Quality Evaluation Tools for Learning Objects
[A Case of Engineering Tuition in an Open
Distance Learning Setting]

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Abstract

Learning Objects (LO) are applied in an educational setting to enhance the delivery of course content through multimedia approaches to pedagogy. In an Open distance learning (ODL) setting and an engineering environment the quality of the LO applied can make a difference between a high level of student comprehension, therefore successful completion of the qualification and a high attrition rate in the specific field of study. This research seeks to address the question whether the criteria employed to assess LO is adequate and appropriate for engineering teaching and learning (T&L). A technology scorecard is established for various LO technologies and an assessment is performed using the LORI instrument criteria. The results of the assessment are analysed with the ECSA module outcome criteria to measure whether the criteria applied is appropriate and adequate to measure the acceptable level of LO quality for engineering T&L. An experimental approach method is employed in the research and a technology scorecard is established. The results of the study will indicate whether the LORI criteria is adequate and appropriate for engineering and if not a gap will be identified and stipulated. Recommendation for closing the gap will be tabled and a new LO quality assessment will be established.

Keywords
LORI, LO, Engineering, Technology scorecard, ODL

1. Introduction
The technology scorecard will discuss and evaluate various technologies applied in education and specifically those that are used in experiments for tuition in industrial engineering (IE). The criteria for evaluation adopted in the scorecard, are stipulated in the Learning Object review Instrument (LORI) for learning object (LO) evaluation. Throughout the scorecard, some important issues relating to the technology tools used or experimented with are addressed, and the scorecard is focused on the issues addressed by the LORI criteria and these assessment criteria are applied on technology assessment scorecard. There are significant challenges to effective evaluation, in part because review processes and tools cannot be developed as 'one size fit all' and therefore must balance assessment validity. Like the LORI, this scorecard is founded on broadly interpreted dimensions intended to support and highlight the SWOT of the technologies applied or evaluated. Methods used are rarely chosen independent of the context

(Georghiou &Roessner 2000), the LORI criteria represent a world-class approach and unbiased assessment. The general dimensions of the scorecard are made of the functionalities of the technologies, which are captured by the themes and the evaluation score which is captured by the indicators. When focusing on a particular technology, for example, the indicator will reflect a value that describes the importance of a particular attribute of the technology as described by the theme. That value will range from 1 to 5, as stipulated by Krauss and Ally (2005) for the LORI. The technologies that will be evaluated in this scorecard include:

- Content curation tool: ContentGems and Liist
- Web 2.0 Tools: Diigo and Edmodo
- Disruptive technologies: MOOCs
- Mobile technologies: PDA
- Asynchronous technologies: Google App – Classroom
- Synchronous technologies: Audio Clips
- Digital Game Based Learning: Games
- LMS: ATutor
- Multimedia: Podcast

1.1 Objectives
The scorecard will use eight themes, weighing equally as explained below.

1. **Content Quality**: Veracity, accuracy, balanced presentation, ideas, and appropriate level of detail.
   A learning resource is of no use if it is well designed in all other respects but its content is inaccurate or misleading (Leacock & Nesbit 2007). Quality is defined, in this case, as content validity, potential effectiveness as a teaching tool and ease of use.
2. **Learning Goal Alignment**: Alignment among learning goals, activities, assessments, and learner characteristics. Frequently a learning and assessment mismatch is found, especially in instances where students are tested in in concepts that are remotely related to the course activities (Leacock & Nesbit, 2007). Improving instructional alignment between teaching and assessment can boost student achievement. Goal alignment provides a more efficient heuristic approach suitable for digital resources at a moderate level of granularity (Leacock & Nesbit 2007).
3. **Feedback and Adaptation**: Adaptive content or feedback driven by differential learner input or learner modelling. Generating effective feedback and adapting to learner characteristics have been understood as important goals for educational technology, this goal is partly motivated by the belief that adaptive teaching strategies are the key to reproducing very high achievement levels (Leacock & Nesbit 2007).
4. **Motivation**: This aspect of technology affects the amount of effort that the user is willing to invest in working with the technology. Motivation is a function of value one places on a technology (Leacock & Nesbit, 2007).
5. **Presentation design**: Design of visual & auditory information for enhanced learning and efficient mental processing. Presentation design refers to the quality of exposition in technology or digital resources and it applies to all expository media (Leacock & Nesbit 2007). Much of the science behind presentation design follows from the properties of human working memory, as addressed in cognitive load theory (Leacock & Nesbit, 2007).
6. **Interaction Usability**: Ease of navigation, predictability of the user interface, and quality of the interface help features. Usability has been recognized as a critical issue in software quality because usability efforts focus on error prevention (Leacock & Nesbit, 2007). To reduce the effort learners must invest in learning the technology; usable designs build on learner's prior knowledge of common interface patterns and require recognition (Leacock & Nesbit, 2007).
7. **Accessibility**: Design of controls and presentation formats to accommodate disabled and mobile learners. There is an apparent widespread disregard for accessibility among developers of educational software (Leacock & Nesbit 2007), a survey of major providers of instructional software found that there was no

