Grades Formula 7.4.3

User and Reference Guide

Last Updated: June 28, 2006

Desire2Learn

Contents

About this guide

This guide focuses on features unique to the Formula grade item type and the Formula grading system. For general information on Grades and grading participants, including setting up your grade book, creating grade items, and releasing grades to students, refer to the Grading Participants section of the *Teaching with D2L* guide.

Related documentation

- *Teaching with D2l User Guide and Reference*

Grade item formula types

The formula type grade item is created in the same way as the other grade types using the Grades tool.

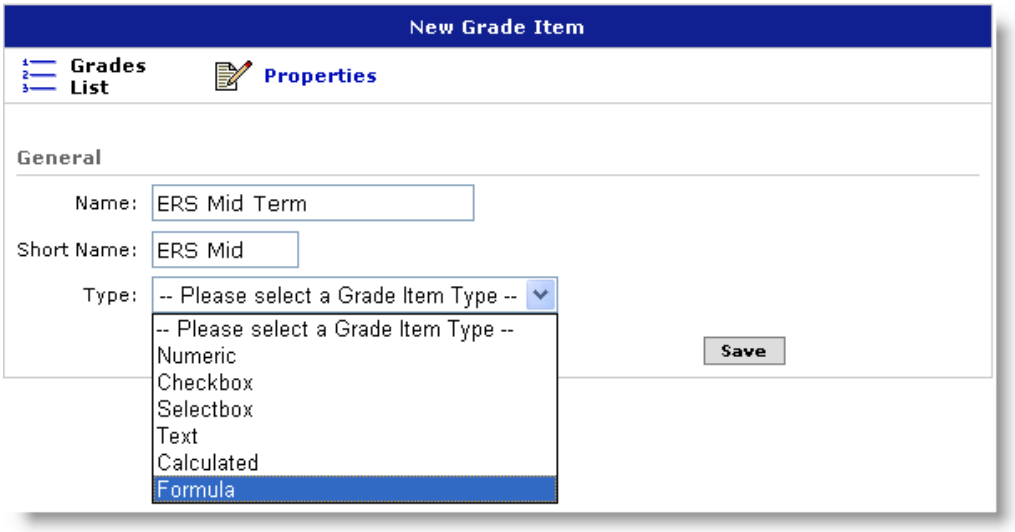
The formula type grade item gives you the ability to build formulas made up of a number of grade items in an assortment of relationships. For example, the formula can include numeric, checkbox, selectbox, and formula grade items. From these grade items you could build a formula that drops the minimum or maximum value from a range of grade items.

Formula overview

There are two main areas of interest related to the grade's formula feature: (1) formulas created as grade items, and (2) formulas created as part of the final grade, calculated and adjusted.

Please Note All of the formula functionality is turned off by default in the DOME when v7.4.3 of the Learning Environment is installed. Refer Appendix A for a list of the configuration variables relating to the Formula features.

Formula Grade Item



New Formula grade item

The formula grade item is a grade type created in the same way as the other grade types.

The formula grade item allows you to build formulas from grade items, including other formula items. When you create a formula grade item you specify which grade items will be included in the formula and the relationship between the items.

For example, if you wanted a grade to be made up of the sum of a number of other grade items, then you would use the formula grade item to achieve this.

Note Formula grade items cannot belong to a grade category. You must create all of the grade items that you want to include before you create a formula grade item.

Accessing the formula editor in order to create or edit a grade item

Creating a new formula grade item type

From the **Grades List** page, click the **New Item** icon  . The New Grade Item page displays.

