COMPARATIVE EVALUATION OF “LEED” CERTIFIED SCHOOLS WITH “YES-TR” IN THE CONTEXT OF “GREEN CERTIFICATION”

IZEL AKYEL¹ and RUVEYDA KOMURLU²

¹Interior Design Program, Vocational School, Doğuş Univ, Istanbul, Türkiye
²Dept of Architecture, Faculty of Architecture and Design, Kocaeli Univ, Kocaeli, Türkiye

With the emergence of green building concept in the construction sector, the increase in green building production has resulted in green building certification systems. It is important to establish these certification systems on a national scale for reasons such as the compatibility of sustainable architecture with local conditions and differences in the legislation of countries. It is inevitable to change the criteria of the certification system in accordance with the function of the building. As the schools are directly related to learning as well as providing the health and comfort to the users, there are internationally specialized certification systems for green schools. In this study, some of the LEED-certified schools in Türkiye were compared; these buildings were evaluated within the framework of the “Green Certificate (YeS-TR)” introduced by the Türkiye’s Ministry of Environment, Urbanization and Climate Change in 2022. The main categories of “LEED v2009 for Schools” and “Green Certificate” were compared; while “sustainable sites” and “regional priority” categories in “LEED v2009 for Schools” are not included in the “Green Certificate”, the main category of “integrated design, construction and management” and “life cycle assessment” were not met in “LEED v2009 for Schools”. As a result of the study, various suggestions were made for the development of certificates in this context.

Keywords: Green building, Green schools, LEED for schools, Green certificate, YeS-TR.

1 INTRODUCTION

The aim of green building design is to reduce the consumption of non-renewable natural energy resources, soil, water and building materials. In addition, to achieve zero energy consumption and to prevent and reduce pollution during construction and demolition stages are among the aims of green building. After this, green building certification systems developed. It basically describes to design and construction professionals what the standards required for green building production are, what path should be followed to achieve these requirements, the methods and service tools that can be used, and as a result, certification is made (Selçuk 2010). Studies on green schools reveal how much these schools positively affect students' physical, psycho-motor and cognitive, social and academic performances. Green schools purify the environment from toxic substances, improving student health and reducing absenteeism. In short, green schools help create a healthy environment, thus helping both students and school staff to be more active and disease-free (Bademcioglu 2017).
2 MATERIALS AND METHODS

Within the scope of the study, firstly, buildings in Turkiye with LEED certification were examined. As a result of the examination, 8 educational buildings with LEED 2009 for Schools New Construction and Major Renovations (v2009 BD+C: Schools) version were identified in Turkiye. Then, by comparing the YeS-TR: Green Certificate with the LEED v2009 BD+C: Schools certificate, the main differences and similarities between the two certificates were revealed. For practicality in this study, it will be referred to as LEED, not LEED 2009 for Schools New Construction and Major Renovations (v2009 BD+C: Schools). There are no different certificate types for different building types in YeS-TR. However, the scores assigned by YeS-TR vary depending on building types i.e. residential, office buildings, schools, hotels, healthcare buildings, shopping and commercial centers and others. There is a table in each category listing the building types and the scores available for the building types. In this study, the categories and scores mentioned as YeS-TR belong to schools.

3 YeS-TR: GREEN CERTIFICATE_BUILDING AND LEED

With the implementation of the Green Certificate system for Buildings and Settlements, the "YeS-TR: Green Certificate" system, which was prepared as a local and national application for the first time in order to certify sustainable green buildings in Turkiye, started to serve. Within the scope of the YeS-TR: Green Certificate_Building, a total of 110 points can be obtained, including integrated building design, construction and management (14 points); building material and life cycle assessment (16 points); indoor environmental quality (20 points); energy efficiency and use (30 points); water and waste management (20 points); innovation building (10 points) (Republic of Turkiye Ministry of Environment, Urbanization and Climate Change 2022). LEED Certification System is the certification system published by USGBC (US Green Building Council) in 1998 to define and evaluate green buildings (Savas and Komurlu 2022). Total of 110 points can be obtained in LEED v2009 BD+C: Schools. Category-based scores are seen in Section 3.1.1.