access provision in most products (Leacock & Nesbit 2007). Therefore, people with a disability are disadvantaged.

8. **Reusability**: Ability to use in varying learning contexts and with learners from differing backgrounds. When a technology is designed for a diverse use, it is more likely that it is reusable. Reusability includes a consideration for the needs of diverse learners for example, those with different backgrounds, abilities and disabilities (Leacock & Nesbit 2007).

2. Literature Review

A Literature review of various articles provides the ideas for the criteria to apply in this review technology scorecard and report and the LORI criteria was more appropriate for the task. The evaluation is based on a system that requires accessibility, operability and support, etc. The criteria used in the scorecard are modified to ensure a consistent evaluation criterion is used in assessments (Kauss & Ally 2005). The chosen variable and criteria are measured by asking questions that, in turn, can be used to assess the risks contain in the SWOT that is confronting the technology in question (McGrath & McMillan 2004).

The criteria applied are founded on the behaviourist model of learning, as is the LORI, which is based on the theory of stimulus and response (Krauss & Ally, 2005). To meet diverse learning needs and to improve learning a variety of resources is applied, including digital technology, where a combination of media and methods are used to change with the context and try take into account learners' differences (Akkpinar, 2008). The scorecard is not an exhaustive evaluation tool because it is not based on scientific evidence, and it does not account for human error as the basis for evaluation is based on the user's opinion (Hodges & Repman, 2011).

Table 1. The technology scorecard

5 = excellent 4 = very good 3 = adequate 2 = difficult 1 = unsatisfactory	Content-Gems	Liist	Diigo	A–Tutor	PDA	Class-room	Edmodo	Pot-cast	MOOC
Content Quality : Veracity , accuracy , balanced presentation ideas, and appropriate level of detail	4	3	4	4	3	3	3	3	4
Learning Goal Alignment: Alignment among learning goals, activities, assessments, and learner characteristics	2	2	4	4	3	4	4	2	4
Feedback and Adaptation: Adaptive content or feedback driven by differential learner input or learner modelling	4	3	5	3	3	3	4	1	3
Presentation Design: Design of visual & auditory information for enhanced learning and efficient mental processing	2	2	4	3	3	3	4	2	3
Interaction Usability : Ease of navigation, predictability of the user interface, and quality of the interface help features	3	3	4	4	3	4	4	3	3
Motivation: amount of effort	4	4	5	4	4	4	4	4	4
Accessibility : Design of controls and presentation formats to accommodate disabled and mobile learners	3	3	3	3	2	3	3	2	2

Reusability : Ability to use in varying learning contexts and with learners from differing backgrounds	4	4	5	4	4	4	4	5	5
Average Score	**3.25**	**3.0**	**4.25**	**3.62**	**3.13**	**3.5**	**3.75**	**2.75**	**3.5**

3. Discussion
LORI Methodology results based on weighting dimensions:

3.1 Content Gems

Table 2. Technology scorecard

Content Gems	3.25	Adequate – Would recommend/ use it again

Content Gems is a curation tool that helps curators find, curate, and share engaging content so they can build their company's thought leadership and increase qualified website traffic. It is freely available and to use it you go through an easy sign-up process. The tool allows you to synchronize it to your social media, e.g. Tweeter, Facebook, etc. Content-Gems monitors the people you follow on Twitter and indexes the articles they share. It then recommends the most relevant articles based on your interests. Experimenting with this technology is exciting and relatively easy to use once you have gone through a number of setup phases and rules, but definitely doable.