From the New Grade Item page

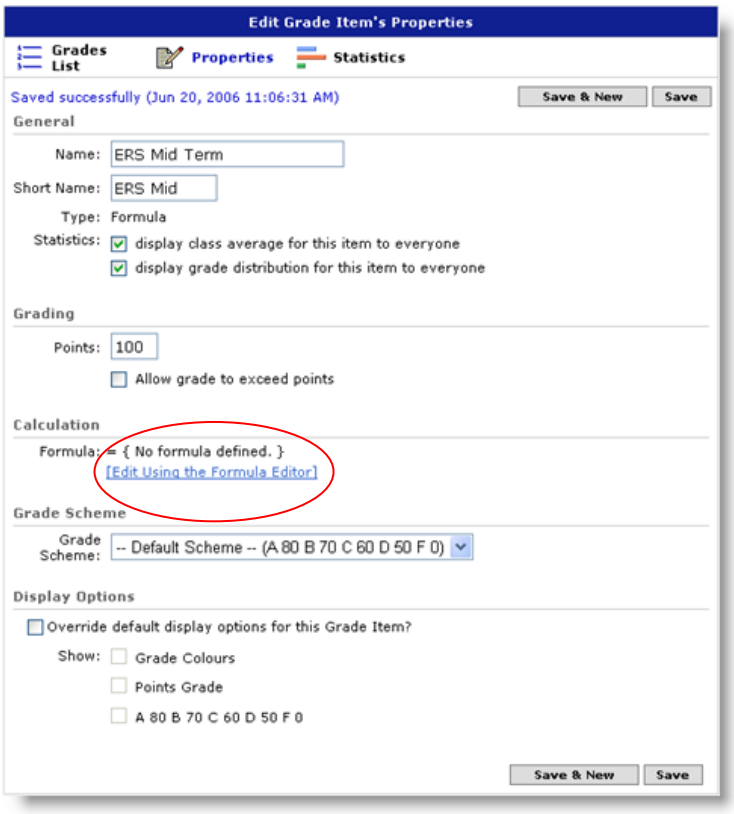
1. Give your new grade item a **Name** and an optional **Short Name**.
2. From the **Type** drop-down list, select the "Formula" option.
3. Click **Save**.

These steps set the item type and open the **Edit Grade Item's Properties** page.

Note In order for the grade item Formula to show up in the Type drop-down list, the variable d2l.Tools.Grades.ShowFormulaGradeItemType must be turned ON for the organization.

From the Edit Grade Item's Properties page

1. The **Name** and **Short Name** (if provided) will be filled in for you. You can edit them from this page.
2. The Type is set and cannot be changed.
3. Check any **Statistics** you want to display to students: class average and/or grade distribution for this item.
   - Display class average for this item to everyone will show a graphical representation of the class average on this item in the item statistics page.
   - Display grade distribution for this item to everyone will show a grade distribution graph for this item in the item statistics page.
4. Set **Points** value. This is a required field with a default value of 100.
5. Check **Allow grade to exceed points** if you want to allow students to receive a grade higher than the number of points specified. For example, if you want to allow for bonus grades on this grade item.
6. From the **Calculation** area you will define and edit your formulas. If you are editing an existing formula, it appears here. To create a new formula, or edit an existing one, click the **Edit Using the Formula Editor** link. The Formula Editor displays. See below for information on using the editor.
7. Select a **Grade Scheme** from the drop-down list of available schemes: percentage, letter grade, pass/fail, or custom. Refer to the Grade Scheme section in the *Teaching with D2L* guide for information on creating, selecting, and deleting grade schemes.
8. By default, the grade item will use the display options that you defined in the Grades Setup area, but you can override settings by checking Override default display items for this Grade Item and checking the boxes next to the types of information you want to display to students for this item.
9. In the **Display Options**, check the boxes beside the grade items you want to include: colours, points, or letter.
10. Click **Save** to complete your grade item, or click **Save & New** to save your item and continue creating new grade items.



Grade Item's Properties with the Formula Editor link highlighted

Formula Editor

Use the Formula Editor to add and edit a formula in a grade item.

