directly or with their teacher directly via chat or live camera or indirectly via forums and e-mail.
- Make assignments and hand in where deadline management and grading are integrated (teacher receives notification of submission, student receives notification of approaching / exceeded deadlines).
- Teachers can create content, monitor students progress add completion criteria and backup and restore their content
- The interface is customizable to the housestyle of an institute.

Moreover, the environment is not a folder structure such as the "file repositories", but as a teacher you classify the environment as a lesson. The relevant documents are placed per lesson and the assignments are indicated with a deadline. This means that everything is in one place, which is easy for both student and teacher.

The different platforms were addressed on the following four pillars:

- Cost; free in the ideal case.
- Data storage; unlimited in the ideal case.
- Number of possible users; unlimited in the ideal case.
- Portability; how much files, lesson structure, completed assignments, etc. can be taken from the platform to be used elsewhere where they do not have the platform. In the ideal case, of course, everything can be exported.

Portability in particular is important. The reason we explore this is that the biggest disadvantage of Online Environments is that you commit to a certain platform as an organisation. It takes time to organize everything in the online environment. Not all institutes and organisations use the same platform and you may want to switch to a different platform in the future or exchange courseware. So if it is easy to export the online environment and import it into a different environment, then that increases the applicability of your curriculum in the curriculum of other schools and you are also flexible for other platforms in the future.

An overview table has been made indicating with a plus and a minus how a platform "Scores" on these four pillars.

Omgeving	Kosten	Dataopslag	#Gebruikers	Portabiliteit	Integratie externe apps (Google)
Blackboard	-	+	+	+	-
Dropbox	-	+/-	+	+	-
Google Classroom	+	+	+	+/-	+
Google Drive	+	+/-	+	+	+
Moodle server[2]	+	+	+	+/-	+
Moodle cloud	+	-	-	+/-	-
Moodle partner (UP Learning BV)	+/-	+	+/-	+/-	+
Moodle partner (Avetica)	+/-	+	+/-	+/-	+

Tabel 1. Vergelijk van online platformen voor onderwijs op gebied van kosten, dataopslag, aantal toegestane gebruikers, portabiliteit en de mogelijkheid om externe applicaties te integreren.

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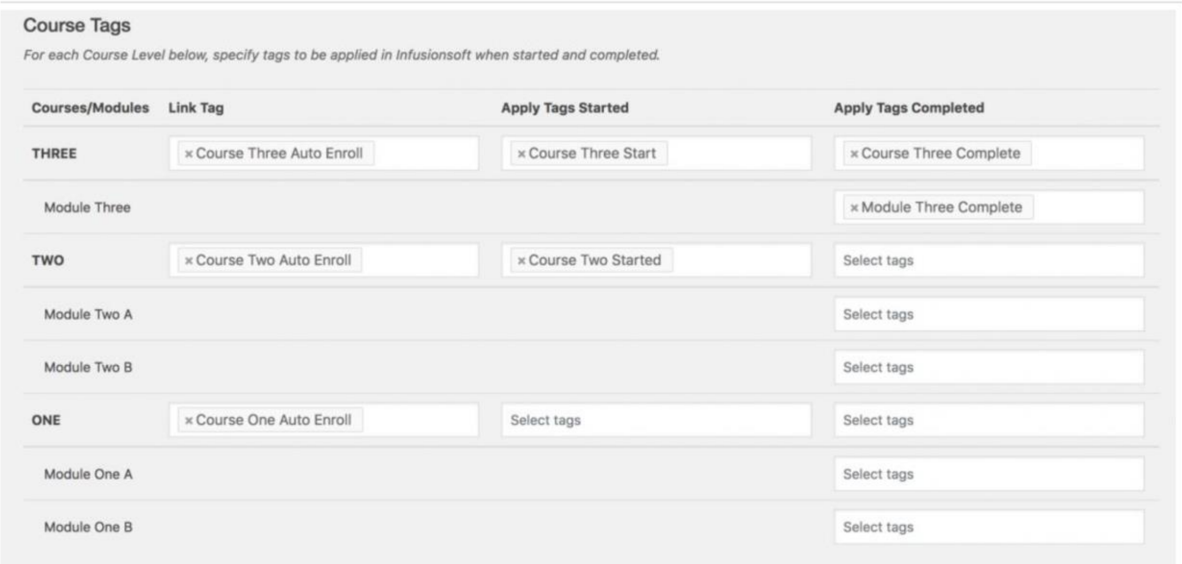
Because Moodle is offered in various ways, there are four rows for Moodle. An extra column "Integration external apps" has been added to the table. Here we explore the option of adding applications from Google such as Google Documents (collaborative writing tool) to the Online Environment.

