Adaptive reuse design method in a sustainable interior design model

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ABSTRACT: The author has analysed modifications to interior design teaching to incorporate environmental sustainability in the design of indoor spaces. Effective management of solid waste produced as a result of repetitive construction, deconstruction and demolition of components in interior environments is recognised as one of the main requirements for a sustainability strategy for the conservation of natural resources and energy. The purpose of this article is to verify, by survey, students' understanding of the value of waste management as a cost-effective and environmentally responsible interior design method. Consideration is given to the entire life-cycle of a building's interior components Also, investigated are the obstacles preventing the successful implementation of the *adaptive reuse design concept* by interior design students in their projects. The aim of the study is to promote the inclusion, into the interior design curriculum, of the environmentally responsible use of building materials.

INTRODUCTION

Environmentally sustainable resource management through reuse and recyclability in interior design was identified by Grazyna Pilatowicz as the only sensible response to the growing solid waste problem [1]. John Tillman Lyle, after analysing indoor environment design, concludes that the main problem in creating a new approach to building materials and products in new surroundings is to decline to consider them as worthless material [2]. According to Lyle, it is necessary to revise the assumption that used materials cannot exist in any other than the originally presumed functional sense. The cyclical model applied to building materials and products, as emphasised by Pilatowicz, should help recognise waste as resources, worthy to be reintroduced into the indoor environment. Sim Van der Ryn and Stuart Cowan highlight the relevance of restorative materials cycles in the context of material usage in ecologically efficient architectural design [3]. Architects and designers should make their decisions with regard to the life-cycle of materials and allow these materials to be repeatedly reclaimed and reused. This strategy can be executed successfully with the adaptive reuse method, along with recycling, flexibility, ease of repair and material durability.

The Cradle-to-Cradle (C2C) product design framework, developed by William McDonough and Michael Braungart, based on the two interrelated concepts of food equals the waste and eco-effectiveness highlights the value of product performance evaluation based on the life-cycle approach [4]. This model is used to analyse the manufacturing process to identify the provision for the reclaiming and recycling of components. There is a strategy of design for disassembly (DfD) to lengthen a product's lifespan and to achieve sustainable resource management.

Susan M. Winchip emphasises that reusing buildings including interior finishes and furnishing components must be the preferred solution when designing interior environments [5]. The fulfilment of the above is becoming a condition for the significant reduction in the negative impact on the natural environment through the conservation of non-renewable resources, as well as the lowering of the completion costs. Charles J. Kibert underlines that reuse in architectural design is similar to the reduction and recycle priorities recommended for environmentally sustainable building materials and products [6]. Reusing existing buildings is a sustainable practice in itself [7], and, as indicated by Graeme Brooker and Sally Stone *interior architecture, interior design, interior decoration, and building reuse are very closely linked subjects* [8]. The issues related to the end-of-life phase of a building and its structural components being reintroduced into a built structure still are insufficiently recognised by interior designers [4].

The author refers to this problem indicating necessary curriculum adjustments based on the findings of a survey. The objective of the study was to assess student knowledge and attitude towards sustainable design strategies concerning environmental requirements. This was used to verify the current interior design teaching framework. The suggested modifications should lead toward a comprehensive consideration of environmentally oriented problems

in a new course. This should concern a resource management strategy for the indoor environment, with the introduction of an adaptive reuse method.

RESOURCES MANAGEMENT IN INTERIOR DESIGN EDUCATION

Grasping a closed-loop sustainable design model or Cradle-to-Cradle scheme for interior environments requires interior design students to have relevant knowledge and commitment [4]. This consciousness toward environmentally responsible solutions facilitates the environmental practices of interior designers, as focused on the reduction of solid waste and on the sustainable management of natural resources. The reduced consumption of natural resources and its responsible management in interior design is partially a consequence of the adaptive reuse of reclaimed or salvaged building materials and products, as claimed by the author. The sustainable design methods and techniques are not included in the existing interior design teaching programme in a comprehensive manner.

Currently, interior design education is built around interior design studios complemented by courses on architecture theory and history, aesthetics, graphic presentation techniques, building construction, structure and material technologies. It provides an incomplete and disconnected paradigm of environmentally responsible design and sustainable methods, techniques and tools. These latter are necessary for professional practice and permit the closing of the *sustainability gap* between theory and practice [9].

A comprehensive methodology of sustainable design is not sufficiently embedded in presently delivered courses. Current interior design teaching programmes just offer the students lectures on sustainability in architectural design, discussing the impact on the integrative design process and its fundamental role in creating a healthy natural and indoor environment. These presentations are within elective lectures delivered to the undergraduate students. The educational framework requires adjustments to the comprehensive approach to sustainability requirements, including knowledge of the environmental strategies to be applied in interior design.