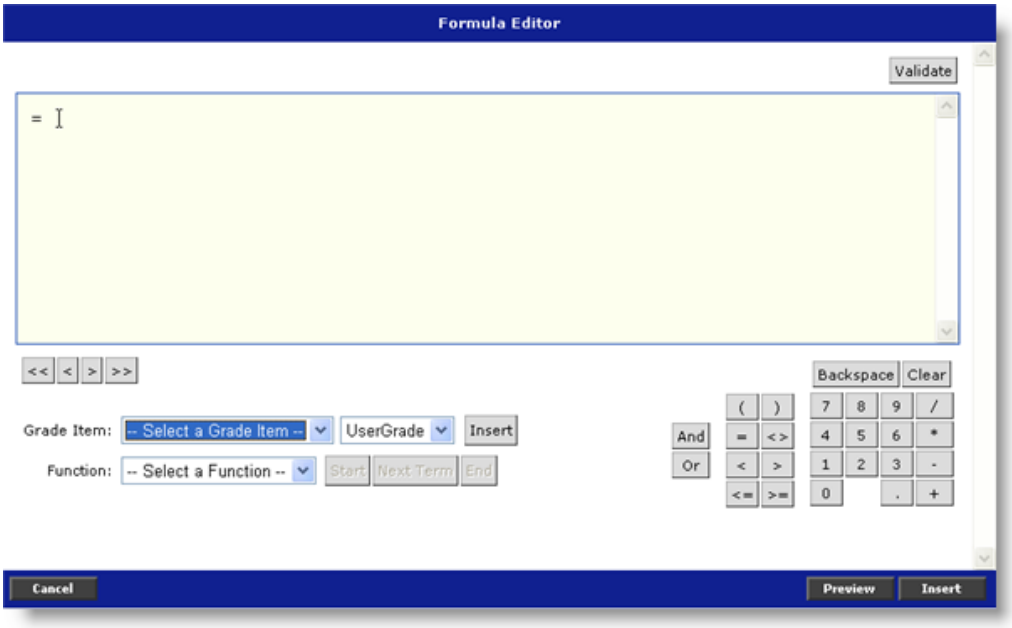
Accessing the formula editor

The formula editor is accessed through the **Edit Grade Item's Properties** page, which is accessible when you create a new grade item or edit an existing one.

From the Edit Grade Item's Properties page:

Click the **Edit Using the Formula Editor** link in the Calculation area of the Edit Grade Item's Properties page (highlighted in the screenshot above.)

The Formula Editor pops-up.



The Formula Editor is the interface through which you build, edit, validate, and add formulas to a grade item.

Using the Formula Editor

While the operation of the formula editor is fairly straightforward—essentially it relies on a WYSIWYG interface—there are some features unique to this editor and worth highlighting.

Note For many operations, you can either use the interface keys or the corresponding keys on your keyboard to add and edit items in the formula.

Formula Editor features

Formula area

The formula area is where the formula text is displayed.

The equals sign (=) displayed in the formula is present when you begin creating a new formula, and cannot be deleted.

Cursor

A cursor shows your position in the formula. Additional formula items are added in front of the cursor, and the cursor is positioned after the new items that are added.

Click in a formula to position the cursor.

Moving the cursor

Certain buttons on your keyboard and buttons on the editor's interface correspond. Corresponding buttons perform the same actions when clicked.

These buttons moves the cursor to the start of the formula text (and to the right of the equals sign (=) that start all formulas) and to the end of the formula text.

These buttons move the cursor one item to the left or one item to the right in the formula text.

Building your formula

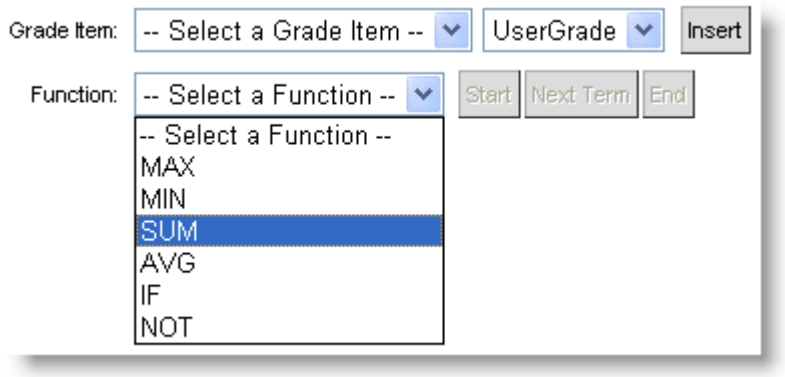
Build formulas using a combination of grade items, grade item options, and functions; plus numeric, comparison, and Boolean operators. The complexity of your formulas can range from simple—determining the sum of a series of grade items—to increasingly involved—being able to drop the highest or lowest grade from a series of grade items before determining their sum.

In general, the steps involved to build a formula are as follows: (1) Choose the combination of function, grades items, and operators, and the relationship between them that you want to include in the formula. (2) Validate your formula. (3) Preview the formula. And (4) insert the formula in the grade item.

