LEARNING GAIN IN HIGHER EDUCATION

Edited by Christina Hughes
and Malcolm Tight

INTERNATIONAL PERSPECTIVES
ON HIGHER EDUCATION RESEARCH

VOLUME 14

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INTERNATIONAL PERSPECTIVES ON HIGHER EDUCATION RESEARCH VOLUME 14

LEARNING GAIN IN HIGHER EDUCATION

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Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2021

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN: 978-1-83867-280-5 (Print)
ISBN: 978-1-83867-279-9 (Online)
ISBN: 978-1-83867-281-2 (Epub)

ISSN: 1479-3628 (Series)

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EDITORIAL INTRODUCTION

Christina Hughes and Malcolm Tight

Learning Gain in Higher Education

Increasing attention has been paid, nationally and internationally, in recent decades to the issue of what higher education does for its students. What do students gain – in terms of learning (knowledge and skills) – from engaging in higher education for three, four or more years? And how might this learning gain best be measured?

Institutions of higher education, along with national governments and international organizations, are closely concerned with the answers to these questions. With mass participation in higher education, and students bearing an increasing proportion of the costs of their participation, it is seen by some as being critically important to be able to demonstrate – convincingly and transparently – how students have progressed.

This volume explores the latest thinking and research on this topic, and discusses varied practice, from across the globe. It tackles and offers answers to key questions about learning gain in higher education: what is it? – how does it relate to other key ideas and concerns? – how can it be studied and measured? – how is it conceived of in different parts of the world? – what is the evidence on the extent of learning gain in higher education?

Chapter Contents

The 10 chapters in the remainder of this book together offer a picture of the state of play of research and thinking on learning gain in higher education. Their perspectives range from the global to the national and institutional, and their foci cover methodology, measurement, employability, quality and sustainability.

Malcolm Tight discusses the results of a systematic review into existing research on learning gain in higher education. Building on another recent systematic review, he identified a total of 103 relevant published articles on the topic for analysis. He considers the origins and meaning of learning gain, and its relation to similar terms, the ways in which it has been applied in practice and research, and the issues and critiques that have been raised.

Jekaterina Rogaten and Bart Rienties provide a critical review of learning gains methods and approaches. They review some of the common definitions and the methods employed in research on learning gains, and will provide a critical

evaluation of the computational aspects of learning gains, the lessons learned and what is not yet known.

Olga Zlatkin-Troitschanskaia and Miriam Toepper outline the challenges that research and practice in higher education have faced in measuring students' competences and learning outcomes. They focus in particular on the German context and its national-wide programme on Modelling and Measuring Competences in Higher Education. The central results of the second phase of this programme are presented and discussed for the first time.

Katrina Crotts Roohr, Margarita Olivera-Aguilar, and Ou Lydia Liu approach the issue from the US context. They offer a brief history of the discussion of the value added by higher education in the US, summarise the initiatives that have been undertaken, and review how value added is measured. Problems of methodology and interpretation are examined, and the authors conclude by considering possible future directions.

From the UK perspective, **Christina Hughes and Heike Behle** provide an overview of the Legacy project and its evaluation, focusing on the effectiveness of the different methodologies used for measuring learning gain. The overall impact of the project on participating institutions and the higher education sector as a whole, in terms of capacity building and developing communities of understanding, is also reviewed.

In their chapter, **Shweta Mishra and Edith Braun** map the changes in the overall goals and objectives of higher education against various political and economic forces, and discuss the implications of these changes with reference to 'employability gain' of graduates. After discussing definitions of employability, they examine the potential of two assessment approaches – self-reports and performance-based tests – for measuring employability gains based on research findings from two higher education quality management projects implemented in Germany.

Camille Kandiko Howson examines the new approaches to quantifying learning gain and new metrics that were developed through 13 pilot projects across England. Evaluation of the projects explored the theoretical underpinnings of the metrics including behavioural, cognitive and affective approaches, as well as progress and outcome measures, and identified challenges to measuring learning gain. In this chapter policy implications of the global accountability agenda are discussed, including the use of metrics to drive enhancement, rank excellence and ensure quality and standards.

