

Learning Gain - Annotated Bibliography

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Abstract

The purpose of this literature search was to produce an annotated bibliography outlining the new literature and research that has emerged on learning gain within higher education since the RAND report was published in 2015. Using some of the key themes from the RAND report, this bibliography organises the literature into: (1) ways of measuring learning gain, (2) limitations to measuring learning gain, (3) benefits to student learning gain and (4) the purpose of measuring learning gain.

This research found that four main areas emerge from the current literature. These are: (1) the use of current data sources to measure learning gain, (2) the limitations of using assessment grades to measure learning gain, (3) the development of current teaching practice to impact student learning and (4) the inclusion of learning gain within the Teaching Excellence Framework (TEF).

From this research it is clear that recent discussion of learning gain focuses on many of the key areas of the RAND report. In addition, the search further highlights the significant variations of measuring learning gain and the implications and issues around it.

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1. Introduction

In recent years there has been a growing interest in evaluating how learning gain can be used to capture the student experience within higher education. When implemented effectively it is seen throughout current research as a useful tool of measuring the impact higher education can have upon its students. It is perceived as a valuable way for university institutions to distinguish themselves in the growing popularity and demand of attending university by evidencing the quality of their education to future students, as well as highlighting the professional development of their students to employers (McGrath *et. al.* 2015).

In 2015, RAND Europe carried out research, commissioned by the Higher Education Funding Council of England (HEFCE), evaluating the importance of capturing learning gain within higher education (McGrath *et. al.* 2015). This research used an analysis of current literature, as well as information gathered from university institutions and higher education bodies within the UK to evaluate current opinion of learning gain and the different ways it is being measured and used. Within this research the authors found numerous issues around the concept of learning gain. Firstly, the definition of learning gain changes across institutions. Whilst the report follows HEFCE's definition of the concept as an 'attempt to measure the improvement in knowledge, skills, and work-readiness and personal development made by students during their time spent in higher education', the research highlights an uncertainty around what learning gain actually means, with some seeing it as 'distance travelled', some as 'value added' and some as merely 'learning' (2015, p. xi). This uncertainty and lack of fixed definition creates a certain sense of hesitation around measuring the concept.

Secondly, the RAND report highlights another uncertainty in terms of the variety of ways in which learning gain can be measured. The authors identified 14 different ways of measuring learning gain within higher education ranging from assessment 'grades', to 'standardised tests', to 'student surveys' (p. xiii). As well they identified certain 'proxies' of measuring learning gain, such as graduate outcome surveys or data on student 'engagement and experience'; concluding that these methods do not provide an accurate measurement of learning gain and need to be used alongside other methods (p. xiii-xiv). The report concludes overall that there needs to be more research and discussion around the importance of learning gain and also more evaluation into the practicality of these different methods of measuring learning gain within higher education.

2. Aims and Objectives

The purpose of this literature search was to produce an annotated bibliography outlining the new literature and research that has emerged since the RAND report was published in 2015. Using some of the key themes from the RAND report, this bibliography organises the literature into: (1) ways of measuring learning gain, (2)

limitations to measuring learning gain, (3) benefits to student learning gain and (4) the purpose of measuring learning gain.

3. Key Findings

The following is a brief summary of the key findings of conducting this literature search.

- There seems to be increased discussion of using current data sources to measure learning gain, despite previous perceptions that this was not the most effective method.
- Many continue to discuss limitations of using grades to measure learning gain, with some advocating for reform in the way universities implement and respond to assessment.
- A large proportion of the sources focus on how current methods of teaching could be developed in order to further impact student learning, especially in terms of making sessions more interactive.
- A few sources mention the implications of using learning gain within the Teaching Excellence Framework (TEF), and the considerations needed for learning gain to be a beneficial aspect of the framework.

4. Research Protocol

4.1 Organisation of the Literature Search

Once the aims and objectives of this literature search were finalised, the following databases were identified as the most relevant for this research.

SAGE journals	Scopus
Education Database on ProQuest/ Educational Research Abstracts	ERIC
Taylor and Francis Online	Science Direct

Alongside this, this search also explored larger databases such as Google Scholar. However, one issue with searching Google Scholar is that it brought up many useful sources that came from a SRHE conference in autumn 2017. Most of these were posters or PowerPoint presentations and did not have all the information needed to evaluate the source and therefore, accurate analysis could not be ensured. Due to the scope and time-limit of the study, the search only focused on sources available in these databases and did not explore grey literature or sources from higher education websites, like the Higher Education Academy.