3.1 Evaluation of Schools in Turkiye with LEED v2009 BD+C: Schools

Below, information about schools with v2009 BD+C: Schools in Turkiye is shown in Table 1.

Table 1. LEED v2009 BD+C: Schools Certificated Schools in Turkiye (USGBC 2023a, USGBC 2023b, USGBC 2023c, USGBC 2023d, USGBC 2023e, USGBC 2023f, USGBC 2023g, USGBC 2023h).

<table>
<thead>
<tr>
<th>School</th>
<th>Building Area (sq ft)</th>
<th>Certificate Degree</th>
<th>Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Atatürk Fen Lisesi</td>
<td>6,543</td>
<td>Platinum</td>
<td>Oct, 2020</td>
</tr>
<tr>
<td>*Kadıköy Belediyesi Bahriye Ucok Anaokulu</td>
<td>10,855</td>
<td>Platinum</td>
<td>Nov, 2017</td>
</tr>
<tr>
<td>*TED Ronesans Koleji</td>
<td>201,466</td>
<td>Gold</td>
<td>May, 2014</td>
</tr>
<tr>
<td>*Terakki Tepeoren- Elementary School</td>
<td>97,829</td>
<td>Gold</td>
<td>Nov, 2018</td>
</tr>
<tr>
<td>*Terakki Tepeoren- High School</td>
<td>100,194</td>
<td>Gold</td>
<td>Jun, 2019</td>
</tr>
<tr>
<td>*Terakki Tepeoren-Kindergarten</td>
<td>68,245</td>
<td>Gold</td>
<td>Nov, 2018</td>
</tr>
<tr>
<td>*Mavisehir Egitim Kurumu</td>
<td>68,537</td>
<td>Certified</td>
<td>Jul, 2016</td>
</tr>
<tr>
<td>*Cihangir Koleji Bahcesehir Kampusu</td>
<td>110,760</td>
<td>Certified</td>
<td>Mar, 2015</td>
</tr>
</tbody>
</table>

1 Although the building areas are in sq ft in the USGBC Official website data, Atatürk Fen Lisesi is given in sq m. In order to compare the data, the area size of 6,052 sq m was converted to sq ft and added to the table.
3.1.1 Examination of schools with LEED v2009 BD+C: Schools certificate in Türkiye based on main categories

Table 2 shows the scores obtained by schools with LEED v2009 BD+C: Schools certificate in Türkiye in the main categories.

Table 2. Scores of schools with LEED v2009 BD+C: Schools certificate in Türkiye in main categories.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>*Ataturk Fen Lisesi</td>
<td>20</td>
<td>10</td>
<td>32</td>
<td>5</td>
<td>11</td>
<td>4</td>
<td>4</td>
<td>86</td>
</tr>
<tr>
<td>*Kadıköy Belediyesi Bahriye Ucok Anaokulu</td>
<td>21</td>
<td>8</td>
<td>29</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>*TED Ronesans Koleji</td>
<td>18</td>
<td>8</td>
<td>11</td>
<td>6</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>62</td>
</tr>
<tr>
<td>*Terakki Tepeoren Elementary School</td>
<td>14</td>
<td>5</td>
<td>25</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>61</td>
</tr>
<tr>
<td>*Terakki Tepeoren High School</td>
<td>14</td>
<td>4</td>
<td>27</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>65</td>
</tr>
<tr>
<td>*Terakki Tepeoren Kindergarten</td>
<td>14</td>
<td>3</td>
<td>26</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>63</td>
</tr>
<tr>
<td>*Mavişehir Eğitim Kurumu</td>
<td>15</td>
<td>10</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>44</td>
</tr>
<tr>
<td>*Çiğli Koleji Bahçeşehir Kampusu</td>
<td>13</td>
<td>10</td>
<td>0</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>45</td>
</tr>
</tbody>
</table>

According to the Table 2, the success percentages of educational buildings; sustainable sites %67.19; water efficiency %65.91, energy & atmosphere %58.33; materials & resources 47.12; indoor environmental quality %34.87; innovation %79.17; regional priority %78.13.