Kerry Shephard analyses the evidence for learning gains but suggests that we should also be open to the possibility of learning losses. He explores if teaching students the skills and dispositions to think critically, deeply and independently, better than we do at present, might not only be a better fit to the liberal traditions and abilities of higher education, but also best support generations to come to decide for themselves what their contribution to sustainability could be.

Darrell J. R. Evans argues that Australian universities have a rich history for enabling, promoting and evaluating innovation and excellence in learning and teaching. However, the recent removal of specific government funding to support innovation, the increased emphasis on student success and employability

outcomes, and the threat of performance-based funding means that Australian universities will need to commit to the ongoing development of learning and teaching and demonstrate the potential for learning gain.

Finally, **Robin Goldberg and Vicki Chandler** detail the experience of Minerva in the US. At Minerva, they had the luxury of starting a new college from scratch. They discuss how the college was designed to deliver specific student outcomes, with all of the operating practices and systems needed to support faculty and students in this pursuit. They share how Minerva defined what they teach, how they teach, and how its practices enable them to measure whether their students are indeed achieving the outcomes intended for them.

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EXISTING RESEARCH ON LEARNING GAIN IN HIGHER EDUCATION

Malcolm Tight

ABSTRACT

This chapter provides a review of existing research on learning gain and related topics in higher education. The methodology adopted is a form of systematic review. The origins and meaning of learning gain, and its relation to similar terms, are discussed. The ways in which learning gain has been applied in practice and in research are considered. The issues raised by this practice and research are examined, and the various criticisms made are reviewed. Some conclusions are then drawn.

Keywords: Higher education research; learning gain; systematic review

INTRODUCTION

This chapter presents a systematic review of the existing research literature on learning gain in higher education. The aim is to offer an overview of where we currently are in our thinking, and thus be able to indicate what we are less sure of and where further research might be directed.

The chapter begins with a brief methodological discussion and reviews the findings of another recent systematic review of the field. It then considers the origins and meaning of the term 'learning gain' and its relation to similar or cognate terms. The issues and critiques raised by the research are reviewed, before some general conclusions are reached.

Learning Gain in Higher Education
International Perspectives on Higher Education Research, Volume 14, 1–16

ISSN: 1479-3628/doi:10.1108/S1479-362820210000014002

METHODOLOGY

The methodology underlying this chapter is systematic review (Jesson, Matheson, & Lacey, 2011; Torgerson, 2003), an approach which seeks to identify, and synthesize the findings of, all the relevant published research on a particular topic. It is a primarily qualitative approach, unlike meta-analysis, its quantitative equivalent, which focuses on published studies that report numeric findings. Both meta-analyses and systematic reviews, but increasingly the latter, have recently become popular in higher education research (Tight, 2020).

While systematic reviews aim to be as comprehensive as possible, it is normal to set some limiters, such as on date and language. Here, the focus is on the literature on the topic that has been published in the English language. Relevant articles, books and chapters were identified using keyword searches in the Google Scholar and Scopus databases. Copies of relevant publications were then obtained for scrutiny and analysis. The references in the selected publications were also scrutinized for other relevant sources missed by the database searches.

There is an existing and recent systematic review on the topic of learning gain (Rogaten et al., 2019). This study used the ERIC and Web of Science databases and identified 52, mostly American, studies of relevance (involving a total sample of 41,009 students). Note that while this study described itself as a systematic literature review, it took a semi-quantitative approach, having many of the characteristics of what others would call a meta-analysis.

Rogaten et al. distinguished between affective (e.g., confidence, motivation and attitudes), behavioural (e.g., leadership, study and team working skills) and/or cognitive (e.g., knowledge and understanding) learning gains; noting that 'most studies identified in this review focussed on cognitive learning gains, followed by behavioural and affective learning gains' (p. 326). The studies were fairly evenly split between those employing self-reported and those using 'objective' measures:

> The review found a rich but diverse variety of adopted methodologies and approaches to "measure" affective, behavioural and cognitive (ABC) learning gains. Nonetheless, there is a lack of consistency in the ways in which learning gains are currently measured and reported. These inconsistencies and limitations hamper effective comparisons of learning gains and teaching excellence. (p. 321)

Nevertheless, Rogaten et al. concluded that:

> universities should consider to use pre-post measurements of learning gains in order to strengthen the methodological rigor of learning gains research… researchers and policy makers [should] examine learning gains longitudinally throughout the entire student journey... [there] is an urgent need for researchers and policy makers to start to develop, test, implement and evaluate pre-post objective measurements of affective and behavioural learning gains. (p. 333)

This would, of course, be a substantial undertaking, adding a whole new raft of assessment and evaluation activities to the existing methods of end-of-course examinations and coursework.