For some examples of formula scenarios, refer to Appendix B.

The building blocks

Functions



Use the values in the Function drop-down list to insert functions in formula.

After selecting a function, click **Start** to insert the start of the function into the formula.

Function	Description	Calculation
SUM{ a, b, c, ... }	The Sum function calculates the sum of a series of values {a, b, c, ...} These values may be real numbers, numeric grade items, checkbox grade items, selectbox grade items, formula grade items, or functions.	The calculation for the Sum function adds the values {a, b, c, ...} together and returns the total. The range of possible return values are the set of real numbers, as well as the *null* value.
AVG{ a, b, c, ... }	The AVG function calculates the average of a series of values Calculate the average of the series of values {a, b, c, ...} These values may be real numbers, numeric grade items, checkbox grade items, selectbox grade items, formula grade items, or functions.	The calculation for the AVG function adds the values together, divides the total by the number of values, and returns the results. The range of possible return values are the set of real numbers, as well as the *null* value.

MAX{ a, b, c, … }	The MAX function calculates the maximum of a series of values {a, b, c, ...} These values may be real numbers, numeric grade items, checkbox grade items, selectbox grade items, formula grade items, or functions.	The calculation for the MAX function returns the largest values of the series {a, b, c, ...} The range of possible return values are the set of real numbers, as well as the *null* value.
MIN{ a, b, c, … }	The MIN function calculates the minimum of a series of values {a, b, c, ...} These values may be real numbers, numeric grade items, checkbox grade items, selectbox grade items, formula grade items, or functions.	The calculation for the MIN function returns the smallest value of the series {a, b, c, ...} The range of possible return values are the set of real numbers, as well as the *null* value.
IF{ cond, then_val, else_val }	he IF function operates as a Boolean statement with the following properties. All three parameters are required for the function to be valid. *cond* is a Boolean statement. *then_val* may be a Real number value, a numeric grade item, a checkbox grade item, a selectbox grade item, a formula grade item, or a function. *else_val* may be a Real number value, a numeric grade item, a checkbox grade item, a selectbox grade item, a formula grade item, or a function.	The calculation for the IF function works such that, IF *cond* is TRUE, then the *then_val* is returned. If *cond* is FALSE, then the *else_val* is returned. The range of possible return values are the set of real numbers, as well as the *null* value.
NOT{ cond }	The value in the NOT function operates as a Boolean statement.	The calculation for the NOT function works such that, if *cond* is TRUE, then a *FALSE* statement is returned. If *cond* is FALSE, then a *TRUE* statement is returned.

Start

Click the Start button to insert a function in the formula.

The selected function is inserted into the formula area, followed by an open bracket {.

Grade Item

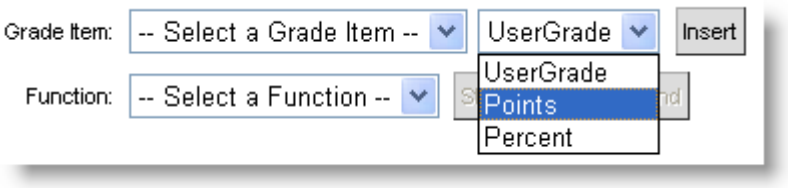
The Grade Item drop-down list contains the following items that you can insert into your formula:

- Numeric grade items
- Checkbox grade items
- Selectbox grade items
- Formula type grade items*

After selecting a grade item, choose which grade item value will be inserted into the formula.

*The formula type grade items that you can add to a formula cannot be the formula itself. That is, a formula item that depends on itself for value. This prevents a circular reference from occurring between formula items.

Grade Item Values



The grade item values drop-down list determines the grade item value that will be inserted into the formula.

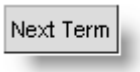
Value	Description
Item.UserGrade	The score the user has received for the grade item.
Item.Points	The Points value for the grade item. This value only applies if the grading system for the OrgUnit is set to the 'Points' or 'Formula' system.
Item.OutOf	The Out Of value for the grade item. This value only applies if the grading system for the OrgUnit is set to the 'Weighted' system.
Item.Percent	The percentage value for the grade item. This value is calculated as follows: (Item.UserGrade / Item.Points) * 100 Item.Points is replaced with Item.OutOf for the 'Weighted' system.