When searching these databases a set of search strings was established in order to ensure consistent research. However, as the aim of this search was to provide a general overview of the recent published literatures, many of the search strings were kept broad (e.g. 'Learning Gain' AND 'Higher Education'). The search strings varied

in the terminology used, using phrases such as 'value added' and 'distance travelled', in order to ensure thorough results

4.2 Inclusion and Exclusion Criteria

The following inclusion and exclusion criterion was set in order to ensure an organised search:

Include	Exclude	Rationale
2016 onwards	pre-2016	In line with the purposes of the literature search
Higher education/ tertiary education/ further education	Primary education/ secondary education/ non-higher education	The literature search was focused on higher education context only
Region: anywhere		In order to explore the ways in which learning gain is perceived internationally - as a way to develop UK practice - also to prevent the scope being too small
Specific reference to: methods of measuring learning gain/ limitations in measurements of learning gain/ ways of impacting student learning gain/ the purpose of measuring learning gain		In line with aims and objectives of the research

4.3 Search Process

When conducting the search a list was created that outlined the different sources discovered, their bibliographic information, the area(s) the sources address, whether the sources were relevant and the quality of the research. Following this, a data extraction process was used to outline the sources most relevant to the study. Due to the limited scope through the focus on post-2016 sources, the majority (15) of the sources were put through the data extraction process, except those that were not higher education specific or any that merely provided a description of a current practice of measuring learning gain with no reference of its impact on current discussion. From these 15 sources, 10 sources were identified as being the most relevant and providing good quality research. These sources are included in the following annotated bibliography.

5. Annotated Bibliography

5.1 Methods of Measuring Learning Gain

As the RAND report (McGrath *et. al.* 2015) highlighted there are numerous ways to measure learning gain across higher education; however, the response to whether these ways are effective or not varies. The report outlined how many of the ways to measure learning gain, such as grades or engagement surveys were not initially created for this purpose. As well, the report notes that, with these types of measures, comparing across institutions can be difficult. They note that in order to accommodate for this difficulty they should be used alongside other methods. However, with some of the recent literature outlined below, they discuss how current data sources and methods can actually be used in isolation, to measure learning gain.

Cameron, A., Wharton, Y. and Scally, J. B. (2018). An Investigation into the Comparative Learning Gain and 'Value Added' for Students from Widening Participation and Non-Widening Participation Groups: A Case Study from Sports Degrees. *Higher Education Pedagogies*. 3 (1), pp. 40-59.

The article discusses a longitudinal research project 'outlining graduate outcomes of both Widening Participation (WP) and non—WP students graduating from a sports degree, between 2000-2015' (p. 40). The aim of the research was to assess whether the learning gain was different between the two groups of students. In a higher education context, the authors point out that, WP students 'are less likely to complete their studies' and 'are less likely to pursue postgraduate study' (p. 41). The authors outline that, apparently, WP students are 'less likely' to live in university accommodation or take part in university organised social activities, factors that, they argue, impact upon a student's learning gain. Whilst many have seen graduate outcomes as a 'proxy' for measuring learning gain, the study attempts to show how it can be beneficial to current research projects.

In this study students were asked to fill out a questionnaire that invited them to discuss areas of employability, such as career aspirations and their 'preparedness for employment' (p. 45). Each response was correlated to that student's demographic data in order to associate answers with either WP or non-WP students. The overall findings of this showed there was no difference between the amounts of WP or non-WP students that were not awarded a degree. There was no difference between the degrees gained by students who were 'first in family' to attend university and those who had family history of higher education (p. 49). As well, the findings show that students from 'deprived backgrounds were as likely to complete postgraduate study' (p. 49). The study concludes that the research demonstrates how the sports programme at this particular university benefits the learning gain of WP and non-WP students equally. Their research also concludes that it is important to compare learning gain across student groups in order to ensure that education is inclusive and equally beneficial to all. As well, this study highlights how graduate outcomes, can actually be useful in measuring the learning gain of students, rather than a 'proxy' measure as it is currently seen in learning gain discussion.