The present analysis builds on the work of Rogaten et al. in taking a clear qualitative approach and in updating the publications examined.

ORIGINS AND MEANING

Two points about the use of the term 'learning gain' in the context of higher education should be stressed to begin with.

First, published discussions of learning gain in higher education are relatively recent, essentially confined to the 21st century. Bibliographic searches reveal that discussions of learning gain, or gains in learning, go back at least as far as 1939 (according to Scopus), but closer inspection reveals that the focus was on school education, training or, later, robotics, rather than higher education.

Second, the relative recency of the discussion of learning gain in higher education is not because higher education researchers, practitioners and policy-makers have only latterly discovered an interest in the topic. It is, rather, at least partly a matter of terminology and fashion. Instead of, or as well as, referring to learning gain, researchers, practitioners and policy-makers have used a range of synonyms and overlapping terms. These have included, for example, employability, graduate attributes, learning competencies, learning outcomes, learning transfer and value added.

Indeed, those working in and studying higher education have arguably always been closely interested in what is now referred to as learning gain. This has been demonstrated by their keen desire to assess, evaluate or measure what their students have learnt through oral and later written tests, traditionally taken at the end of a programme of study, but latterly also during their studies.

Similarly, those funding higher education (notably national and state governments), those employing its products (employers) and those controlling entry to the professions (professional bodies) have also long taken a close interest in the content and outcomes of these tests. The public debate over whether universities and colleges were suitably and adequately preparing their students for their subsequent employment and life dates back at least a century and a half.

So why the contemporary interest in learning gain in higher education? There are, broadly speaking, two alternative explanations, each of which probably has some validity, so they are perhaps best taken in combination. The first explanation is that the debate over learning gain in higher education is simply the current manifestation of the ongoing debate over the liberal and/or vocational purposes of higher education. In other words, is higher education an end in itself or is it about preparing students for their future work roles?

The second, alternative, explanation rests on the belief that there has recently been a fundamental step change in the relationship between higher education, the economy and the wider society. This recognises that the 'massification' of participation has altered the nature of the higher education operation, making it a much more central and crucial activity, but also goes beyond that. It makes use of a colourful terminology – e.g., industry 4.0, 21st century skills, work-ready graduates – in arguing that much more is expected of higher education

graduates than the possession of a degree-level qualification. Instead they should have a whole and varied portfolio of abilities and qualities to offer.

Underlying this second interpretation, of course, is a concern that higher education as a whole, or some of its constituent universities and colleges, or some of their departments and courses, may not be producing graduates of the requisite quality required. The concern with quality goes back to the second half of the 20th century, when the massification of higher education was accompanied by worries that 'more means worse'. Its current manifestation as learning gain reflects the expectation that universities and colleges will demonstrate what they have achieved with their students, and that employers, policy-makers and others will be able to easily assess the relative worth of these outputs for themselves.

Unsurprisingly, learning gain has been defined and explained in varied ways:

> Learning gain is understood in a variety of ways by the higher education sector: as the difference in student performance between two stages of their studies, as a variant of the concept of 'value added' commonly used in school performance tables, or simply as 'learning'… For the purposes of this report, the concept of 'learning gain' is defined as the 'distance travelled', or the difference between the skills, competencies, content knowledge and personal development demonstrated by students at two points in time. This allows for a comparison of academic abilities and how participation in higher education has contributed to such intellectual development. (McGrath, Guerin, Harte, Frearson, & Manville, 2015, p. xi)

The difference between learning gain and more traditional measures of the outputs of higher education, then, is that it is more than a simple statement of what students know or can do on graduation, but concerns the difference between that and what they knew or could do on entry to higher education.