Three options emerge best from the comparison: Google Classroom, Google Drive and Moodle server. In all three cases it is a free product for an unlimited number of users where various external apps can be installed / used. Google Classroom basically uses Google Drive and adds extra tools (for example, taking quizzes and a teaching environment). If you compare this with Moodle, Moodle has more options (including even the integration of Google Drive) and it is also a bit easier to install if you have access to a server (with server management). For Google Classroom you must first be registered as a school at Google

Tagging Courseware

Tagging courseware with unified labels is as important as search engine optimisation is to a website page: if google does not provide the webpage in a Google search command (query) your page is not visited: so courseware needs to be recognizable to be create platforms



Course Tags

For each Course Level below, specify tags to be applied in Infusionsoft when started and completed.

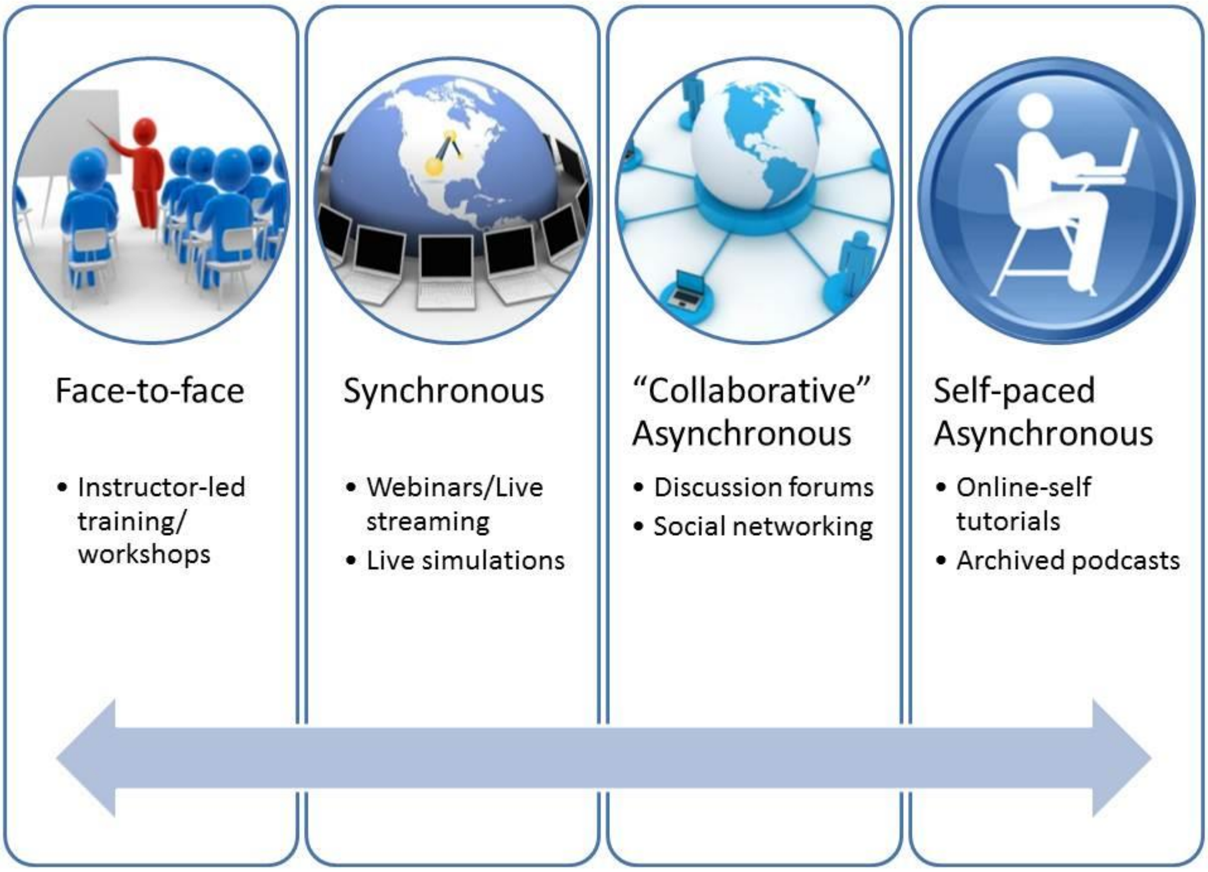
Courses/Modules	Link Tag	Apply Tags Started	Apply Tags Completed
THREE	× Course Three Auto Enroll	× Course Three Start	× Course Three Complete
Module Three			× Module Three Complete
TWO	× Course Two Auto Enroll	× Course Two Started	Select tags
Module Two A			Select tags
Module Two B			Select tags
ONE	× Course One Auto Enroll	Select tags	Select tags
Module One A			Select tags
Module One B			Select tags

