The impact of the Great Exhibition of 1851 on the development of technical education during the second half of the nineteenth century

Abstract

This paper examines the contribution made by the mechanics' institute movement in Britain just prior to, and following, the opening of the Great Exhibition of 1851 in London. It argues that far from making little contribution to education, as often portrayed by historians, the movement was ideally positioned to respond to the findings of the Exhibition, which were that foreign goods on display were often more advanced than those produced in Britain. The paper highlights, through a regional study, how well suited mechanics' institutes' were in organising their own exhibitions, providing the idea of this first international exhibition. Subsequently, many offered nationally recognised technical subject examinations through relevant education as well as informing government commissions, prior to the passing of the Technical Instruction Acts in 1889 and the Local Taxation Act of 1890. These acts effectively put mechanics' institutes' into state ownership as the first step in developing further education for all in Britain.

Introduction

There has been a general consensus among both historians and educationalists that mechanics' institutes' in Britain were a 'failure' in supporting working-class adult education. It has been argued that such institutes offered advanced scientific lectures to the middle and professional classes and became social centres for concerts and popular lectures, patronised by the middle classes. Indeed, James Hudson writing in 1850, prior to the opening of the 1851 Great Exhibition of the Works of Industry of all Nations (hereafter referred to as the Great Exhibition), suggested that the institute movement had failed in its aims of providing education for the working classes. Auerbach (1999) states that by mid-1840s, technical education in Britain was minimal, 'this was true not only in the absolute sense, but also relatively, in comparison with other nations' (p.10). He believes that 'there were two principal attempts to improve workers' skills and education levels in Britain during the first half of the nineteenth century – mechanics' institutes and schools of design – neither of which proved very successful' (p.10) Auerbach argues that mechanics' institutes' had 'ceased to be regarded as a medium for the instruction of the masses' (p.12) This paper questions such assumptions, in the context of the Great Exhibition and after, with both examples and particular reference to the Yorkshire Union of Mechanics' Institutes (herewith referred to as the Yorkshire Union) through a regional study. Finally, it will identify the legacy

left by the mechanics' institute movement with respect to the development of further education for all.

In Britain, several Mechanics' Institute Unions were established from the late 1830s, the Yorkshire Union of Mechanics' Institutes' being the first one to do so in 1838 (Popple 1962, 55). Others established included the Lancashire and Cheshire, Kent, the Midlands, Northumberland and Durham and the Scottish Unions. The Devon and Cornwall Union was the last one to be formed, operating from 1850 (63) In the case of the Yorkshire Union, by the 1890s there were over 600 member mechanics' institutes', which were located in the then counties of Yorkshire, County Durham, Cumberland, Lancashire and Westmorland *(Annual Reports of the Yorkshire Union of Mechanics' Institutes'* 1838-1900).

Leeds was the first Yorkshire Union institute to be established in 1824 and by 1850 it was the second largest in the country, with 1,852 members (Hudson 1969, p.232). However, it was not just the larger industrialising towns in Yorkshire and beyond that were associated with mechanics' institutes' but also in smaller ones and those developing in rural areas. Yorkshire Union institutes were to be found by the 1840s, particularly in the textile communities of the Dales and Pennines (*Annual Reports of the Yorkshire Union of Mechanics' Institutes* 1838-1900). Other Yorkshire Union institutes' were established in the villages of the Cleveland Hills and on the borders between the North and West Ridings. There was also activity outside the county, particularly in the developing mining villages of County Durham (*Annual Reports of the Yorkshire Union of Mechanics' Institutes'* 1838-1900).

Mechanics' institutes and their support for adult technical education and industrial exhibitions

Technical education was a general term covering wide-ranging subjects during the nineteenth century such as industrial design and drawing (art), textile design and manufacture, steam, magnetism, acoustics and electricity, various branches of chemistry, geometry, machine and building construction, mechanics and mathematics (*Annual Reports of the Yorkshire Union of Mechanics' Institutes'*, 1838-1900). Argles (1964) suggests that the

purpose of technical education was ‘to provide instruction in the principles of art and science applicable to industry and in the application of special branches of art and science to specific industries and employment’ (p.6). In the pre-1850 mechanics’ institutes, lectures and subjects taught were often associated with high-level scientific content and were of little interest or relevance to the adult working classes, many of whom had had little formal education.

Subjects taught from the late 1840s onwards, however, became more relevant to industry, often supported with elementary education as institutes responded to the need to compensate for the lack of basic education of many working-class adults. The Yorkshire Union Institute at Keighley, for example, had established several classes in science, literature, architecture and mechanical and perspective drawing by 1845 (*Eighth Annual Report of the Yorkshire Union of Mechanics’ Institutes* 1845, p.43). In the same year, the Huddersfield Yorkshire Union Mechanics’ Institute Committee had made the strategic decision to concentrate on elementary education knowing that the vast majority of members had had little or no previous schooling: ‘The founders and supporters of this Institution, while providing for the intellectual wants of the adult, have steadily kept in view the importance of the educational training of the young and ‘their attention has therefore been particularly directed to the efficiency of the classes for elementary instruction’ (p.30).