Roohr, K. C., Liu, H. and Liu, O. L. (2017). Investigating Student Learning Gains in College: a Longitudinal Study. *Studies in Higher Education*. 42 (12), pp. 2284-2300.

This article discusses a longitudinal study into student learning gain within American higher education. The study uses an ETS Proficiency Profile (EPP) to assess student gains within areas of 'critical thinking, reading, writing and mathematics' (p. 2284), in order to evaluate the difference in student learning gain across different periods of time. In addition, the research team aimed to use demographic data to evaluate 'factors predicting learning gain' (p. 2291). The EPP is a nationwide assessment taken by college students in the US so that institutions can show the quality of their programmes offered for 'accreditation and funding purposes' (ETS, 2018) and to impact upon other aspects within evaluating higher education. In this research, the authors used the EPP as a way of measuring learning gain of students. The research was conducted on a sample of 168 students from one US institution. Students took the test at the beginning of their studies and were re-tested at different points later in their course; the 'learning gain was calculated using the difference between the first and last test scores' (p. 2289).

The authors found that the more time spent at college the higher the learning gain across all 4 areas being measured. They found that after 2 years students had minor learning gains, mostly in critical thinking, whilst after 4 or 5 years students had more substantial gains, mainly in reading and maths. As well, the researchers identified a 'racial/ethnic gap in college reading performance' (p. 2296), in which white students had more significant learning gains than students from other racial backgrounds. The authors conclude that strategies used to improving student learning gain need to be inclusive of all student identities in order to ensure the entire cohort is benefiting from the education. Whilst the authors note there are certain limitations to their study in regards to sample size and its focus on just one institution, the authors emphasise how a longitudinal study is the most appropriate way of measuring learning gain due to the 'limitations with cross-sectional data' (p. 2285).

Neves, J and Stoakes, G. (2018). UKES, Learning Gain and How Students Spent their Time. *Higher Education Pedagogies*. 3 (1), pp. 1-3.

Neves and Stoakes argue that the United Kingdom Engagement Survey (UKES) is an effective tool for measuring student learning gain in higher education. The authors aim to show how the UKES assessment of student engagement can actually highlight the learning development of students. The authors used the 2016 data from UKES to show how student's engagement with activities outside of their academic course actually shows their skills development, an essential part of learning gain. From this data the authors found that there is a variation in skill development across the type of engagement activity, with each having a different level of impact. For instance, the article illustrates that 43% of participants agree that their caring responsibilities impacted upon their academic skills, compared to 38% who agree their paid work benefits their academic performance (p. 2). Additionally, 60% stated

that their experiences of volunteering has benefited their career skills, whilst comparably, 49% of students stated that their caring responsibilities had an impact on employability (p. 2). The authors conclude from their findings that, overall, students who engage with activities and commitments external to their academic course have a significant skill development due to their involvement in these activities. They conclude that looking at student's engagement can highlight the impact it has on students learning gain, and their distance travelled in terms of skill. They also state that this highlights students own awareness of their learning gain rather than being assessed objectively. Their research usefully provides an example of how a current data source could be used to measure student learning gain.

5.2 Limitations to Measuring Learning Gain

A common area of discussion in terms of learning gain is the issues around some of the methods already in place to measure it. The RAND report outlines in detail the advantages and disadvantages of each potential method. For instance, in terms of using grades to measure learning gain the report notes that comparison across the sector is an issue as institutions and subjects measure assessment differently. The two sources identified below also focus on how using assessment grades can be a problematic way of measuring learning gain.

Boud, D. (2018). Assessment Could Demonstrate Learning Gains, but What is Required for it to do so? *Higher Education Pedagogies*. 3 (1), pp. 1-3.