This screenshot is an example for tagging possibilities at different levels of a course: per module , per course etc.

Tagging is also required to allow trainees to create own lesson trajectories and learning paths

Special Tags are need to indicate starting criteria, target group. ETS points, etc to allow trainees to integrate the course in their education trajectory.

Monitoring Students Progress



The chosen monitoring approach must fit with how the courses are offered to the trainees. The requirement to monitor realtime the steps a a trainee takes requires a synchronous teaching approach either in one room or at a remote location.

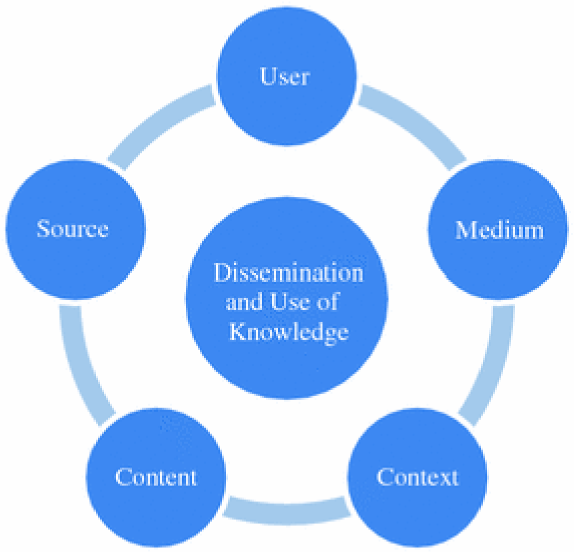
Sophisticated educational tools monitor each step, route, lead-time for the trainee offering benchmarking to the trainee , offering more advanced training exercises or possibilities to train steps without interference of a teacher. This gives the possibility for differentiated learning and self paced learning with more efficient teaching approaches.

Researchers As A Targetgroup

The methods researchers use to disseminate their findings tend to be passive and traditional among academics and not necessarily those that best connect stakeholders with research evidence. In one study, 75% of public health researchers reported that dissemination to nonresearch audiences was important. However, the same study found that the most frequently reported dissemination methods were academic journals (99%), followed by academic conferences (81%). **Methods used less commonly included seminars and workshops (69%), face-to-face meetings (50%), press releases (33%), and media interviews (33%),** which was similar to findings from researchers in the United Kingdom. When rating their dissemination efforts, only 28% of this group reported that their efforts were excellent or good. Several factors predicted whether researchers reported excellent or good dissemination efforts, giving some indication of what motivates scientists.