> Learning gain can be operationalised as a change in knowledge, skills, work-readiness, and personal development to include beliefs and values, and enhancement of specific practices and outcomes in defined disciplinary and institutional contexts. (Evans, Kandiko Howson, & Forsythe, 2018, p. 4)

Of course, students might learn in other ways during their three, four or more years in higher education, through maturation and experience or other activities, so the learning gain measured may not be entirely because of higher education. One would also expect that, if they engage seriously at least to some extent with their higher education, students would develop and expand their knowledge and skills. The concern with learning gain does, therefore, reflect doubts about this, or about what and how much is being learnt or developed. In essence, it is demanding that higher education providers 'prove it'.

APPLICATION AND PRACTICE

The number of studies focussing on learning gain in higher education is, unsurprisingly, increasing. While Rogaten et al. identified 52 relevant studies in their article published in 2019, searches on Google Scholar (searches carried out on 5/3/20), for

example, identified 159 articles with 'learning gain' in their titles, while on Scopus, the figure was 549: many of these did not, as subsequent checks confirmed, focus on higher education. Searching for articles with both 'learning gain' and 'higher education' in their titles, a very narrow frame of reference, brought up only 12 on both Google Scholar and Scopus.

Checking the articles identified through these searches for relevance reduced the number of 'new' articles to 51; meaning that, together with those identified by Rogaten et al., a total of 103 articles were available for analysis.

Published articles on learning gain in higher education focus on a range of countries, including Australia (Matthews, Adams, & Goos, 2015), Belgium (Berghmans, Michiels, Salmon, Dochy, & Struyven, 2014), Brazil (Meguizo & Wainer, 2016), China (Cai et al., 2019; Liu, Liu, & Chi, 2014), Colombia (Balcazar & Nopo, 2016; Garzon & Acevedo, 2019; Shavelson et al., 2016), Germany (Woltering, Herrier, Spitzer, & Spreckelsen, 2009), Kuwait (Anderson, 2006), Mexico (Juarez & Herrera, 2019), New Zealand (Shephard et al., 2015), Norway (Caspersen & Smeby, 2018; Lehre, Hansen, Lehre, & Laake, 2014; Michelsen, Vabo, Kvilhaugsvik, & Kvam, 2017; Sweetman, Hovdhaugen, & Karlsen, 2014), South Africa (Mathabathe & Potgieter, 2014), Taiwan (Cheng, Liang, & Tsai, 2015), Turkey (Yalaki, 2010), the United Kingdom (Allan, 1996; Evans et al., 2018; Girot, Miers, Coles, & Wilkinson, 2006; Hadjianastasis, 2017; Melton, 1996; Polkinghorne, Roushan, & Taylor, 2017; Rodgers, 2007; Rogaten et al., 2019; Vermunt, Ilie, & Vignoles, 2018) and the United States (Anaya, 1999; Andrade, 2018; Cunha & Miller, 2014; Douglass, Thomson, & Zhao, 2012; Liu, 2011a, b; Liu, Bridgeman, & Adler, 2012; Roohr, Liu, & Liu, 2017; Yunker, 2005). The dominance of US-based studies noted by Rogaten et al. (2019) has been watered down, with a substantial number of articles now stemming from the UK, and others from Latin America, Europe and the Asia Pacific region.

Studies of learning gain in higher education also focus on a range of disciplines, including agriculture (Wattiaux & Crump, 2006), astronomy (Margoniner, 2014), biochemistry (Ojennus, 2016; Villafane, Loerstcher, Minderhout, & Lewis, 2011), biology (Andrews, Leonard, Colgrove, & Kalinowski, 2011; Campbell et al. 2014; Casem, 2006; Shuster & Peterson, 2009), biomechanics (Riskowski, 2015), business (Moorer, 2009), chemistry (Erdmann & March, 2014; Mathabathe & Potgieter, 2014; Pentecost & Barbera, 2013; Seymour, Wiese, Hunter, & Daffinrud, 2000; Tomasik, Cottone, Heethuis, & Mueller, 2013; Winklemann et al., 2020; Yalaki, 2010), computer science (Ak & Kutlu, 2017; Lim, Hosack, & Vogt, 2012), ecology (Beck & Blumer, 2012), engineering (Cabrera, Colbeck, & Terenzini, 2001; Nagel, Pierrakos, Zilberberg, & McVay, 2012; Radu, Cole, Dabacan, & Harris, 2011; Stolk & Martello, 2015), management (Gill & Mullarkey, 2015), marketing (Polkinghorne, O'Sullivan, Taylor, & Roushan, 2019), mathematics (Cai et al., 2019), medicine (Buriak & Potter, 2014; Emke, Butler, & Larsen, 2016; Woltering et al., 2009), mineralogy (Scribner & Harris, 2019), nursing (Getha-Eby, Beery, O'Brien, & Xu, 2015), nutrition (Anderson, 2006), physics (Allen & Cockman, 2009; Cahill et al., 2014; Georgiou & Sharma, 2015; Gok, 2012; Hill, Sharma, & Johnston, 2015; O'Shea, Terry, & Benenson, 2013;