At Huddersfield, the Institute supported the advanced classes. The School of Design, for example, offered ornamental, architectural and mechanical drawing classes which were both popular and the standard of work very high. As early as 1841, the teaching of design and practical chemistry classes had been introduced. ‘The importance of the chemistry class cannot be overlooked in the neighbourhood, when we consider how inferior our fabrics are in beauty of dye and colour, to those of our competitors’ (*Huddersfield Examiner* 29 April, 1882). By 1848, Huddersfield was very much aware of foreign competition and the Committee stated ‘our neighbours on the continent, especially France and Belgium, are fully sensible of the importance of these schools where French designs are superior to English,

and fetch more cash in the market' (*Eleventh Annual Report of the Yorkshire Union of Mechanics' Institutes* 1848, p.55).

The smaller institutes were also responding to the needs of technical education. The Whitby Yorkshire Union Institute on the Yorkshire Coast, for example, which had originally been established in 1823 as the Yorkshire Philosophical Society and Museum, and by 1845 it had become a mechanics' institute. It offered elementary level subjects in reading, writing and arithmetic as well as specific drawing and chemistry classes (Browne 1946, p.121). Similar developments were taking place at other institutes both in the Yorkshire Union and across the country as a whole. The institute movement was beginning to respond to the needs of working-class adult education, local industry and competition from abroad (Walker 2013, 2).

Many institutes opened their doors to females with regard to both public lectures and classes in the arts and elementary subjects (O'Day 2000, p.96). Women were taught separately from men and usually by women. While in most cases, their numbers were low in comparison to men, both Bradford and Huddersfield had separate female institutes and were 'two chief single-sex female institutes that did provide a wider curriculum'. (Watts 1998, pp.186 – 7) They merged with their male counterparts during the 1880s when purpose-built technical schools were established.

One important way of publicising technical education and developments was through exhibitions held at mechanics; institutes. The idea for an international exhibition in London came from the many successful ones that had been held in Britain from the late 1830s at various institutes' and literary and scientific societies. Such exhibitions were seen as 'enlightening the public and awakening their curiosity' and at the same time provided publicity and raised much needed funds for the newly established institutes. Their committees were confident that exhibitions would attract the working classes, stimulating

their imagination and making them aware of new arts and science developments (Tylecote 1957, p.78).

The first large exhibition was held at the Lancashire and Cheshire Union Manchester Mechanics' Institute in 1837. Exhibits included 31 model steam engines, 79 models of 'useful machines and ingenious mechanical contrivances', 12 models of public buildings, 90 philosophical [scientific] instruments, 140 India ink and coloured designs and drawings, 28 specimens of painted and stained glass and 10,000 insects (Tylecote p.306). In the case of the Yorkshire Union, there was an exhibition held at the Bradford Mechanics' Institute in 1839 which raised between £700 and £800, the proceeds going towards a new Institute building (p.229). In the same year at Halifax, an exhibition on science and art was jointly organised between the Infirmary, the Literary and Philosophical Society and the Mechanics' Institute and attracted 100,000 visitors (p.238). Other Yorkshire Union mechanics' institutes' which organised exhibitions included the one at Todmorden in 1839 (*Report of the West Riding Union of Mechanics' Institutes' 1839*, p.24). At Sowerby Bridge, in the same year, the exhibition lasted seven weeks, attracted 29,000 visitors and made a profit of £142 (p.38) An exhibition of arts and manufactures held at the Leeds Institute in 1842, raised £1,630 which supported the purchase of a building and helped pay off some of the debt inherited from the previous Literary Institution which it had taken over (Tylcote p.71). At the Huddersfield Institute, an exhibition was held in 1844 which included displays of 'microscopes, dissolving views and optical illusions'. A series of experiments were carried out for visitors, of whom there were between 500 and 600, including several on the science of galvanism as well as 'demonstrations on the use of oxy-hydrogen blow pipes, air pumps, a diving bell and working models of machinery' (*Report of the Yorkshire Union of Mechanics' Institutes' 1844*, p.27).

In other parts of the country, institute exhibitions were also common and popular. The Birmingham Mechanics' Institute, for example, opened its exhibition to foreign competitors in 1849, something which the 1851 Exhibition was also very keen to do and which would highlight the serious concerns that Britain was lagging behind other countries in relation to industrialisation and skill. In part, at least, this was due to the lack of technical education

available to the majority of employees (Davis 1999, p.11). Dunstan believes that 'The Great Exhibition had its antecedents in the modest provincial exhibitions organised by mechanics' institutes'. Such 'exhibitions were a straightforward application of learning by looking' during a period when many working people were just beginning to receive an elementary education (Dunstan 1996, pp.11 – 12).

