Does Brightspace integrate with?  
The possibilities are endless with IMS LTI

This technical paper introduces the IMS Learning Tools Interoperability (IMS LTI) standard as an exciting option for integrating external learning tools with learning platform. The architecture of the standard, along with the implementation and usage in the Brightspace platform, are discussed in this document as well.

A question heard frequently by learning platform and tool vendors is “Do you integrate with Vendor XYZ?” Integrations between software vendors typically encompass either single sign-on (SSO) (where a user signed into one system can access a second system without logging in again) or a deeper transfer of information or commands between the two systems. These integrations are commonly enabled by Web Services or other connections from one system to the other using common Internet protocols with which information, commands, or files are communicated.

A major challenge for software vendors today is that many offer proprietary extensibility models. These might leverage common architectures or protocols to facilitate integrations, but each vendor’s specific interface is unique. This puts an ongoing maintenance requirement on the software vendor to maintain each proprietary method. In addition, because it is not possible for one vendor to build support for the proprietary extensibility model of each potential partner, vendors must prioritize their development investment, often leaving a gap in the marketplace for certain combinations of software.

Solution: Standards-based extensibility

Learning Tools Interoperability (LTI) is a standard from IMS Global Learning Consortium which enables tool consumers (primarily learning platforms) to easily connect with and pass system, course, and user information to tool providers (commercial tools or tools written and hosted by institutions for eLearning such as wikis, simulations, and protected content). LTI also includes the ability to pass back a grade from the tool provider to the learning platform and support Mentor roles which can be used to represent a parent, guardian or auditor.
LTI architecture

LTI 1.0 (or Basic LTI) was the first release of the LTI standard, which was made public early in 2010. D2L launched support of IMS LTI 1.0 with version 8.4.2 of the Brightspace platform, and was the first learning platform provider officially certified by IMS GLC for IMS Basic LTI Standard compliance. From a learning platform point of view, support for this standard means:

- Allowing users to configure connections to an external tool (typically by providing a URL to the tool’s launch page, a key (account id), a secret (password), and a list of system/course/user information required by the external tool).
- Enabling users to create and display links to the external application from within the learning platform for others to access.
- Providing a runtime environment to create launch requests and send the launch requests to tool providers when links are accessed.

LTI 1.1 was released in March 2012. From a learning platform point of view, support for this standard means:

- Allowing grades to be passed back from the Tool provider to the learning platform and stored in the Gradebook tool.

LTI 1.1.1 was released in July 2012. From a learning platform point of view, support for this standard means:

- Providing mentors/auditors with access to information within the Tool Provider for their associated students such as tracking and summary information.
D2L has been compliant for all versions of LTI as of version 10.1 of the Brightspace platform.

When a user clicks a link, the learning platform packages additional (or optional, depending on the tool provider’s requirements) information with an OAuth signature and sends it to the tool provider. OAuth is an open protocol used by a number of applications to allow secure API authorization in a simple and standard method, enabling tool providers to trust that the information in a launch request was packaged by the tool consumer.

When the tool provider gets the request, they use the shared secret to decrypt the information and ensure that the request is from the learning platform. The tool provider also uses the other information in the request to present its application with the appropriate settings for the user and the context (such as what course the link was clicked from). Behind the scenes, a LTI launch request is an HTTP Post from the learning platform to the tool provider with an array of hidden form elements. The tool provider receives the request, validates the information, creates user accounts and courses as required, and ultimately creates a session and redirects the user’s browser to the appropriate page of the tool. In the case of LTI 1.1, the tool provider may also set, read and/or delete numeric grades as needed, via simple messages of data signed with OAuth.

As more and more learning platform providers and tool vendors support the standard, additional combined solutions are available to the market. And, because a single standard is at the heart of the integrations, from an individual vendor’s point of view, only a defined investment is required. Although it is true that an integration based on a standard might not be as rich as what two vendors working together could accomplish to leverage all the unique capabilities of custom integration, standards-based integrations are simple and universal. In some cases, integrations using LTI can be the starting point for future deep integrations where the support of LTI enables organizations to use the two systems in conjunction to identify requirements, benefits, and an overall business case for deeper integration.
More about the data