Pollock, 2006; Willoughby & Metz, 2009), psychology (Hatch et al., 2014), science (Matthews et al., 2015; Varsavsky, Matthews, & Hodgson, 2014), sociology (Delucchi, 2014) and STEM (science, technology, engineering and mathematics) disciplines in general (Rogaten & Rienties, 2018; Scalise, Douskey, & Stacy, 2018; Strayhorn, 2010). The prevalence of studies in the science disciplines is notable.

Research on learning gain has also considered different aspects of, or approaches to, teaching and learning, including flipped learning (Davies, Dean, & Ball, 2013; Jensen, Kummer, & Godoy, 2015; Juarez & Herrera, 2019; Mortensen & Nicholson, 2015; Ojennus, 2016), online learning (Cheng et al., 2015; Dollar & Steif, 2008), peer instruction (Balta, Michinov, Balyimez, & Ayaz, 2017; Berghmans et al., 2014), problem-based learning (Woltering et al., 2009) and service learning (Moorer, 2009).

As already suggested, however, this underestimates the amount of research on learning gain in higher education because a number of more or less synonymous terms are in usage. Amongst the most popular of these are learning outcomes (e.g., Allan, 1996; Coates, 2016; Duque, 2014; Hadjianastasis, 2017; Havnes & Proitz, 2016; Jacob & Gokbel, 2018; Lehre et al., 2014; Melton, 1996; Michelsen et al., 2017; Proitz, Havnes, Briggs, & Scott, 2017; Shephard et al., 2015; Sweetman et al., 2014; Zlatkin-Troitschanskaia, Pant, & Coates, 2016) and value added (e.g., Balcazar & Nopo, 2016; Cunha & Miller, 2014; Girot et al., 2006; Kim & Lalancette, 2013; Liu, 2011a, b; Rodgers, 2007; Shavelson et al., 2016; Yunker, 2005).

These cognate terms have their own histories and relationships, as Havnes and Proitz outline in the case of learning outcome (LO):

> The term 'learning outcome' is closely linked to the history of another highly relevant term in the field of curriculum development —'teaching and learning objective'… that the two terms are often interconnected in the literature makes it difficult to distinguish between them. The development of the LO concept is described as a linear process, starting with the objectives movement and continuing through the mastery learning theories before ending up with the current, outcome-based education movement. (2016, p. 209)

The term 'value added' is even closer in meaning to 'learning gain', having a particular purchase in the Americas. This is made clear when it is defined, for example:

> The value added of a college for a student i is the student's observed score (Oi) on an outcome measure minus the student's expected (Ei) outcome based on a prediction from their college-entry characteristics. (Shavelson et al., 2016, p. 696)

This bears close comparison to the explanations of learning gain quoted earlier from McGrath et al. (2015) and Evans et al. (2018).

The contemporary interest in learning gain drew much stimulus from two large-scale American studies. The first, and probably most influential, of these was conducted by Arum and Roksa (2011) (see also Arum & Roksa, 2014). They collected data from 2322 undergraduate students in 2005 and 2007 who were

studying at a diverse range of 24 American higher education institutions, concluding by highlighting:

> four core 'important lessons' from our research. First, in terms of undergraduate learning, four-year colleges and universities and students attending them are too often 'academically adrift'. While US higher education is expected to accomplish many tasks, we draw on students' reports of their collegiate experiences to demonstrate that undergraduate learning is rarely adequately prioritized. Second, gains in student performance are disturbingly low; a pattern of limited learning is prevalent on contemporary college campuses. Third, individual learning in higher education is characterized by persistent and/or growing inequality. Fourth, while the overall level of learning is low, there is notable variation both within and across institutions that is associated with measurable differences in students' educational experiences. (Arum & Roksa, 2011, p. 30)

These findings, of course, stimulated a great deal of discussion and concern over whether American universities and colleges were both doing their job and giving their students a reasonable deal (i.e., what American researchers often refer to as the issue of accountability).