The 1851 Great Exhibition of the Works of Industry of all Nations

The Great Exhibition was opened in London, England by Queen Victoria on 1 May 1851. It was the idea of the Queen's consort, Prince Albert who, with other organisers saw such an Exhibition as a means of improving design and artisanal skills in support of Britain's industrialisation as a result of foreign advancement and competition in science and technology The idea came from the success of previous exhibitions held at mechanics' institutes' up and down the country. As President of the Society for the Encouragement of Arts, Manufactures and Commerce (hereafter referred to as the Society of Arts), Prince Albert had substantial backing for the initial idea and support for a Great Exhibition. Lord Henry Brougham, the Whig Chancellor who supported educational reforms in Parliament wrote articles on scientific education in the influential *Edinburgh Review* where he once stated that 'British artisans were the least trained and the middle-class manufacturers the worst educated in Europe' (Auderbach 1999, p.11).

The Prince believed that the involvement of the working men 'was critical to the success of the Exhibition'. He included them on the London Committee of the Exhibition 'to promote the interests of the working classes'. Samuel Wilberforce, the Bishop of Oxford, who was on the same committee, gave a speech in which he stated that 'it [the Exhibition] sets forth in its true light the dignity of the working classes…it tends to make other people feel the dignity which attaches to the producers of these things [exhibits]' (Auderbach 1999, p.129).

Many industrial towns throughout Britain supported the Exhibition through the setting up of their own local committees for the purpose of publicising the event and providing some funds for travel and accommodation for those who otherwise would not have been able to go to London. The Manchester Exhibition Committee, for example, was supported by the Unitarian

industrial families of Heywood, Philips, Henry, Potter and Greg, all of whom had been influential in establishing and providing on-going support for the Manchester Mechanics' Institute (Auderbach 1999, p.77). The Committee requested 'that two men from each principal workshop and manufactory in Manchester are to assist in carrying out the objects of the Great National Exhibition of 1851'. It was also keen to promote the Exhibition through establishing 'an active canvass amongst the artisans in different machine shops and manufactories to ascertain how many individuals, or associated bodies, will prepare specimens of their skill for the Exhibition'. The Committee also promised to arrange cheap rail transport so as to allow all those who were interested, to visit the exhibition at the lowest possible cost (Inkster 2000, p.152).

Meanwhile, specifically with regard to the Yorkshire Union, mill owners were encouraged to support the Leeds Committee by encouraging their workers to subscribe to its funds. John Gott's employees, for example, donated £75 towards the Exhibition (Inkster 2000, p.135). At Huddersfield, a donation of £25 was given by the local landlord, Sir John Ramsden, which enabled eight students from the Mechanics' Institute to travel to London and attend the Exhibition (*Annual Report of the Yorkshire Union of Mechanics' Institutes'* 1851, p.60).

The mechanics' institutes' committees nationally were identified as the mainstay in supporting the Exhibition in relation to working-class technical education. The Yorkshire Union of Mechanics' Institutes' agents 'enthusiastically took part in giving preliminary lectures about the nature and objects of the Great Exhibition' in towns which had Union institutes' (p.14). The Union reported in 1850 that it had 'pleasure in drawing to the attention of the Institutes the great and novel Exhibition which was taking place in London next year, at which the works of Industry of all Nations will be exhibited'. It was sure that such an Exhibition would not fail to give a 'great stimulus to mechanical skill and inventiveness' as well as to 'enlarge the minds and improve the taste of the multitudes that will flock to behold it' (Barton 2005, p.60).

The Yorkshire Union stated that the Royal Commissioners had offered to send lecturers to its mechanics' institutes, 'to give a gratuitous lecture on the nature and objects of the

Exhibition'. The *Yorkshire Union Report* of 1850 noted that 'the Committee of the Union scarcely needed recommending its institutes to invite the lecturers to address them on the subject (*Annual Report of the Yorkshire Union of Mechanics' Institutes'* 1850, pp.14 – 15). Union agents were appointed to lecture on the Exhibition. It is known that they visited Bingley, (*Annual Report of the Yorkshire Union of Mechanics' Institutes'* 1851, p.32), Burley (p.37) and Guiseley Institutes' (p.44). and Keighley. In the case of the latter, 240 members attended a lecture given in the evening was by the Union agent entitled *On the Objects and Benefits of the Great Exhibition*.(p.57). Agents also visited Morley (p.65), Pudsey (p.69) and Wakefield Institutes'. In the case of Wakefield, 'a club was formed with the view to assisting members to visit the Great Industrial Exhibition' (p.79). Other Mechanics' Institute Unions across the Country arranged similar lectures.