After choosing both the grade item and the item's value, click **Insert** to add it to the formula.

Insert

Use the Insert button to insert a grade item in the formula.

Next Term

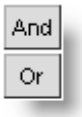


The Next Term button, activated when you have a function selected, inserts a comma (,) in the formula area in order to separate the terms in a function.

End

The End button ends a function by inserting a closing bracket } in the formula.

And/Or



The And and OR buttons insert the associated Boolean operator in the formula area.

Comparisons and Brackets

Use these buttons to insert the associated comparison operator or bracket into the formula area.

Operator	Definition
=	Equal to
< >	Not equal to
>	Greater than
> =	Greater than or equal to
<	Less than
< =	Less than or equal to
(	Left bracket

Operator	Definition
)	Right bracket

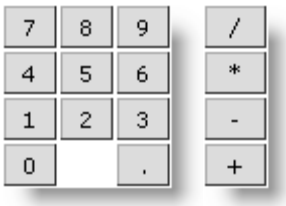
Backspace

The Backspace button deletes the terminal item to the left of the cursor.

Clear

The **Clear** button clears the contents of the formula editor. After clicking this button, you will be prompted as to whether or not you are sure you want to clear the entire formula that is in the formula area.

Numeric keys



Use the number, decimal, and operator keys to insert the associated item in the formula area.

Operator	Definition
+	Addition
-	Subtraction
*	Multiplication
/	Division

Cancel

Click **Cancel** to cancel changes made to the formula text and close the Formula Editor pop-up window.

After clicking this button, you will be prompted as to whether or not you are sure that you want cancel your changes.

Preview

Clicking **Preview** opens the Formula Preview pop-up window. The formula is validated before the Preview window pops-up.

This operation previews the formula as applied to the first 10 participants from the Grades List.

If the formula is invalid, you will receive an error message when you try to preview it.

Clicking Ok in the error message returns you to the formula and the cursor will be positioned in the formula at the spot where the error occurs.

The error type will also display in red above the formula error.

Refer to Validation Errors section, below, for a list of potential errors and their causes.

Insert

Similar to the Preview button, clicking the **Insert** button first has the system try and validate the formula.

The syntax of the formula text that has been entered into the formula area must conform to standard formula grammar in order to be inserted.

Refer to the Validation Errors section, below, for a list of potential errors and their causes and solutions.

If the formula is valid, the Formula Editor window closes and the formula is updated in on the page from which you accessed the Formula Editor.

Validate

Click **Validate** in order to validate the formula that you have entered into the formula area.
The syntax of the formula text that has been entered into the formula area must conform to standard formula grammar in order to be valid.

You cannot preview or insert an invalid function.

If the formula is invalid, you will receive an error message when you try to validate it.

Clicking Ok in the error message returns you to the formula and the cursor will be positioned in the formula at the spot where the error occurs.

The error type will also display in red above the formula error.

Refer to the following section for a list of potential errors and their causes and solutions.

If your formula validates successfully, then you receive a message stating: “Formula syntax validated successfully” above the formula area.

Validation Errors

Error	Description	Examples

Unexpected token type	This error type occurs when an unexpected token has been entered into the formula syntax	=[GradeItem X.Points]4
		= 5SUM{
		= 5(
		= }5
		= }SUM{
		= }(
		=)5
		=)SUM{
		=)(

Unbalanced parentheses	This error type occurs when a single (or) or { or } bracket is entered into the formula or function without the associated) or (or } or { bracket.	= (5 + 1 = 5 + 1 } = MAX{ 5, 2
Invalid number of operator parameters	This error occurs when there are an invalid number of operator parameters	= 5 +
Invalid number of function parameters	This error occurs when there are 0 parameters to a function, when there are more than 3 parameters to an IF function, or when there are more than 1 parameter to a NOT function.	= SUM{} = IF{ 5 < 2, 2 } = NOT{ 5 < 2, 2 }
Numeric value expected	This error occurs when an AND or OR operator is used outside of a Boolean condition.	= IF{ 5 < 2, 1 OR 2, 4 } = 1 < 4 = SUM{ 1=2, 3, 4 }
Boolean value expected	This error occurs when a comparison operator (that is, >, <, >=, etc.) is used outside of a Boolean condition.	= IF{ 5, 1, 4 } = NOT{ 4 } = IF{ MIN{ 4, 5 }, 1, 2 }