Boud discusses the concerns that arise when using assessment grades as a basis for measuring the learning gain of students. This opinion piece states that in theory assessment grades should be able to measure student gains in learning, but this cannot happen as assessment 'ironically' does not determine 'what students can and cannot do' (p. 5). Boud outlines the main issues with assessment practice in higher education, which makes it problematic to use grades to assess learning gain. These issues include but are not limited to: (1) the variation in ways marks are given, (2) the disassociation between marks and learning outcomes, (3) the diversity of student performance across learning outcomes or marking criteria, or (4) the issues around which mark should be used to assess learning gain in the case of re-sits. Boud argues that there is 'no common metric' (p. 5) to assess gains through assessment, and it needs to be made clearer what university assessment actually aims to do. In concluding this opinion piece, Boud notes that current assessment practice cannot be used as a measurement for learning gain and thus, advocates for a development in assessment practice. Boud provides the following examples on how to develop current practice: (1) corresponding assessment with learning outcomes, (2) there needs to be sector consistency about the marking criteria, but only within the same course, and (3) learning outcomes need to be the same in one course across all levels of study (p. 5). Boud suggests that these developments will make assessment grades a more feasible tool for measuring learning gain. Whilst this source is limited in its scope as an opinion piece it explores the current restrictions around using

grades to assess learning gain, and provides solutions to making this method more effective.

Ylonen, A., Gillespie, H. and Green, A. (2018). Disciplinary Differences and Other Variations in Assessment Cultures in Higher Education: Exploring Variability and Inconsistencies in One University in England. *Assessment and Evaluation in Higher Education*. 32 (6), pp. 1-9.

The authors explore how assessment practice in UK higher education has significant variations across different subject disciplines and institutions, and in turn arguing that these issues raise uncertainty around using grades to measure learning gain. The authors use both theory and practical research to highlight inconsistencies across assessment practices. For instance, the authors initially outline the 'Biglan – Becher typology of disciplines' (p. 1). This theory identifies differences in the assessment culture across disciplines; determining that the assessment practice of 'hard disciplines', like science subjects, is dominated by examinations, whilst 'soft disciplines', like education, has more focus on essays to assess students (p. 1). As well, their research evaluates the assessment culture of 8 higher education institutions in the UK, as well as using information provided to them by academics via interview. The authors found, not only that learning gain differed across disciplines, but that there are many issues in how institutions mark student's assessments. Despite the marking system of 'Senate Scale', many academics noted that they had 'developed their own marking scale' (p. 4), whilst some interviewees highlighted how different institutions use different methods of calculating student's grades. In addition, the authors show further inconsistency through the variations in subject nature; for instance, in science-based courses there is usually a right answer to questions asked in assessments, whilst for subjects in disciplines like humanities, assignments are usually formed on the basis of opinion (p. 6). The authors conclude that these variations make it problematic to compare student learning gain across subject or institution using grades. They note that these issues need to be taken into consideration when developing the Teaching Excellence Framework (TEF) to include an exploration of learning gain.

5.3 Methods that Can Benefit Student's Learning Gain

The RAND report also addresses how measuring learning gain can be used to 'inform improvements to learning and teaching' (p. 74). In some of the sources found in this literature search, many do this exact thing; they measure student gains in order to show how specific teaching tools benefit students learning.

Kinoshita, T. J. and Knight, D. B. (2017). The Positive Influence of Active Learning in a Lecture Hall: an Analysis of Normalised Gain Scores in Introductory Environmental Engineering. *Innovations in Education and Teaching International*. 54 (3), pp. 275-284.

The longitudinal study explores a 'SCALE UP' method in an engineering course in Australia, to explore whether active teaching methods, as opposed to more traditional lectures, can impact a student's learning (p. 275). The authors argue that whilst interactive teaching has been developed in engineering courses, there are issues around using a more active version of teaching in lecture halls; that these teaching methods usually occur in 'flat-floored classrooms' (p. 276). In this research they incorporated activities into 5 sessions of the course, whilst all other sessions continued with the traditional lecturing style. Doing this created a 'quasi-experimental approach' in order to compare the impact of interactive sessions and traditional sessions (p. 278). One example of these sessions was: the lecturer taught the class for approximately 40-50 minutes but for the remainder of the session students worked in groups to complete exercises (p. 278). These exercises were then graded after the session. As well, the students were asked to complete a test at the start of their course, this test included the same questions as their final exam, so therefore the researchers could thoroughly assess the learning gains (p. 278). The researchers found that 'normalised gain scores illuminate statistically significant differences between learning gains in content delivered using the active learning method versus a traditional, lecture- only delivery' (p. 275). They found a 16.7% increase in learning gain during the weeks of study that had more interactive learning. Therefore, the authors conclude that more interactive activities need to be adopted within lecture hall style environments; in doing these adaptations of teaching methods can have a significant impact upon students learning gain.