3.2 Diigo

Diigo	4.25	Adequate- will definitely recommend /use again

Diigo is a social bookmarking website, which allows signed-up users to bookmark and tag web pages. Additionally, it allows users to highlight any part of a webpage and attach sticky notes to specific highlights or to a whole page. Diigo is a multi-tool for knowledge management and it is easy to setup and use. A definite recommendation to implement and use again. It is an excellent technology for learning and a good tool for knowledge sharing. It can easily score a four and five when used repetitively.

3.3 Liist

Liist	3.0	Adequate- will recommended/ use again

Liist is a curation tool that helps curators organize and share engaging content efficiently and effectively and will increase qualified website traffic when used. During experimentation, Liist was identified to be an excellent complement to Content Gems and that it will improve the administrative capabilities of Content Gem. It is freely available and has an easy sign-up process. An absolute pleasure to use and access and can easily be a four when its application is known and understood well enough.

3.4 Edmodo

Emdodo	3.75	Adequate – It is recommended as good and will be used again

Emdodo was set out to bridge the gap between how students live their lives and how they learn in school. It was created to bring education into a 21st century environment. It is a dedicated to connecting learners with the people and the resources they need to reach their full potential. Emdodo is a collaborative technology tool for teachers, learners and parents; it enables parents to connect and work collaboratively with learners with assignments and discover new resources. This technology is a four when proficiency in using it has been achieved and can easily be a five. It is easy to use and to access, once you on the internet and navigation is through the Emdodo is directed through simple rules and online assistance.

3.5 MOOC

MOOC	3.5	Adequate – recommended as good and will be used again

Massive Open Online Courses are offered to anyone with an internet connection, the courses are of high quality and many of them are quite informative and getting better. MOOCs provide access to the world-class professors at an unbeatable price. Some MOOCs offer a sequence of courses akin to college majors and students may even receive a verified certificate. The only setback with MOOCs is that hosted by colleges and they holding technology at bay and they are not freely accessible since you need access credentials of that particular college.

3.6 PDAs

PDAs	3.13	Adequate – will be recommended/ use again

Personal digital assistant or personal data assistant is a mobile electronic devise that functions as a personal information manager. The devise has an ability to connect to internet, it has an electronic visual display enabling it to include a web browser. It contains audio capabilities enabling use of portable media player. PDAs are portable and easy to use. They are an adequate technology for learning and for access of multiple information streams, through the internet. PDAs are appropriate and adequate technology tools for asynchronous learning. Experimenting with this technology is easy and accessible, although the digital tools themselves need some practicing to improve usage.

3.7 Classroom

Classroom	3.5	Adequate and leaning towards goods. Is recommended/ will be used again

Classroom is a google App design to help academics create and collect tasks (assignments) paperless. It contains time saving features such importing google documents and sharing with students and saving them use later in central folder. Classroom is a teaching App and a facilitator creates a folder for each assignment and for each student and the marking process is automatic and a facilitator can group performance into group in click. This enables the facilitator to analyse performance per student, per assignment and per question in the assignment. The App enhances communication, and it is easy to set up, saves time and improves organisation of teaching and learning. This technology is a definite four or five but needs one to be efficient in application and using it. It is definitely recommended as adequate to apply in learning and will be used again.

3.8 A-Tutor

A-Tutor	3.62	Adequate to excellent, definitely recommended/use again

A-Tutor is an Open-Source Web-based Learning Management System (LMS) used to develop and deliver online courses. Instructor and administrators can install or update A-Tutor in minutes, develop custom themes to give A-Tutor a new look, and easily extend its functionality with feature modules. Educators can quickly assemble, package, and redistribute Web-based instructional content, easily import prepackaged content, and conduct their courses online. Students learn in an accessible, adaptive, social learning environment, an ideal LMS for student because going to school is inherently social.

3.9 Multimedia Podcast

Multimedia Podcast	2.75	Difficult – might not be recommended/ use again

The multimedia podcast fosters a deep understanding in students and when designed in ways consistent with the methods people use to learn and will serve as an aid to students learning process (Mayer, 2003). A multimedia instructional tutorial, according Mayer (2003), will not include the teaching of an arbitrary list of facts but will contain

a presentation of words and pictures that is designed to foster meaningful learning and provide explanations of how things work (Mayer, 2003). To ensure that the multimedia instructional tutorial deliver the promised results (to serve as an aid to student learning) a cognitive theory multimedia learning structure is espoused.