Note

If you are using the Formula Editor to edit a grade item formula, then the denominator value used in the preview is the value of the Points/Out Of field for the grade item when the editor was opened. If the value for the Points field for the grade item was empty when the editor was opened, you will receive the following message:

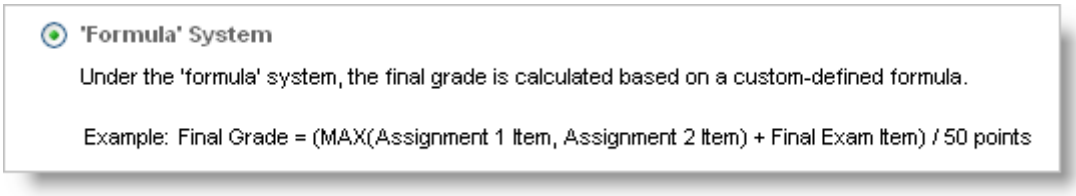
"The formula cannot be previewed because a Points value has not been entered for the grade item. You must insert the formula you have entered and enter a Points value before you can Preview the results."

Editing a formula

To edit an existing formula grade item, from the **Grades List** page, click the header name for the formula. This is a link that will take you to the **Edit Grade Item's**

Properties page for that formula. From here, you can edit the formula and/or the formula properties, as described in the previous sections.

Final Grades Formula



Formula option on the Grades Calculations page

In order to use a formula to calculate the final grade—calculated or adjusted—select the "Formula" System option on the Grades Calculations page.

Note This option is dependent on the variable d2l.Tools.Grades.ShowFormulaSystemOption being set to ON for the OrgUnit.

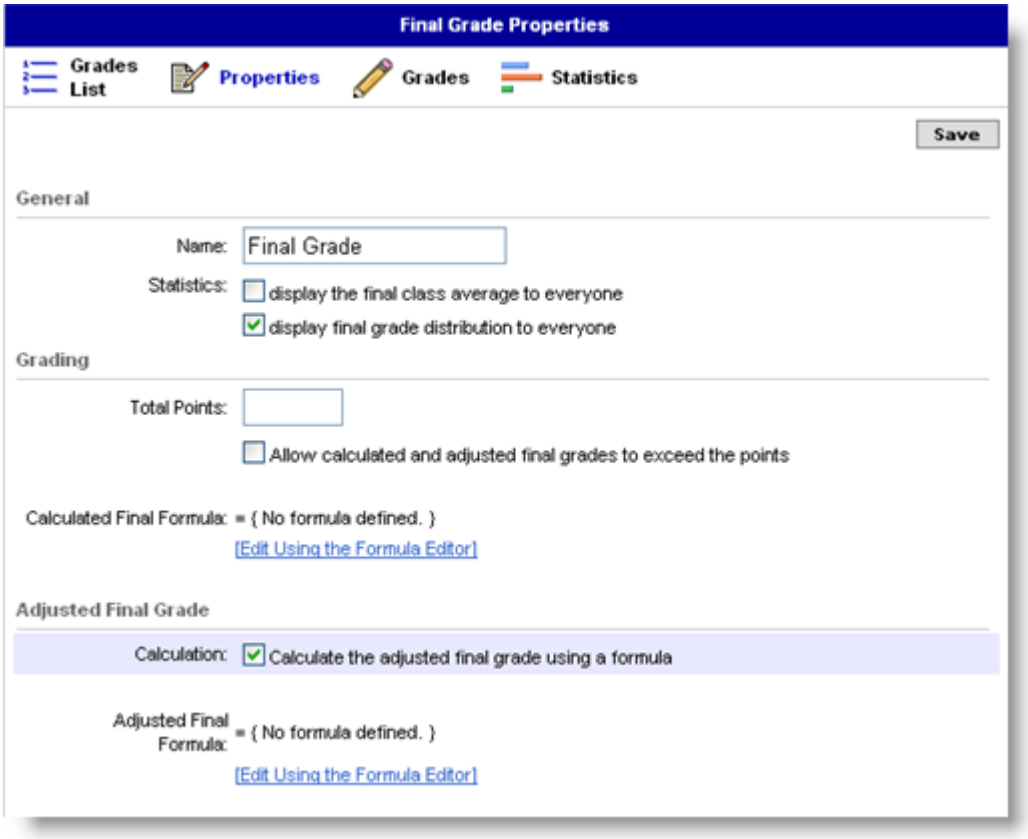
Final Calculated Grade and Adjusted Final Grade Formulas

In addition to being available to grade items, the Formula Editor is available to add formulas to the Calculated Final grade and the Adjusted Final grade.