4 COMPARISONS OF YES-TR: GREEN CERTIFICATE_BUILDING AND LEED V2009 BD+C: SCHOOLS CERTIFICATES

In this section, YeS-TR and LEED v2009 for Schools are compared based on main categories.

4.1 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR Integrated Building Design, Construction and Management Category

In LEED, having accredited personnel in the innovation design category earns 1 point. In YeS-TR, the application is made by a green certificate expert. YESU's participation in the project earns 5 points. In YeS-TR, establishing a project team that includes relevant disciplines earns points in the project planning category, interdisciplinary stakeholder participation, preparing the emergency plan, ensuring its up-to-dateness, increasing fire safety, making life cycle assessment, planning the operating life, engineering and design solutions that increase the quality of life. There is also the category of controlling the noise emitted by the building. These criteria are not included in LEED. In YeS-TR, the selection of sustainable land and transportation links is discussed in the project planning category and is evaluated with 10 points. In LEED, the sustainable land category is discussed as a separate title and is evaluated with 24 points. While YeS-TR includes preliminary research / analysis and evaluation of possible strategies regarding energy, LEED include energy and atmosphere and water efficiency categories. There are no criteria for developing the strategy in question within the relevant categories. While points are earned for visual, auditory, thermal comfort and air quality in YeS-TR, relevant criteria are included in the indoor environmental
quality category in LEED. In addition, all these criteria are included in detail in the indoor environment quality category in YeS-TR.

### 4.2 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR

**Building Material and Life Cycle Assessment Category**

In YeS-TR, the indoor environment quality main module includes the criteria of ensuring the required level of illumination and uniformity in terms of visual comfort, providing the necessary glare values of artificial lighting systems, ensuring adequate daylight performance, and ensuring solar control. A total of 25 points are earned. In LEED, controllability of systems-lighting and daylight and views criteria are included in the indoor environmental category. They are total of 2 points. In YeS-TR, a total of 25 points can be obtained in the auditory comfort theme. There are no prerequisite criteria. In LEED, minimum acoustic performance is mandatory in the indoor environmental quality category. In YeS-TR, it is a mandatory criterion that the thermal dissatisfaction percentage index and Average Thermal Sensation Indicator in the thermal comfort theme meet the conditions specified in the TS EN ISO 7730 standard and earn 25 points (Turkish Standardization Institute 2006). LEED includes thermal comfort-design and thermal comfort-verification criteria. In YeS-TR, the air quality theme includes the criterion of providing fresh air intake in accordance with the TS EN 16798-1 standard to ensure indoor comfort in natural or mechanical ventilation methods (Turkish Standardization Institute 2019). This criterion is mandatory and provides 25 points. There is an increased ventilation criterion in LEED.

### 4.3 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR

**Indoor Environmental Quality Category**

In YeS-TR, the indoor environment quality main module includes the criteria of ensuring the necessary brightness level in the visual comfort theme, ensuring the necessary brightness uniformity, providing the necessary glare values of artificial lighting systems, ensuring adequate daylight performance, and ensuring solar control. A total of 25 points are earned. In LEED, controllability of systems-lighting and daylight and views criteria are included in the indoor environmental category. Controllability of systems-lighting earns 1 point, while daylight and views earn 1 point each, for a total of 2 points. In YeS-TR, a total of 25 points can be obtained in the auditory comfort theme within the indoor environment quality main module, there are no prerequisite criteria or mandatory criteria. In LEED, minimum acoustic performance is mandatory in the indoor environmental quality category. LEED includes thermal comfort-design and thermal comfort-verification criteria. In the indoor environment quality main module of YeS-TR, the air quality theme includes the criterion of providing fresh air intake in accordance with the TS EN 16798-1 standard to ensure indoor comfort in natural or mechanical ventilation methods (Turkish Standardization Institute 2019). This criterion is mandatory and provides 25 points. There is an increased ventilation criterion in LEED.

### 4.4 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR

**Energy Use and Efficiency Category**

In YeS-TR, the criterion of increasing the weighted energy performance is mandatory and 75 points. Minimum energy performance is a prerequisite in LEED. In YeS-TR, criterion for studying renewable energy systems in the theme of renewable energy technologies is 7 points, renewable energy use (OPTION-1 Installation and use of renewable energy technologies) is 18 points,
Renewable Energy Use (OPTION-2) Purchasing renewable energy from off-site is 10 points. Points can be obtained only from option 1 or 2. A total of 35 points can be achieved in LEED.