3.10 Summary of score and ranking, and the required adjustments
In order to factor in a wide variety of averages an inclusive range is developed and applied. The range divides the scores from meet or exceeds (3.0) to excellent (5.0) into six categories. It was highlighted in the discussion that some the technologies assessed above could actually score higher once proficiency in using the tool is achieved. Therefore the experimentation time can disadvantage the technology rating in that it is scored a 3.5 but it can actually be a scored a five. This is due to the ability of the user to navigate through the technology in the early stages of the experiment. When ranking is spread over a wider average most the technologies assessed above are upgraded to a higher score, as depicted below.

Rating	Comments
4.5 – 5.0	Excellent
4.0 – 4.5	Very Good – Definite recommended
3.5 – 4.0	Good – will be recommended to use again
2.5 – 3.5	Adequate – meets minimum stds
2.0 – 2.5	Difficult – likely would not apply
2.0	Difficult - Does not meet minimum standards
1.0	Unsatisfactory - Not worth using

4. Analysis
All the technology tools chosen and assessed have a high motivation factor, which means the amount of effort that the user is willing to invest in working with the technology is high, this is a positive attribute for the technology because motivation is a function of value one places on a technology. Note that the reusability of technologies is high. Reusability includes a consideration for the needs of diverse learners for example, those with different backgrounds, abilities and disabilities (Leacock & Nesbit 2007).

PDAs have a consistent score across all themes in the scorecard, whereas podcast have the lowest score in the report. It must be noted that lowest score of the podcast does not rule out the use of multimedia podcast in learning, this is because the multimedia podcast are highly reusable and therefor desirable in teaching and learning. The consist scoring of PDAs is attributed to a wide spread of the technology and the fact that most users have gone through the learning curve in using the technology, there is some comfortability in using the technology. In terms of the product life cycle, the PDAs are at the maturity level.

The scorecard is an objective and quantitative assessment tool. All themes carry equal weight and the indicators reflect the same scoring for all themes. It is major finding to note that accessibility scored low amongst most technologies but it is not surprising for there is an apparent widespread disregard for accessibility among developers of educational software, and in a survey of major providers of instructional software, it was found that there was no access provision in most products (Leacock & Nesbit 2007). A very distinctive pattern of high scores in experienced with Web 2.0 technologies, i.e. Diigo and Emdodo. This supports the notion that Web 2.0 technologies have developed and have become accepted enough that transition to new ones is the next apparent move (Alexandra 2006).

One significant limitation of the scorecard is that scoring does not take into account the effect of unfamiliarity with a particular technology application. The fact that when experimenting with the technology for the first few times, it is difficult, But once the user has gained proficiency in the application of the technology tools, then scoring can be upgraded to a 4 or 5. This lag in application proficiency is the time taken through a learning curve. Unless this biasness is factored out by widening the rating range of by any other statistical decision making method, rating and scoring will be skewed and might not reflect the true pictured as intended in the scorecard.

Application in An Educational Setting

ATutor

A-Tutor is an Open Source Web-based Learning Management System (LMS) used to develop and deliver online courses. Instructor and administrators can install or update A-Tutor in minutes, develop custom themes to give A-Tutor a new look, and easily extend its functionality with feature modules. Educators can quickly assemble, package, and redistribute Web-based instructional content, easily import pre-packaged content, and conduct their courses online. Students learn in an accessible, adaptive, social learning environment, an ideal LMS for student because going to school is inherently social (Kolowich 2012). A-Tutor's base in Open Source technology makes it a cost effective tool for both small and large organizations developing instructional content and delivering courses on the Web. Comprehensive help is available through the documentation, through a number of support functions, or through the community forums.

A-Tutor is used in various contexts, including online course management, continuous professional development for teachers, career development, and academic research. The software is cited as unique for its accessibility features, (useful to visually impaired and disabled learners); and for its suitability for educational use according to software evaluation criteria established by The American Society for Training and Development (ASTD). A-Tutor is used internationally and has been translated into over fifteen languages with support for over forty additional language modules currently under development.