The calculated grade and the adjusted grade can use different formulas. If you want to use the same formula for both instances, you can define the formula for the calculated grade and transfer it to the adjusted grade on the final grades page.

The Final Calculated Formula and the Final Adjusted Formula fields display when the grading system for your organization is set to 'Formula System' in the Grades Calculations page.

With both these options, click the **Edit Using the Formula Editor** link to open the Formula Editor in order to add/edit the appropriate formula.



Final grade properties showing the calculated and adjusted formula options

Final Calculated Formula

If the grading system for your organization is set to the Formula system, then a Final Calculated formula is required.

A Total Points value is also required for a Final Grade Item if the grading system is set to Formula.

The total points field has no default value. You must set this value before you will be able to calculate the final grade value.

Under the formula grading system, the Total Points value for a formula grade item is used to give provide the "out of" score for the final grade item.

The formula that is defined for the final grade item calculates the value for the numerator for the final grade item, and the Total Points value provides the denominator.

Final Adjusted Formula

The Final Adjusted formula is *not* required under the formula system. If you choose not to define an adjusted formula, then the final adjusted grade is treated the same as the other grading system.

If you check "Calculate the adjusted final grade with a formula" checkbox, then when the adjusted final grade is recalculated the value will be calculated using the formula defined here.

Note The adjusted final formula may include the final calculated formula value in its formula. This is unique to this feature.

Notes

If you are using the Formula Editor to edit the Calculated Final Formula or the Adjusted Final Formula, then the denominator value used in the preview is the value of the Total Points field for the Final Grade Item when the editor was opened. If the value for the Total Points field was empty when the editor was opened, you will receive the following message:

“The formula cannot be previewed because a Total Points value has not been entered for the Final Grade Item. You must Insert the formula you have entered and enter a Total Points value before you can Preview the results.”

User Grades

The "show final grade calculation" option is not available when using the formula system, and the formula used to calculate the final grades is *never* displayed to the participant.

Formula errors in formulas and in the final grades

Errors may occur on a user-by-user basis, depending on the structure of the formula and the grade items included.

If a grade item that is used in a formula cannot be found when the formula is validated, then the formula will produce an error.

Errors in the formula are never displayed to the participant, even in the final released grades. Instead, a formula with an error will display to the participant as a symbol "-".

Errors are displayed on the Grades List to instructors.

Deleting Formula Items

Delete Formula items in the same way as you would delete other grade items.

From the Class List page, click the delete icon  . Select the formula to delete and click **Delete Selected**.

▸ Deleting grade items used in a formula

Grade items that are used in a formula are highlighted in the list of grade items to delete. The message “(This grade item is currently in use by a formula.)” is displayed after the grade item.

Click the Help icon next to the item to open the View Formulas pop-up and see a list of formulas using this grade item.

Grade items that are in use by a formula can still be deleted; however, when a formula containing a deleted grade item is validated, the validation will return a missing grade item error.

Exporting Formula Grade Items

When you export a formula grade item, *only* the calculated value of the formula is exported (excluding final grade), not the formula itself.

Copying the Grade Book will not copy formulas.

As of this version, you cannot import formulas to the Grade Book.

Some notes on formulas

Formulas and the Weighted system

If your organization uses the Weighted grading system, then the category and grade item weights are ignored in the calculation of a grade item value. The weighted system uses the 'Out of' value.

If your organization uses the Weighted grading system, and the value for the 'Out of' field for the grade item was empty when the Formula Editor was opened, you will receive the following message:

“The formula cannot be previewed because an Out Of value has not been entered for the grade item. You must insert the formula you have entered and enter an Out Of value before you can Preview the results.”