Stanford, J. (et.al). (2017). Early Undergraduate Research Experiences Lead to Similar Learning Gains for STEM and non-STEM Undergraduates. *Studies in Higher Education*. 42 (1), pp. 115-129.

In this article the authors outline a programme entitled the STAR (Students Tackling Advanced Research) Scholars Programme. This programme is a research scheme, in the US, in which undergraduate students work alongside an academic who mentors them through a research project. The scheme runs in the summer period between first and second year and students engage in full time research with their faculty. All students in this programme are honours students and are given the opportunity to take part rather than being allowed to apply. The students are either high academic achievers or have been recommended by their faculty, and the programme is open to both STEM and non-STEM students. This study aims to compare the student outcomes of this project of both STEM students and non-STEM students. They aim to highlight how exposing undergraduates to research experience earlier on can impact upon their learning gain, and also benefit the faculty.

To assess the learning gain of these students the researchers used a USSRA (Undergraduate Research Students Self-Assessment) tool. The USSRA is a commonly used survey that 'has been shown to reliably measure gains in: content knowledge, laboratory skills, and personal growth among undergraduates engaging

in STEM research' (p. 117). However, as this tool is usually used for STEM subjects they altered the questions in order to suit all courses involved. The students reported the most gains in research skills, 'ability to work independently', and 'present[ing] their research', whilst the authors identified the least gains in 'writing reports' or 'using statistics to analyse data' (p. 122). Overall the authors found that the project increased learning gain but that there was no amount difference between STEM students and non-STEM students, showing that it benefits students from all disciplines. The study, therefore, provides an example of a beneficial way to impact student learning gain. Whilst the programme only benefits a select amount of students, making it more inclusive to students who are not high academic achievers could provide a thorough tool for impacting and measuring student learning gain.

Stonebraker, L. (2017). Library-Sponsored Case Competitions: Best Practices and Assessment of Learning Gains. *Journal of Business and Finance Librarianship*. 22(1), 46-60.

Stonebraker's article outlines an annual library case competition, in an American university, in which 'undergraduate students compete against one another to make better evidence-based decisions for business problems' (p. 46). In the competition the students are given a scenario that has a potential business problem and the students are expected to use existing information and research resources to solve the problem. The authors note that these competitions have significant impacts on student skills such as working in teams and communicating effectively; however the article focuses on how it impacts student's 'information literacy' skills (p. 46). The article not only attempts to add to current literature on these competitions, but also hopes to encourage other institutions to adopt the same practice due to the impact it can have on student learning gains. The research included students on an Information Literacy course and those who were not, to assess if learning gains were different.

This study used qualitative data collection, such as focus groups, to gather student opinion on the competition. The research found that the students thought their learning benefited from their involvement in the competition, noting that they enjoyed the experiences they gained. Students were also offered to take part in a 'self-assessment' (p. 51) both before and after the competition, in which students were asked to assess their ability to do certain things, such as research. These assessments show an increase in student's skills after the competition. As well, the authors found that the competition benefited the learning gains of students on the Information Literacy course and those who were not, showing its overall benefit to the entire student cohort. The author concludes that future research needs to be done on a larger scale in order to effectively highlight the competitions benefit to learning gain. This research usefully highlights a different way to impact upon student learning gain that can be incorporated into other global higher education institutions.

Wiggins, B. (et.al). (2017). The ICAP Active Learning Framework Predicts the Learning Gains Observed in Intensely Active Classroom Experience. *AERA*. 3 (2), pp. 1-14.

The overall premise of this study was to research whether 'interactive activities' are more effective than 'constructive activities' in increasing student learning, with the focus on STEM subjects (p. 1). The authors look into ICAP (interactive, constructive, active and passive) teaching methods; a theory developed by Chi and Wylie (2014) to assess different methods of student learning. The authors outline the range of teaching styles across higher education, incorporating both passive methods, such as lecturing, and more participatory sessions such as group work. The authors define constructive activities as those that 'require students to synthesise their own ideas and generate novel output', whereas, interactive activities are seen as an 'exchange of ideas' with others (p. 2). The authors seek to prove the hypothesis that interactive sessions generate the most learning gain due to its focus on student engagement in the classroom. In the research the authors created different classroom activities, ranging between interactive or constructive, within an undergraduate biology course, for students to participate in. The activities focused on specific biological course content, in which constructive activities asked students to show an 'understanding that went beyond the answers provided' (p. 4) in which discussion with peers was not essential. Whereas, with the interactive activities students worked in groups in which students took it in turns to learn certain material and teach this material to each other. In order to assess which activity generated more gains the researchers conducted observations of the sessions and asked students to take a test. The test included exam style questions and students were asked to complete this before and after each session. The authors found that the students who participated in interactive sessions had higher learning gains. As well, the researchers assessed whether different demographic groups of students had differences in their learning gain. The authors found no difference between groups of students. Whilst their study raises an issue through their inclusion of scripts for students in the interactive activities, the study shows how evaluating the methods of teaching in university classrooms can benefit student learning gain.