A-Tutor was first released in late 2002. It came in response to two studies conducted by the developer in the years prior that looked at the accessibility of online learning systems to people with disabilities. Results of the studies showed none of the popular Learning Management Systems at the time even provided minimal conformance with accessibility guidelines. At the time a blind person for instance, could not participate fully in online courses and therefore students were not enabled to think of themselves as whole people and not some composite of non-overlapping silos (Batson, 2012

 The authoring tool also includes a Web service that evaluates the accessibility of authored content against various international standards. In addition to creating accessible content, the tool is itself accessible, allowing a blind learner to create content themselves. A-Tutor is also designed for adaptability to any of several teaching and learning scenarios. There are four main areas that reflect this design principle: themes, privileges, tool modules, and groups. The A-Tutor theme system allows administrators to easily customize the look and layout of the system to their particular needs.

The privilege system allows instructors to assign tool management privileges to particular members of a course. Instructors may create assistants or course tutors that had limited control over any of the authoring or management tools. A-Tutor was designed with accessibility as a priority. A wide range of features ensure assistive technology users can participate fully in learner, instructor, and administrative activities. DIV based themes are available for added accessibility. A-Tutor conforms to international accessibility standards. IMS/ISO Access for all support allows learners to configure the environment and content to their specific needs.

Unisa is a distance education (DE) institution and it has currently employed a blended method approach to teaching. Assignments and tasks are marked online but study material is still paper based. The module in which I intend implementing A-Tutor is an engineering module. There are 500 student in the registered in the module and it is open for registration twice a year, i.e. it is a semester module. The demographics of the students are diverse, in that student who are already in employment and those who come from high school and therefore the age range is between 18 and 55 yrs.

Participating students will require access to internet, which Unisa provide free in the university's adhoc centres throughout South Africa. Assignments, tutorial and course communication will be conducted through A-Tutor and therefore all participating students will have to download A-Tutor from internet into their computers, PDAs and Smartphones. At the end of the semester all exams marks and assignment marks will be transferred back into SAKAI

for formal university communication with students. A-Tutor is social learning LMS and therefore it will be relatively easy to encourage students to enrol in the module once the it uses A-Tutor as described above. The only foreseeable limitation currently will be that the course material is not yet developed for other media such as smartphones.

Diigo
We are now spending a big part of our day working with online information - reading and researching related to travel, health, shopping, career, hobbies, news, online learning, smart investing, school papers, work projects, you name it. Yet the workflow with information, from browsing, reading, researching, annotating, storing, organizing, remembering, collaborating, sharing, to connecting dots into knowledge, is still largely ad-hoc and inefficient. Diigo streamlines the information workflow and dramatically improve your productivity. Our users include all, basically anyone who consumes lots of online information, either individually or as a team. Diigo is used in education, primarily to do the following (retrieved from – http://www.diigo.com/about).

- **Read more effectively with annotation tools** as you browse around the web. Add digital highlighters and sticky notes whether on PC, tablets, or mobile, and have them always be where you left them when you return! Print to mark-up, No longer necessary. Better recall, Proven, create reports with your annotations, just a few clicks, and no more copy & paste into Word or email.

- **Build your personal library in the cloud**, with links, pages, notes, pictures, etc. Never to be lost and ready to be accessed anywhere. Of course, those digital highlights, sticky notes and screenshots you added while going around the web automatically go into your library.

- **Say goodbye to broken links and lost treasures**, the web is dynamic - valuable content you found earlier is often no longer there when needed. Diigo archives the webpages for the links you save. Better yet, the archived pages are fully searchable. So do not just bookmark, save to Diigo.

- **Provide feedback and catch attention with annotation or screenshots** Want to draw attention to a particular paragraph to your Twitter followers, Highlight it and tweet. Want to comment on a student's writing, Use sticky notes for inline commenting. Want to provide feedback on a web design, Capture the page and mark it up.

- **Organize your information as little or as much as you want.** Since Diigo provides powerful search capabilities, the simple act of saving or annotating something, often with just one-click, will enable you to find it easily later. But of course, when you do want better organization, for easier review, for connecting the dots, for better sharing, for presentation, or whatever, Diigo provides unsurpassed organization capabilities, with both tagging and lists, to suit different needs.