4.5 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR Water and Waste Management Category

In YeS-TR, the criterion for selecting appropriate fixtures and equipment for the efficient and effective use of water in the theme of water and waste management is 15 points. In addition, 10 points are earned if losses and leaks are prevented / necessary precautions are taken in water distribution, while monitoring and recording water usage with meters is a mandatory criterion. There are no criteria that provide points in these commands in LEED. In YeS-TR, the water quality control criterion is 5 points, and rainwater collection, purification and use is 7 points. In LEED, it is evaluated with 2 points, one point each for quantity control and quality control, within the stormwater design credit in the sustainable sites category. In YeS-TR the wastewater reuse (grey water) criterion is 13 points. In LEED, it is evaluated as 2 points in the water efficiency category with the innovative wastewater technologies criterion. In YeS-TR, preparation of a waste management plan is mandatory, and in LEED 1-2 points can be obtained from the construction waste management credit in the materials and resources category. In YeS-TR, the criterion of separating waste on site and collecting it in appropriate places and volumes is 20 points, and in LEED, storage and collection of recyclables is a prerequisite. In YeS-TR, the criterion of reducing the volume of waste to be disposed of by encouraging and ensuring the reuse of separated waste is 10 points. The criterion for recycling/gaining and energy recovery is 15 points, the criterion for separate accumulation and reuse of demolition waste is 5 points. In LEED, a total of 8 points can be obtained from building reuse, materials reuse and recycled content credits.

4.6 Examination of LEED v2009 BD+C: Schools Certificate within the Scope of YeS-TR Innovation_Building Category

In the YeS-TR innovation_building main module, in the theme of engineering and design solutions that improve the quality of life, the criterion of innovation - applications that are not included in the current certification requirements but have innovative value in green building certification is 25 points. In YeS-TR, the criterion of improvement in the theme of engineering and design solutions that increase the quality of life - providing improvements that increase the quality of life of building users with innovative applications to be developed is 25 points. In YeS-TR, in the theme of developing a monitoring and evaluation system, the criterion that the project includes innovative solutions for monitoring, measuring, and evaluating water, heat and energy sustainability is 50 points. In LEED, innovation in design is evaluated with 1-5 points.

5 RESULTS AND CONCLUSIONS

When the schools that received certificates in the LEED v2009 BD+C: Schools category in Turkiye are examined, it is seen that the categories with the highest success rates are "innovation" and "regional priority". This shows that adaptation to regional conditions and interest in innovative construction solutions are high. It is an indication that the evaluation made by local certification systems will produce successful results. Although it is necessary to determine the international common framework of the green building concept, it is inevitable to create regional certification systems due to both developing technology and increasing awareness about green building.

Conditions evaluated in the regional priority category must contribute to the structure of local certification systems and, where necessary, be prerequisites. In this context, YeS-TR: Green
Certificate for Buildings and Settlements created in Türkiye is an important step. Compared to LEED v2009, YeS-TR: Green Certificate for Buildings and Settlements suggests an important project management strategy, especially in integrated design, construction, and management.

The criterion of occupational health and safety, which is included in the “Integrated Building Design, Construction and Management” category in Yes-TR: Green Certificate for Buildings and Settlements, is also an important issue and an important step. In LEED v2009 BD+C: Schools, there is no criteria to earn points regarding this issue. Thus, an enhancement in LEED v2009 BD+C: Schools regarding this issue may be valuable.

This study points to the importance of regional priorities and innovation in school building regarding green building certification systems. It is expected that this study directs experts for improving both subject certification systems and guides professionals for further research studies.

References


Republic of Turkey Ministry of Environment, Urbanization and Climate Change, Binalar ile Yerleşmeler için Yeşil Sertifika Yönetmeliği (Green Certificate Regulation for Buildings and Settlements), Republic of Turkey Official Gazette, 31864, June 12, 2022 (in Turkish).


Turkish Standardization Institute (TSE), TS EN ISO 7730: Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria, 2006.