The newly expanding rail network was to contribute to the success of the Exhibition. The railway companies offered specifically low fares to visit it, usually with return tickets that were valid for up to three weeks. Working-class travellers had financial support from their local committee (Hobhouse 2002, p.70). These offers encouraged many to attend the Exhibition and to take the opportunity to visit and stay in London. However, some workers took night trains, spent the day at the exhibition and then returned home the following evening ready for work the next morning. This meant that they lost only one day's wages where employers were not willing to support them (Auderbach 1999 p.148). This indicates very strongly that many working-class employees, wherever they lived, were enthusiastic about visiting the Exhibition.

The scale and success of the Exhibition can be measured by the number of visitors who travelled from all parts of the country to see the exhibits. It was visited by over six million people between May and October 1851 (the period it was open), with over 17 per cent of the population visiting Hyde Park. Many may well have visited more than once (Taylor 1988, p.10). Over 100,000 visitors attended on 7 October alone, presumably wanting to see the exhibits before the Exhibition closed at the end of the week. The entrance fee was one shilling and it took two hackney carriages 'to take the day's takings to the Bank of England'

(Hobhouse 2002 p.69). Visitors often took advantage to visit other sights while in London where, for example, the British Museum saw an increase in the number of visitors from 720,000 the previous year to over two million in 1851 (p.69). Thus, a huge number of people gained first hand experience, technological developments that were on show and were able to take the ideas from both the Exhibition and other places of interest in London, back to their own place of work and local mechanics' institute.

The Exhibition went somewhere towards ending 'the contempt shown for tradesmen and mechanics once the World witnessed the skill involved in the production of artefacts for display'. It was an opportunity for many of the working class to demonstrate their skills and intellectual capabilities in the design and making of exhibits (Barton 2005, p.150). Indeed, the relationship between the working class and the Exhibition was widely discussed at the time. The Liberal intellectuals hoped that the Exhibition would be 'an ambitious model of recreation that would fulfil a wider educative function and exert a civilising influence on the majority' (Purbrick (ed) 2001, p.116-117). Henry Mayhew went as far as to argue that the Exhibition demonstrated that 'manual workers have now achieved a recognition and respect in society'. Prior to the opening of the Exhibition, he believed that working men were 'mere labourers'. The Exhibition was therefore 'the first public national expression ever made in this country, a marvellous display of the trophies and triumphs of labour [which] could not fail to fill working men with pride and inspire them with a sense of their position in the State'. The Exhibition was therefore an excellent public relations event in support of British working-class manufactured goods (p.117).

The *Yorkshire Union Report* of 1852 noted that there had been an increase in membership across the Union compared with the previous year. 'It may be in part attributed to the attractions of the Great Exhibition, as alleged in one or two [individual institute] reports' (p.28). In the same year, lectures were given in various institutes, reporting on the Exhibition to those who were unable to attend. Josiah Firth gave such a presentation, entitled *Reminiscences of the Metropolis, or Six Days in London during the recent Exhibition,* at four unnamed institutes in the *Annual Report* (p.29) At Great Ayton Institute, Mr T J Pearson, an

agent for the Yorkshire Union, gave a lecture called *The Exhibition* 'which was deeply interesting and gave great satisfaction to the audience' (p.52). The Rev. Brewer gave a similar lecture *On the Wonders of the Great Exhibition* at Headingly Institute near Leeds (p.54). Mr Pearsell also visited several institutes giving a lecture on the Exhibition at Meltham Mills Institute near Huddersfield, Stanningley near Leeds (p.54) and Wentworth near Sheffield (p.58). This provides evidence that the Union was keen that members had the opportunity to learn about this major event and its exhibits. Spending so much time and effort before and after the Exhibition indicates how much importance institute committees put on the influence of Exhibition with regard to adult education.

The Yorkshire Union made specific reference to the Exhibition in its *Annual Report* of 1853, stating that 'inhabitants of every town, village and hamlet in the kingdom, more especially among the working and industrial sections, whose laudable pride led them to that temple of industry to see machines of the new age' (*Annual Report of the Yorkshire Union of Mechanics' Institutes' 1853*, p.96). The point that the Union reported the positive effect of the Exhibition in such generous terms suggests that institutes were benefiting from the Hyde Park effect in stimulating interest in new developments that were being exhibited as well as learning technical subjects taught in the institutes supporting industry.