- **Share information as much or as little as you want:** One advantage of storing information in the cloud is that you can share them easily when you want to. Each piece of information can be set as private or public on Diigo. If you are an extrovert and like to share your passion and showcase who you are, make public as the default, If you are introvert, keep them all-private, Want to send a whole collection to someone, just a few clicks away.

- **Enable better collaboration on information for any group**: large or small. Too little or too much sharing with email? Build a group knowledge repository for your family, your class, your team, or your entire company; each group member can add and subscribe to it and browse and search it. Better yet, group members can interact with on-the-page annotations. So imagine your class are all reading the same Wikipedia article, and commenting and discussing right on the same page.

Unisa is a distance education (DE) institution, and it has currently employed a blended method approach to teaching. Assignments and tasks are marked online but study material is still paper based. The module in which I intend implementing Diigo is an engineering module. There are 500 student in the registered in the module and it is open for registration twice a year, i.e. it is a semester module. The demographics of the students are diverse, in that there are student who are already in employment and those who come from high school and therefore the age range is between 18 and 55 yrs. Diigo will be implemented to to support and complement SAKAI, which the LMS in the university. Traditional instructions will be based on SAKAi and all courses.

MOOCs

A MOOC is a self-paced course that is offered freely online through the world best known universities. The collaborative components of technology-enhanced teaching and learning are visible in a MOOC and it is build on a platform e.g.edX, and is accessible freely online. The registration and/ or sign-up is both streamlined and relatively simple, as is the course space. It is easy because materials are clearly labelled, facilitators are introducing themselves, there are weekly assignments, and the entire course is packaged quite well. The platform or environment is created for scale and simplicity and the platform is intended to perpetuate its own framing of course design. The MOOC is delivered as a video podcast with an online discussion platform and links to asynchronous platforms for Q&A and student – student discussions.

Various small cohorts of self-selected groups, either by background or interest are formed outside the MOOC platform. Not surprising because enterprising 'MOOC-sters' organise themselves outside the online classroom, using social-media tools like Google Hangout and Facebook (Kirschner, 2012). There is an open course evaluation through which reviews from participants is solicited and the identity of the reviewers can be kept anonymous if they wish so.

MOOCs such the Analytics Edge have finally broad an understanding of the potential of adult learning on a global scale, especially when judged by the quantities and numbers of participants at a point in time, around the world and the shock and awe of scaling an architecture for participants. The SAKAI LMS is unable to accommodate a MOOC and therefore an external complimentary LMS such as Moodle, A-Tutor is required to run a MOOC in the university. Preferably, Moodle will do a better job because it complements SAKAI and the same document format is acceptable in both LMSs.

Unisa is a distance education (DE) institution and it has currently employed a blended method approach to teaching. Assignments and tasks are marked online but study material is still paper based. The module in which I intend implementing a MOOC is an engineering module. There are 500 students in the registered in the module and it is open for registration twice a year, i.e. it is a semester module. The demographics of the students are diverse, in that there student who are already in employment and those who come from high-school and therefore the age range is between 18 and 55 yrs.

Participating students will be required access to internet, which Unisa provide free in the university's adhoc centres throughout South Africa. Assignments, tutorial and course communication will be conducted through MOOC LMS and therefore all participating students will have to download the LMS from internet into their computers, PDAs and Smartphones. At the end of the semester all exams marks and assignment marks will be transferred back into SAKAI for formal university communication with students.

5. Conclusion

This assignment provided an accurate and in-depth overview of the nine technologies, many of which were used for the first time and therefore new and unfamiliar. At the beginning, the capabilities of these technologies were not known and navigation through each of them was a daunting task but at the end, all of them were found adequate, good and excellent in application. The task of reviewing how these technologies can be applied in education let to an

in-depth understanding of the attributes of each of the technologies and therefore an understanding of how they can benefit learners in an educational setting.

Various rating were assessed and reviewed but the LORI criteria were found adequate to evaluate the technologies. The criteria include eight themes and an evaluation rating scale of 1 –to- 5. The widening of the rating scale range, proved to be able to reduce the effects of biased evaluation due to unfamiliarity to the capabilities of the technologies, and therefore different or more criteria could have been added to the evaluation score card. Based on suggestions of the various literature that encouraged an inclusion of system requirements, operability, interactivity, learner support and control, fun factor and achievement.

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