Launch requests from the learning platform to LTI-enabled external learning tools are straightforward HTML forms. The data typically identifies the system, the course, the user, and any custom information that the tool requires. It also contains a signature created using a secret known only by the tool provider and the user who configured the link in the learning platform. The table below shows a sample LTI launch request and what the different fields communicate to the tool provider:

```html
<form method='post' id='LtiRequestForm', name='LtiRequestForm' action='http://someserver.com/ABC/toolx_lti.php' encType='xwww-form-urlencoded'>
  Hi Tool!
  <input type='hidden' name='launch_presentation_locale' value='EN__'>
  I'm calling from D2L's Learning Environment at Lake Valley University
  <input type='hidden' name='tool_consumer_instance_guid' value='dc5cf-d553a543a032ac46e053a334311c257eabc'>
  <input type='hidden' name='tool_consumer_instance_name' value='LVU'>
  <input type='hidden' name='tool_consumer_instance_description' value='Lake Valley University'>
  <input type='hidden' name='tool_consumer_instance_contact_email' value='john_smith@lvu.com'>
  <input type='hidden' name='tool_consumer_info_version' value='10.2.0'>
  <input type='hidden' name='tool_consumer_info_product_family_code' value='desire2learn'>
  <input type='hidden' name='user_id' value='39e7bada-5f1b-bb54-ed88-2ab1eb577565_1870'>
  <input type='hidden' name='roles' value='Student,Learner'>
  <input type='hidden' name='lis_person_contact_email_primary' value='fcatcher@email.com'>
  <input type='hidden' name='lis_person_name_family' value='Catcher'>
  <input type='hidden' name='lis_person_name_full' value='Frank Catcher'>
  <input type='hidden' name='lis_person_name_given' value='Frank'>
</form>
```

Hi Tool!

I'm calling from D2L's Learning Environment at Lake Valley University.

Hi Tool!

I'm Frank Catcher and I am a student.
LTI launch request

With the information provided in the launch request, the tool provider can verify the request, create any users or courses it needs, initiate a session, and redirect the user’s browser to the appropriate page, providing a seamless experience for the user.

A number of the fields in the launch request above are optional, and users setting up these links in the D2L Learning Environment have straightforward check boxes for choosing which information to send.

In this way, if a third party tool doesn’t have a need for a certain field, such as user email address or user name, that personal information should not be sent to the tool to protect user privacy. If a tool claims to need this information, you should make sure you understand why that information is required and how it will be used before configuring a link to send personal information of users.
For LTI 1.1, the following addition information will be included in the call to indicate to the Tool Provider where to pass back the grades within the learning platform:

- `lis_result_sourcedid` value="6747f009-b157-47b2-b922-4d4fb8f60f5"
- `lis_outcome_service_url` value="https://lvu.desire2learndemo.com/d2l/le/lti/Outcome"

This is where you can send my score.

For LTI 1.1.1, the role of the user that has launched the call must include “Mentor” and also include the following additional information to indicate which students the user is auditing:

- `role_scope_mentor` value="student12345,student67890"

I have permission to see results and activity for these students.

### User experience in D2L Learning Environment

Tool availability, roles, and permissions are extremely customizable in D2L Learning Environment. Accordingly any step-by-step instructions or screenshots might be different for an individual institution. In general, the process for setting up the system and configuring individual links to external learning tools follows these steps:

#### STEP 1: SYSTEM PREPARATION

This step is completed by the system administrator before the first tool is integrated.

**Set up permissions**

Decide what user roles will have permission to create and manage links, and what roles will be able to access external tools.

**Configure IMS mappings**

Indicate how the specific organization structure maps to the standard types of organizational units defined by IMS, and define the mappings for an organization’s D2L Learning Environment roles to standard IMS roles.

**Review tool consumer and course context information**

Configure the default system information that would identify D2L as the Tool Consumer when making the LTI calls to the Tool Provider(s), if applicable. NOTE: The key that is specified will be the default used if a key is not specified in the Tool Provider or External Learning Tool links. Configure the context information that uniquely identifies each course. Selecting the checkboxes for context will allow those options to be available for selection when an External Learning Tool link is set up. Tool Consumer Configuration is done at the administrative level and can be found under Admin Tools > External Learning Tools > Settings.
STEP 2: CREATE A LINK TO A TOOL PROVIDER
This step is performed by the administrator or the instructor for each vendor.

Get connection information from the tool provider
Tool providers will need to provide a key, secret, and URL, and will often also specify if they require other custom parameters be set and any optional LTI information be sent with launch requests, such as specific user information.

Define a tool provider in D2L Learning Environment (optional):
Tool provider configurations are useful to configure if there will be many links to the same vendor from a course. Configuring a tool provider enables management of the key/secret for all the links to that vendor from one location. Tool Provider configuration is typically done at the administrative level and can be found under Admin Tools > External Learning Tools > Manage Tool Provider.

Create and test the External Learning Tool Link:
Creating an External Learning Tool link can be done at the administrative level or at the course level.