The comprehensive coverage of exhibits, relating to many manufacturing and agricultural developments, supported the technological knowledge and understanding required by both employers and employees. Those attending the institutes would have been able to relate them in their studies. The Exhibition brought to the attention of manufacturers the need for better engineering, scientific and manufacturing skills. Commercial instruments made by the French, for example, won more medals from the judges than the British at the Exhibition. 'In astronomy, navigation, chemistry and meteorology' Britain's contribution was not as good as those from other parts of the World. However, with regard to machinery and manufacturing, Britain was still leading the way (Auerbach 2001, 101). Those who visited the Exhibition were made aware of these developments and no doubt were encouraged to relate findings to their studies, whether in the work place, or local institute.

The Impact of the Great Exhibition on Technical Education

The Society of Arts supported scientific and technical education by offering nationally recognised qualifications in subjects taken by students, many of whom studied at mechanics' institutes. The success of the Exhibition and the encouragement by the Society of Arts in supporting technical education was reflected in the introduction of relevant subjects and examinations in support of Britain's continuing industrialisation.

The impact of the Exhibition meant that there was much debate around supporting the working class with regard to technical education. James Hole, for example, an active member of the Leeds Mechanics' Institute, had a particular interest in supporting adult education amongst the working classes. Writing in 1853, he stated that 'education is not an affair of childhood and youth, it is the business of the whole of life' (Hole 1853, p.44). He believed that 'the nation that possesses the largest number of skilled artisans, capable of availing themselves of the aids which science lends to industry, will, other things being equal, be the richest nation' (p.49). He had identified in both rural and industrial areas the importance of mechanics' institutes' to support adult working-class education. Hole believed that the rural mechanics' institutes could provide courses in the science of agriculture for farmers and husbandmen supporting 'the culture of land, the manuring of crops, their value when reaped, the feeding and treatment of stock, the manufacture and management of butter and cheese' (p.51). He saw the importance of chemistry as an industrial subject supporting the dyeing, bleaching and other trades in support of British industrial progress and particularly relevant to the textile industries of the North (p.51).

Hole not only identified the need for industrial education, but also facilities such as qualified teachers, newspaper and reading rooms, social gathering, exhibitions, penny savings banks and itinerating libraries, all the facilities offered by mechanics' institutes. The government, he believed, should take responsibility for funding and making available education to working-class adults through the Society of Arts which should, he thought, offer nationally recognised examinations and certificates in technical subjects, which it did go on to do.

The Society of Arts was concerned that science and technology in Britain were both being overtaken by other countries developments, having examined the quality of overseas exhibits at the Exhibition. Members of the Society included several Whigs and Tories as well as radical civil servants, aristocrats, industrialists, manufacturers, and academics. Despite their diverse political views, they seemed agreed that there should be a national system of compulsory education and 'adult remedial [elementary] courses for those who lacked schooling'. Without this foundation, the workforce would have little understanding or knowledge of 'scientific elements to their trades'. The Society wanted to offer technical subjects with national recognition being given through examinations and certification (Luckhirst 1957, 144).

The Society of Arts further believed that in order to support these needs, technical training schools should be established to teach new, specialised skills necessary to operate modern industrial machinery and develop a scientific knowledge in support of British science and industry (Luckhirst 1957, 144). It also believed scientific and technological developments could be further supported by the building of more government schools of design. The Society encouraged the creation of new school and technical courses, museums and exhibitions offered by the newly established Society of Arts Union of Mechanics' Institutes' (145). 'It was the Victorians who perfected the science of learning by looking' and after all, 'they invented the most characteristic cultural institutions of the period – the museum, art gallery, the diorama' (Dunstan 1996, p.12). Perhaps most important of all, was the setting up, in 1856, of the Society of Arts Examination Board as suggested by Hole and supported by Prince Albert, in technical and commercial subjects (Bosbach, Bennett, Brockmann, Davis, Filmer-Sankey 2002, p.145).

In 1855, 'the first courses of instruction and examination' were offered at the Society of Arts headquarters in London'. The Society established a Union of Mechanics' Institutes' which it believed would encourage institutes' to support their students to complete the courses to sit the examinations. The Yorkshire Union reported that the 'Union of Institutes' in connection with the Society of Arts has devoted considerable attention in offering Society of

Arts examinations'. The Yorkshire Union gave its wholehearted support to assisting 'the Society of Arts Union in promoting the welfare of mechanics' institutes' and co-operating in whatever way it could (*Annual Report of the Yorkshire Union of Mechanics' Institutes'* 1853, p.10).

It, like other mechanics' institute unions, identified that such a move would support the movement nationally. The Warrington Mechanics' Institute, a member of the Lancashire and Cheshire Union, for example, had been in serious decline around 1850 and as a result of this arrangement, it had 'its life extended well into the 1890s' through offering Society of Arts subjects (Stephens 1958, p.126).