5.4 The Purpose of Measuring Learning Gain

As part of the RAND report, two areas were addressed: (1) how measuring learning gain can provide information for prospective students and (2) how measuring learning gain can become 'part of the quality assurance of learning and teaching' (p. 74). In more recent research this area tends to be overlooked slightly, however one source provided a useful and current way of addressing both these two areas.

Polkinghorne, M., Roushan, G. and Taylor, J. (2017). Considering the Marketing of Higher Education: the Role of Student Learning Gain as a Potential Indicator of Teaching Quality. *Journal of Marketing for Higher Education*. 27 (2), pp. 213-232.

Due to the increasing rhetoric that perceives the university student as a customer, the authors discuss how learning gain data could be evaluated as a marketing tool to promote the teaching quality at each institution to prospective students. The rise in tuition fees has increased a student desire for more information about the quality of institution and education that they are deciding to "buy" into; Polkinghorne's study discusses how advertising learning gain can support this demand. Through discussions with university stakeholders, the authors highlight certain issues that need to be taken into account when evaluating learning gain, in order to utilise it as a marketing tool (p. 213). These issues include: establishing a reason for measuring learning gain, that it needs to be fit for purpose and benefit both the student and the institution; there needs to be less conflation of learning gain and learning outcomes, in which current data sources need to be avoided when measuring learning gain; it needs to be taken into account that student satisfaction is not the same as student learning; there are variations in teaching across subjects, and student learning is not solely dependent upon teaching quality; learning gain data needs to have a purposeful use for future employers.

The authors conclude that if these areas are addressed then learning gain can be utilised as a useful tool for the marketization of higher education institutions. As well, the authors note that when these areas are taken into account then the effectiveness of using learning gain within the Teaching Excellence Framework (TEF) is increased and makes the framework more valuable for prospective students and employers. However, they note that measurements of learning gain need to be 'flexible' to appreciate the variations in 'teaching styles and learning methods' across higher education (p. 228). Yet with these areas in mind the authors present a useful and current way of evaluating learning gain in higher education.

6. Conclusion

Since the RAND report in 2015 (McGrath *et. al.* 2015) there has been frequent research into learning gain within higher education. The sources outlined above build upon what was discussed in the RAND report through areas of measuring learning gain, limitations of the methods of measuring learning gain, methods that can benefit student learning gain, and the purposes of measuring learning gain. Within these sources certain themes are clear. First, a few focus their discussion of using learning gain within TEF in order to highlight the quality of teaching within an institution. Secondly, some focus on how current methods of teaching could be developed in order to further impact student learning, especially in terms of making sessions more interactive. Thirdly, a few mention that current data sources, such as engagement surveys, can be used to measure learning gain independently. Finally, some continue to discuss how using grades is an ineffective way of measuring learning gain.

Some sources provide instances in which they highlight how a student engagement activity, such as the library case competition or the STAR research programme, can

benefit students learning gain. These sources show how a method of increasing student engagement with their course could actually be used to assess student learning gain and highlight instances of quality teaching practice. It is also clear that many of the studies only focus on learning gain within one institution, whilst some of these usefully show examples of a longitudinal study; it suggests a reluctance to evaluate across the sector, perhaps due to the variations in teaching and learning across institutions. A few of the sources discuss students own perceptions of their learning gain, however none discuss how the assessment of their learning gain was given back to students involved.

Overall, it is clear from these sources that recent discussion of learning gain focuses on many of the areas of the RAND report. The search further highlights the significant variations of measuring learning gain and the implications and issues around it.

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