At the administrative level, External Learning Tools can be found under Admin Tools > External Learning Tools. Links are created by an administrator. An example of a link created at an administrative level could be a tool that is placed on the organization navbar and is not specific to any particular course or a tool that is shared across all courses.

At the course level, External Learning Tools can be found under Edit Course > External Learning Tools. Links are typically created by instructors. An example of a link created at a course level is a specific lesson or quiz in a tool provider that is placed within the content of the course for the students to access.

To configure the link, specify the URL, key/secret (if different or not already specified in Tool Provider/Consumer configuration), any optional LTI or custom parameters, and which organization levels are allowed access to the link.

Configuring a New External Learning Tool Link
After configuring a link with the information from the tool provider, the link can be previewed, as can the raw form details. This is useful if there is any troubleshooting with the tool provider required.
STEP 3: INCORPORATE CONFIGURED LINKS INTO THE COURSE

After External Learning Tool links are created, there are various areas to place the links within the D2L Learning Environment such as on the Navbar, on a homepage as a widget, or within a course offering’s course content. In addition, links to External Learning Tools can be created anywhere the Quicklink function exists in the D2L Learning Environment.

Some examples of adding Quicklinks:

- In the Course Content tool, add a Quicklink to an External Learning Tool from the ‘Add Activities’ dropdown
- In the Course Builder tool, drag the Quicklink icon into the course content
- In the HTML Editor, use the Quicklinks tool to add External Learning Tool links to course content, news items, discussions postings, etc. to make the configured tool visible and accessible to users.

Incorporate Quicklinks in other places

Links to the configured tools from the course navigation bar can be added, and, if the tool does not require the full screen, it can also be included inside a custom widget on the course Homepage.

Once links are incorporated into the D2L Learning Environment, users can access them like any static link. Behind the scenes, however, the form generation/submission and tool provider redirects, logs the user into the tool and presents them with the appropriate page.

STEP 4: PASSING GRADES BACK TO THE D2L LEARNING ENVIRONMENT (FOR LTI 1.1+)

If the Tool Provider is LTI 1.1 compliant, a grade may also be passed back to the D2L Learning Environment after the user has completed the assessment. The grade will appear in a grade item in the Gradebook for the course.

The grade item may be created ahead of time by the instructor and associated to the External Learning Tool link in the Content of the course.

Alternatively, a grade item can be automatically created when the Tool Provider sends back the first grade for a user for the specific External Learning Tool link. The automatically generated grade item will be associated to the External Learning Tool link in the content of the course.
Transferring other information
IMS LTI currently covers the launch request from the learning platform (tool consumers) to the tool providers as well as the passing back of a numeric grade to the learning platform (tool consumer); it does not cover any other transfer of data between the two systems. If an integration requires additional information, this must be accomplished in another manner (e.g., the tool provider needs additional information from the learning platform, or the Tool Provider wants to send data back to the learning platform).

D2L Valence Learning Framework API’s can be used to fetch more context around the request (e.g., more detail about a user’s profile) and to post data back into the D2L Learning Environment. Information about D2L Valence Learning Framework API’s can be found on: http://docs.valence.desire2learn.com/index.html

In addition, the IMS Learning Information Services (LIS) standard aims to simplify and standardize the transfer of user, course, and outcome information between systems using Web Services. D2L is currently co-chairing the LIS working group, and collaborating on LIS 2.0 support with SunGard and Oracle to ensure interoperability and good user experience. Information about IMS Global Consortium and the LIS standard can be found on: http://www.imsglobal.org/toolsinteroperability2.cfm

Summary
Using the IMS LTI Standard, D2L has been testing integration with any and all tool providers, enabling these vendors to perform real-world testing while promoting support for the standard. D2L is thrilled with the initial adoption by partners and tool vendors, and is excited for the potential integrations and future partnerships that will result from IMS LTI. As more and more tool vendors, in-house development groups, and learning platform providers support the standard, there are sure to be many and a wide variety of tools available and adopted by organizations. Their seamless incorporation is sure to have a significant impact on teaching and learning.
About D2L

A global leader in EdTech, D2L is the creator of Brightspace, the world's first integrated learning platform. The company partners with thought-leading organizations to improve learning through data-driven technology that helps deliver a personalized experience to every learner, regardless of geography or ability. D2L's open and extensible platform is used by more than 1,100 clients and almost 15 million individual learners in higher education, K–12, healthcare, government, and the enterprise sector—including Fortune 1000 companies. The company has operations in the United States, Canada, Europe, Australia, Brazil, and Singapore. www.brightspace.com | www.D2L.com

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