The Society of Arts had founded its examinations specifically for the 'artisans, labourers, clerks, tradesmen and farmers…apprentices, sons and daughters of tradesmen and farmers, assistants in shops, and others, of various occupations', who otherwise would not have had the opportunity to gain formal qualifications, which were far more relevant to supporting industrialisation than the degrees being offered by nineteenth-century universities (Luckhirst 1957, p.252).

The Science and Art Department was established and funded by government in 1859 and initially provided grants to teachers of science. From 1861, it organised public examinations in the basic sciences (Kelly 1992, p.197). By 1880, there were over 70 mechanics' institutes' offering science and art examinations through the Department to about 7,000 students of whom 4,000 were taking science and the remaining 3,000 attended art and design classes (Shapin and Barnes 1977, 237).

Thus, mechanics' institutes' were responding to the needs of offering technical education, which were examined through the Society of Arts, the Science and Art Department and. from 1888, the City and Guilds of London Institute for the Advancement of Technical Education (hereafter the City and Guilds London Institute) which 'began to examine in technological subjects while the Society of Arts now concentrated on commercial subjects' (Shapin and Barnes 1977, 237).

The impact of the Exhibition in raising the importance of Britain developing technical education through the founding of the Science and Art department, the re-organised Society of Arts and the establishment of the City and Guilds of London Institute supported industrial technology and developments through grants and examinations of subjects delivered at mechanics' institutes' as well as other institutions (Luckhirst 1975, 252).

With regard to the Yorkshire Union by 1865, a drawing class had been started at Keighley for young men who were training to become masons, joiners or mechanics alongside writing, arithmetic and geography classes. Elementary evening classes had also been introduced and were supported by the Science and Arts Department. There was a textile class, known as the 'cutting out class' for young women as well as French and German classes (p.58). By 1865 the newly established School of Art at Keighley was developing a reputation both regionally and nationally (*Twenty Eighth Annual Report of the Yorkshire Union of Mechanics' Institutes* 1865, p.104).

Keighley Mechanics' Institute's Council highlighted in 1874 the problems associated with the textile industry in the area:

> The position lost can only be regained by our manufacturers and workmen surpassing our rivals in the methods of production, which render their productions more acceptable to the public. The Council urge that young men connected with the textile industries should join the Weaving School, so that their faculties of design and manipulation in which they are deficient may be cultivated (*Thirty -Seventh Annual Report of the Yorkshire Union of Mechanics' Institutes 1874*, p.133).

A Weaving School which was set up in 1880 for the 'theoretical and practical study of designing and weaving for those 'intimately connected with the trades of the district'. These included spinning and weaving of wool, and the construction of the special description of machinery required for these processes (*Forty-Third Report of the Yorkshire Union of Mechanics' Institutes* 1880, p.107). From 1881, the Keighley was offering advanced subjects in steam, magnetism and electricity, theoretical chemistry, practical chemistry, solid

geometry, machine construction, applied mechanics, physical geography, theoretical mechanics, building construction and mathematics (p.107).

By 1877, it was not only chemistry at Huddersfield that was being marketed to local industry. The Designing and Weaving School was based on the 'district whose prosperity so greatly depends on a cultivation of the arts of design', although it had taken 30 years for the manufacturers in the area to really appreciate its contribution to their workforce (*Fortieth Report of t he Yorkshire Union of Mechanics' Institutes* 1877, p.128).

The Cotton Manufacture Course at Hebden Bridge Institute in 1882 was delivered through City and Guilds London Institute and was taught by a former student of the science class. Textile subjects, including chemistry, and engineering with building being the most popular (*Forty–Fifth Report of the Yorkshire Union of Mechanics' Institutes* 1882, p.110). The Committee at Lockwood Mechanics' Institute near Huddersfield, stated in 1873 that examinations were held through the Education Department in Whitehall, successor to the Department of Science and Art, and the Society of Arts (*Thirty-Sixth Report of the Yorkshire Union of Mechanics' Institutes* 1873, p.88). In 1884, the Institute introduced a class for the teaching of cloth manufacture, the students being examined through City and Guilds London Institute (*Forty-Seventh Report of the Yorkshire Union of Mechanics' Institutes* 1884, p.110). The science and practical chemistry classes were well attended at Lindley Institute near Huddersfield in 1873 where students, 'who made good use of the laboratory', had been successful in the May Examinations (*Thirty-Sixth Report of the Yorkshire Union of Mechanics' Institutes* 1873, p.87). Thus, the already well-established mechanics' institutes' were in an excellent position to support technical knowledge, through offering relevant subjects in support of industry and trade, supported through examinations offered by the Society of Arts and City and Guilds London Institute.