In another longitudinal piece of research, the Wabash Study, Blaich and Wise (2011: see also Pascarella & Blaich, 2013), surveyed a similar sized sample of undergraduates studying at 19 US higher education institutions in the years 2006, 2007 and 2010, using five measurement scales. They concluded that:

> students do not always grow as much as we hope or in the directions that we expect in college… during four years of the Wabash Study, students grew on some of the outcomes we measured, such as critical thinking and moral reasoning, and declined on others, including academic motivation and openness to diversity… It is incredibly difficult to translate assessment evidence into improvements in student learning… gathering data, even with the complicated longitudinal methodology employed in the Wabash Study, is much easier than using the information to improve student learning. (Blaich & Wise, 2011, pp. 8, 11)

More recently, Roohr et al. (2017) reported on a study of students at one American university which regularly administered a particular instrument to assess learning gain. While their sample was relatively small – just 168 students – it was compiled from those students who happened to have completed the instrument in their first year and once or twice more in their later years of study (a kind of convenience sample).

> This study used the EPP [ETS Proficiency Profile], a SLO [student learning outcome] measure, to estimate student learning gain in college across four different areas – critical thinking, reading, writing, and mathematics – and found results in all areas which are consistent with previous research findings: small and insignificant learning gains after two years in college, but moderate significant learning gains after four or five years. The investigation of factors related to learning gain reaffirms that the more time students spend in college, the more progress they will make, and that variables such as first-year GPA [grade point average] can be useful to predict learning gain. We also found a racial/ethnic gap in college reading performance. This result should encourage HEIs [higher education institutions] to further investigate these race/ethnicity differences. (Roohr et al., 2017, p. 2296)

It is no surprise that studies like these have led to a growing research and policy interest, particularly at national and institutional levels, and that this interest has now spread far beyond the USA. It has also, of course – as academic

research generally does – identified a series of issues needing careful attention and raised a range of critiques.

ISSUES AND CRITIQUE

The most immediate issue faced by researchers and practitioners interested in learning gain in higher education, and thus the one that has commanded the most attention, is how to measure or assess it.

> Measuring learning gain is considered a policy panacea, a 'holy grail' and a concept to 'crack', but measurement is contentious due to the implied consequences of the outcomes through wider accountability regimes. (Evans et al., 2018, p. 1)

There are two main approaches to the measurement of learning gain: to carry out so-called 'objective' measurements comparing test results at two or more points in time or to ask students to report their perceptions of what they have gained. The former has garnered most attention.

For example, Boyas, Bryan, and Lee (2012) consider the use of pre- and post-tests to measure learning gains, noting that:

> post-tests may not demonstrate the full level of student mastery of learning objectives and… both the difficulty level of the questions asked and the level of students in their degree programme affect the difference between graded and ungraded assessments. (p. 427)

Caspersen, Smeby, and Aamodt (2017) reviewed 46 articles published between 2010 and 2015 that reported on the measurement of learning outcomes. They point out the problem with using the grades awarded to students as a measure is the lack of standardisation at all levels, e.g., between departments, institutions and countries. Using standard tests is an obvious response:

> The test-based approach has some clear methodological advantages, but its implementation is also demanding and challenging… in large-scale international comparisons [it] is challenging to come to an agreement about the development of instruments across different countries and to adapt them to national, cultural and linguistic settings. Furthermore, there is little international consensus about generic skills and their connection to professional, cultural and disciplinary contexts. (p. 26)

While international comparisons clearly pose particular challenges, many of these, however, are also present at national and institutional levels.

Casperson, Smeby and Aamodt conclude by stressing the need to refrain

> from mixing the measurement of learning (growth) with the measurement of knowledge at a given point in time and of being clear whether one wants to measure quality, competence or learning at any given point. (p. 27)

Measuring learning gain would seem most relevant to higher education institutions and their funders, whereas measuring knowledge at a particular point would likely appeal more to potential employers.

A lot of attention has been paid to assessing the usefulness of existing instruments for measuring learning gain or to developing new ones. Thus, Steedle