Binary floating point calculations

In some unusual cases, while using Boolean operators in a formula, you may receive unexpected results from your formulas. This is likely due a conflict between the way values are stored before calculations and the way they are rounded off afterwards.

For example, a formula such as = IF{ (grade.item/15) < 0.8, 0, 100} may return unexpected results.

There are two workarounds for this issue:

1. Avoid using decimal places in comparison formulas, by multiplying the comparisons by a factor that eliminates the decimal. For example, a multiple of 10.
   - = IF{ (grade.item * 100) / 15 < 80, 0, 100}
2. When performing comparisons, ensure that both sides of the comparison contain computations. This will guarantee the agreeability of the decimals.

- =IF{ grade.item/15 < 12/15, 0, 100}

Bonus designation and formula grade item values

Whether or not a grade item used in a formula is flagged as a bonus item has no effect on the calculation of a formula grade item value. The bonus designation does not change the calculation of the grade item's user grade, points, out of, or percentage value.

Formula items and categories

Formula type grade items cannot be created within a Grade Category. Similar to Calculated types, Formula types are "top-level" grade items.

Displaying Formula grade type items in the Grades List

Formula type grade items are displayed in the Grades List the same as other grade items.

"Null" values

If the result of a formula calculation is "null," and the "Include non-graded items in calculated final grade and adjusted grade" option is *not* checked for the organization, then the value is displayed as "-/{denominator}", where {denominator} is the Points value for the grade item.

That is, if the flag is not checked, then the null grade item values are calculated with a null value.

Otherwise, if the "Include non-graded items in calculated final grade and adjusted grade" option is checked for the Org Unit, the value is displayed as "0/{denominator}", where {denominator} is the Points value for the grade item.

That is, if the flag is checked, then the null grade item values are calculated with a zero value.

Appendix A: Configuration (DOME) Variables

Variable	Default Value	Description
d2l.Tools.Grades.ShowFormulaSystemOption	Off	When enabled, this variable causes the Formula System option to appear in the Grade Calculations setup page. Note: If the value for this variable is Off and the default value for d2l.Tools.Grades.GradingSystem is Formula System, the Points System will be used instead as the default grading system.
d2l.Tools.Grades.ShowFormulaGradeItemType	Off	When enabled, this variable causes the Formula grade item type to be displayed in the type drop-down list when creating a new grade item. Note: Formula items that have already been created are retained even if this variable is turned off.
d2l.Tools.Grades.GradingSystem	1 (Weighted System)	This variable determines the grading system used by the OrgUnit. This variable replaces the variable d2l.Tools.Grades.UseWeightSystem from previous versions of the tool. The values are: 0 = Points System 1 = Weighted System 2 = Formula System Notes: If the default value is set to Formula System (2) and d2l.Tools.Grades.ShowFormulaSystemOption is turned 'Off', the Points System (0) will be used as the default value instead. If the value for d2l.Tools.Grades.ShowFormulaSystemOption is 'Off' for the Org and the default value for this configuration variable is 2 (Formula System), then the default value 0 (Points System) should be used instead. If the value for d2l.Tools.Grades.GradingSystem is changed for an OrgUnit from 2 (Formula System) to another value, then the

		properties (including formulas) for the Final Grade Item for the OrgUnit are retained.

Appendix B: Use Cases

- **Drop the lowest 2 grade items from a set of 3 grade items.**

  = SUM{ [G1.UserGrade], [G2.UserGrade], [G3.UserGrade] } – MIN{ [G1.UserGrade], [G2.UserGrade] } – IF{ MIN{[G2.UserGrade], [G3.UserGrade]}=MIN{ [G1.UserGrade], [G2.UserGrade] } , MIN{ [G1.UserGrade], [G3.UserGrade] }, MIN{ [G2.UserGrade], [G3.UserGrade] } }

- **If the number in an item is over 5, then subtract 2 points for each number over 5 from the semester grade**

  CALCULATED_FINAL_GRADE.UserGrade - IF{ [ITEM1.UserGrade] > 5, 2 x ([ITEM1.UserGrade] - 5), 0 }

- **If a student's score in any item is below 80%, then the student automatically fails the course**

  IF{ MIN{ [ITEM1.Percent], [ITEM2.Percent] } < 80, 0, 100 }