The success of the Exhibition also encouraged many mechanics' institutes' throughout the country, including those in the Yorkshire Union, to continue to hold annual exhibitions of manufactured goods, in some cases on a much larger scale than before, which apart from

raising additional income, also raised the profile of new developments and inventions that were being exhibited locally and often made by members themselves. At Huddersfield, for example, Thomas Broadbent, a student at the institute in 1857 took several examinations through the Society of Arts (Walker 2008, 28). In 1864, he founded the textile company of the same name and in 1870 he made a centrifugal extractor for the extraction of water from washed wool and cloth. It was so successful that many local mills wanted to purchase Broadbent's machine. He died in 1880, at the age of 47 (Thomas Broadbent and Sons date unknown, pp.2-3).

An art exhibition was held at the Huddersfield Institute in 1882 and 'was very popular with the public' (*Report of the Yorkshire Union of Mechanics' Institutes'* 1882, p.114). A year later the Fine Art and Industrial exhibition was opened during the summer of 1883 at the Institute in order to raise funds for the building of a new Technical School and Mechanics' Institute. It was such a success, there were 170,000 visitors, that several temporary buildings had to be set up in the grounds to house exhibits of machinery, including 'displays of engines, machine tools and machines in relation to woollen manufacture'. There were also 'displays of combing, carding, spinning and weaving processes' (*The Textile Recorder* Manchester 15 May 1883, p.3). The *Huddersfield Chronicle* at the time made mention that 'machinery in motion, including an American loom and 26 other looms, together with combing, carding, spinning, winding, finishing, printing, wood turning and sawing machines, &c &c were on display' in the machinery hall, planned specifically for the exhibition (1 October 1883).

Government involvement in technical education following the Great Exhibition

There were several government-funded reports published and three Acts of Parliament including the 1870 Education and 1889 Technical Instruction Acts, over the following thirty years after the 1851 Exhibition (Purbrick (ed) 2001, pp. 9 – 193). There were seven government reports published in relation to science and technology, following the Exhibition, compared with just one over the previous thirty years (Maclure 1969, pp.9 – 70). This is significant, since the findings of the Exhibition reflected the need to improve education for all,

and especially technical education, the lack of which was impacting on British industrialisation as a result of foreign competition as other countries were offering better technical education than that found in Britain.

In 1855, The *Report of the Commissioners appointed to inquire into the State of Popular Education in England of 1858–1861* was published, highlighting the need for 'the extension of sound and cheap elementary instruction to all classes of the people' and that both working-class children and adults should have the opportunity to attend an educational establishment (p.68). The *Report* provides evidence that government had identified that elementary education should be available, via the state, for all, including adults. The *Report of Her Majesty's Commissioners appointed to inquire into the Revenues and Management of certain Colleges and Schools, and the studies pursued and instruction given therein* (1864) emphasised that mathematics, a modern language, natural science and either mechanical drawing or music should be offered alongside the classical languages and literature (Betts 1991, p.7). Some sixteen years after the Exhibition there was still an urgent need to deliver technical education in schools and universities, as was already happening in France and Germany. In 1867, a government paper *On the best means of Promoting Scientific Education in Schools: A Report presented to the General Committee of the British Association for the Advancement of Science* was published and it identified that across the country and specifically that 'every trade in Birmingham was being injured by the want of technical education' (Betts 1991, 32).

In 1867, a Parliamentary Committee on Scientific Instruction was set up following the Paris Exhibition which had exhibited high quality overseas goods and technology (Argles 1964, p.26). The Huddersfield Committee stated that 'practical men' from the Institute had visited the Paris Exhibition and observed that 'the technical education which operatives on the continent possess may imperil our industrial prosperity' (*Annual Report of the Yorkshire Union of Mechanics' Institutes' 1868*, p.121). One of the 'practical men' was George Jarmain, a chemistry tutor from Huddersfield Institute, who, on his return, established advanced classes for school teachers in science, practical geometry and machine drawing

(Haigh (ed) 1992, p.571). This indicates that institutes were not complacent but that it continually responded to the needs of their membership, whether operatives or teachers.

In 1870, W. E. Forster's Education Act was passed, which stated that 'industrial prosperity depended on the speedy provision of elementary education'. Forster would have been aware of the importance of state-funded school-age education through his strong connections with several institutes', particularly Bradford, where many members had been disadvantaged, through previously not having had an elementary education (Carpentier 2003, 9 – 10). In 1872, the *Report of the Royal Commission on Scientific Instruction and the Advancement of Science* was published. It took the form of a detailed survey of scientific education at universities and other institutions. It urged that children in the elementary schools should have more science teaching and training colleges should provide new courses for science teachers (Maclure 1969*,* p.106).