These variables included feeling obligated to disseminate their findings; thinking that dissemination is important to their department, employer, or funder; and having worked in a practice/policy setting. A study analyzing data across 3 countries found that factors making it easier to disseminate research findings such as a unit/department/school with a formal communication dissemination strategy were rarely available. One approach with potential to improve translation of research to practice is designing for dissemination: an active process that helps ensure that public health interventions, often evaluated by researchers, are developed in ways that match well with adopters' needs, assets, and time frames. However, most researchers report rarely engaging in the activities that characterize designing for dissemination (ie, only one-third of respondents to a survey of US scientists always or usually involved stakeholders in the research process).

https://link.springer.com/chapter/10.1007/978-981-10-0983-9_97



High-performance organizations (i) adopt a strategic approach to dissemination, (ii) know their target audiences, (iii) formulate generic, viable dissemination strategies that can be amended to suit different purposes, (iv) hit the target, and (v) monitor and evaluate their accomplishments. They do so because they can answer the following questions:

What do we want to disseminate? Dissemination is only achievable and successful if, from the outset, there is a shared vision and common understanding of what one wants to disseminate, together with a way of describing that to those who stand to benefit from it.

Who is the target audience and what are we offering it? It is important to clearly identify who the target audience is to map it to one of the categories in the awareness, understanding, and action model. Since target audiences tend to be many, it is best to concentrate on who, at the very least, needs to be informed, and then prioritize for awareness, understanding, and action. Next, it is essential to think about what benefits the knowledge product will offer. A user is most interested in a potential solution to his or her particular problem: successful dissemination strategies are those that actively engage target audiences and deliver what they both need and want. One must then examine the knowledge product and think of how it might be presented as a benefit and solution to users.

When do we disseminate? Dissemination exercises have milestones that must be identified and set early. They must also be realistic.

What are the most effective ways of disseminating? Reports are concrete outputs that can be easily evidenced as solid methods of dissemination. But it is important to explore and evaluate what vehicles meet the needs of target audiences most effectively and appropriately. Varying them will also increase the chances of success.

Who might help us disseminate? Target audiences already have journals, events, professional bodies, and subject associations they engage with. Dissemination will stand a greater chance of success if one can work through existing channels. Collaborating probably improves the impact of dissemination and reduces costs.

How do we prepare our strategy? The strategy flows from the above to cover (i) the objective of dissemination, (ii) what knowledge product one proposes to disseminate, (iii) target audiences, (iv) benefits to users, (v) dissemination methods and related activities, (vi) timescales and responsibilities, (vii) targets, (viii) costs, and (ix) evaluation and criteria for success.

How do we turn our strategy into a dissemination plan? Producing a coherent dissemination strategy does not necessarily result in effective implementation. A clear set of actions must be articulated covering (i) objective, (ii) target audiences, (iii) methods, (iv) vehicles, (v) timing, and (vi) responsibility.

How do we cost our dissemination activities? Having developed the dissemination strategy and turned it into a dissemination plan, one needs to make sure that each dissemination activity has been carefully costed. It is always possible to obtain estimates of costs for all aspects of dissemination. The different aspects for consideration when running a workshop, for example, will relate among others to venue or room hire; equipment, e.g., overhead projectors, laptops; refreshments; lunch; travel to and from the workshop; publicity materials; and subsidies for participants.

How will we know we have been successful? An effective dissemination strategy will only continue to be effective if it is viewed as an evolving and constantly developing process. The context in which we work changes over the course of our activities and the contexts in which users work are likely to change, too.8 Therefore, it is important to put in place mechanisms for reviewing progress. However, one can only do so if clear targets are established at the outset. One of the most effective ways of establishing targets is to link them to the broad purposes of dissemination: (i) awareness, (ii) support and favorability, (iii) understanding, (iv) involvement, and (v) commitment. In each instance, it will be useful to identify beforehand (i) the target group, (ii) the target, (iii) the timescale, (iv) the reasons for selection, and (v) the criteria for success