In 1879, Dr Silvaneous Thompson observed that if Britain was going to maintain its supremacy over the rest of the World, then 'trained workers equipped with intellectual weapons, and clothed with sound science' would be required. 'To ignore this call to arms would result in Britain struggling for existence'. In order allay these fears, and in response to the initial euphoria of science and technology following the Great Exhibition, which seemed to be declining, four artisan exhibitions tours took place between 1867 and 1889. They were devised to publicise the importance of industrial education. The tour organisers sent artisans overseas 'to learn about continental advances in their respective trades and to evaluate Britain's strengths and weaknesses in the light of these advances'. The tours were initiated by the Society of Arts and the findings were included in the science and technology curriculum for examination in education institutions (Bosbach, et al 2002, pp108 – 109).

The result of these concerns was the *Report of the Royal Commission on Technical Instruction* which was published in 1884. Bernard Samuelson, the Chair, had been an iron master and engineer prior to becoming a MP in 1859. He had a personal interest in technical instruction and, having travelled throughout Europe, he had made comparisons between countries in relation to technical education that they were offering. Sir Swire Smith, President

of the Keighley Mechanics' Institute, had also made visits to France and Germany with regards to technical education and was appointed on to the Committee of the Commission. Both men were aware of foreign competition and wanted technical education to support Britain's economic position in the industrial world (Maclure 1969*,* p.121). The Commission on Technical Instruction findings suggested that training should be given in technical institutions and science teaching from elementary to advanced level. The *Report* emphasised the importance of local authorities providing first-class technical instruction in a variety of educational establishments, including day schools and mechanics' institutes' (p.121).

This *Report* led to the passing of the Technical Instruction Act of 1889 which gave local authorities the power to levy a penny rate in order to provide technical courses, appoint teachers and provide grants to schools and mechanics' institutes'. In 1890 the government, put a tax on wines and spirits and it was decided that the money raised referred to as *whisky money*, should be used for supporting technical education (Curtis 1968, p.497). With the passing of the 1889 Act and the Local Taxation Act of 1890, both of which raised government revenue for education, three-quarters of a million pounds was raised by 1891, which was increased to over a million by 1900, providing state-funded adult education (Fieldhouse 1996, p.43).

Indeed, many further education colleges can trace their origins back to the mechanics' institute movement, Venables (1956) makes reference to several including Heriot-Watt College, Edinburgh (1821), Lancaster and Morecambe (1824), Leeds College of Technology (1824), Manchester Municipal College (1824), Dudley College (1862), Cardiff College of Technology (1865), Gloucester Technical College (1873), Northampton Polytechnic. London (1891) Birmingham College of Technology (1895), Leicester College of Art (1896), Brighton College (1897), Stretford Technical College (1899). Other colleges included those at Accrington, Barnsley, Darlington, Hull, Leek, Middlesbrough, Stockton-on-Tees and Wigan (pp.47 – 67). Other mechanics' institutes were to become the foundation for higher education institutions such as Bradford (1824), Huddersfield (1841), Leeds (1824) and Manchester (1824) Universities (Venarables 1956).

Conclusion

Mechanics' institute exhibitions, which had been popular in local towns and communities from the 1830s, became the basis on which the idea for The Great Exhibition of 1851 was conceived. It is a significant fact that the success of the Exhibition was a contributing factor in the growth of the mechanics' institute movement after 1851, at a time when there had been concern that it was in permanent decline. Mechanics' institutes' offered relevant subjects in education and training supporting of British industrialisation, particularly following the concerns raised by the Crystal Palace exhibits that the country was declining and losing its industrial position to foreign competition. Many institutes also offered elementary education as a grounding for advanced subjects. The establishment of local committees, for the purpose of fund raising to support the working classes to attend, were strongly associated with mechanics' institutes.

The Society of Arts was rejuvenated by the Exhibition's success, increasing its membership and finances, which put it in a strong position to support technical qualifications. The Exhibition was not only an advert for industrialisation but also in promoting technical and scientific education. It is no coincidence that whereas in 1850 James Hudson lamented on the decline of mechanics' institutes, the Exhibition a year later actually contributed to the re-branding them in support of the new industrial age through technical education supported by the Society of Arts, Department the Science and the City and Guilds of London Institute.

The success of the Great Exhibition and its impact on technical education was a major contributor to the on-going success and credibility of the mechanics' institute movement. With the Royal Commissions and passing of the 1889 Act and the Local Taxation Act of 1890, government revenue was finally raised for technical education which was to support twentieth-century further education for all which continues today.

Together, the Exhibition and the mechanics' institute movement proved to be a major factor which provided a much needed impetus in support of adult education and training in support of industrialisation for the masses. Such a sound basis provided a transition for mechanics' institutes to often develop into technical schools, many of which were being built

in the early twentieth century and which were to impact on adult and further education in the twentieth century. Indeed most further education colleges can trace their origins back to their local mechanics' institute either directly or indirectly.

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