METHODOLOGY

The study was conducted among the sixth and the last-but-one semester undergraduate students of the Interior Design Faculty who were preparing for their final diplomas before graduating with their Bachelor of Fine Arts degrees in Interior Design. The respondents were attending obligatory courses on interior design supplemented with courses on design theory and history, as well as the compulsory course on Building Construction, and the elective lectures on sustainable architectural design, both delivered by the author. The survey was carried out to verify if the current curriculum and teaching framework are adequate in informing attitudes towards sustainability and providing the ability to incorporate the principles into designs. The main objective of the study was to verify if the current interior design teaching framework provides students with comprehensive, solid and systematically built knowledge of the sustainability principles. Detailed objectives were:

1) Assess students' sustainability consciousness and knowledge of environmental issues with regard to their application in indoor creation.
2) Assess students' perception of the adaptive reuse concept and their ability to identify the main benefits of re-implementation of reclaimed or salvaged building materials and products into a building's internal environment.
3) Encourage students to indicate the main determinants of any reluctance towards acceptance of adaptive reuse as a valuable sustainable interior design method.
4) Indicate reasons for rejecting this adaptive reuse procedure's priority in the interior design model.
5) Recognise the adaptive reuse concept as an essential environmental consciousness indicator, sustainable design criterion, as well as design method enabling the sustainable interconnectedness of natural and built environments.

To meet these objectives, the author puts forward the following two hypotheses:

Hypothesis 1: Interior design students lack comprehensive knowledge on the environmental context of interior design, due to the absence of adequately structured compulsory courses on sustainability design within the existing teaching framework. There is a related deficiency in providing students with systematically delivered information on sustainability issues. These cause problems with students' recognition and application of effective design methods addressing sustainability.

Hypothesis 2: Interior design students lack knowledge on the sustainability strategies in building activities, particularly on effective construction or demolition waste management, as well as reliable information on the benefits from resources conservation. This leads to reluctance to consider the adaptive reuse of reclaimed or salvaged building products as a basic interior design method. Hence, the rejection of this as a method for sustainable design.

An exploratory questionnaire was used in this study. It was divided into four parts, combining questions related to interior design features and environmental attributes, including reduction in resources acquisition, as necessary for the

completion of natural environment-friendly internal spaces. The first section of this survey measured students' attitudes toward environmental responsibility demands. It addressed sources of information on sustainable architectural design and the environmental context for interior design. The second section comprised inquiries combining multiple choice questions, which addressed the students' perception of environmentally responsible interior design and their knowledge on the adaptive reuse interior design method allowing the fulfilment of a sustainability strategy in resource management. This section addressed students' assessment of possible barriers to the introduction of adaptive reuse. Perceived barriers might be technical, functional or costs-related.

The survey aimed to measure the interior design students' consciousness of the relationship between people, their built environment, comprising indoor environment and natural surroundings, as well as the responsibility of interior designers to optimise this interconnectedness. The questionnaire was to reveal if the currently executed educational model, with regard to sustainability, provides students with the knowledge to enable its efficient application in practice. Findings from the investigation confirming the study hypotheses would facilitate the incorporation of sustainability principles into interior design education and inform an environmentally responsible interior design methodology.

STUDENTS' PERCEPTION OF ENVIRONMENTAL CONTEXT AND ADAPTIVE REUSE

Environmental awareness implies rational resource consumption in the creation of built surroundings. This has a strongly defined cognitive and knowledge-based component, as well as an affective, perception-based element, and is understood as *knowing the impact of human behaviour on the environment* [10].

To verify the students' understanding of the adaptive reuse concept and its application, they were asked to indicate different sources of information on the environmental context of interior design and its consequences in the design process. The responses were based on their own experience. Among 26 respondents, 12 declared their engagement in design offices during the academic year, while six declined to attend lectures on sustainability design during the academic year.

The first multiple-choice question addressed the sources of reliable information with regard to the environmental contextualisation of interior design. It revealed the following sources:

- interior design offices provide students with professional training throughout the academic year;
- interior design offices employ students on a part-time basis;
- faculty courses on sustainable architectural design held in higher education institutions throughout the academic year;
- seminars and design studio activities, including refurbishment and adaptation of architectural objects;
- scientific literature recommended by educators;
- scientific literature for the general public recommended by educators or professional interior designers;
- other sources, e.g. Web sites, conferences, exhibitions, trade fairs.

The theme of the second survey question was the identification of sources of reliable information on sustainable interior design strategy for resource management using the adaptive reuse concept. The multiple-choice question revealed the following sources:

- nationally conducted environmental awareness campaigns on the necessity of the reduction of energy consumption in building construction, building materials and products;
- nationally organised campaigns on the promotion of reclaiming and processing of post-construction and demolition solid waste, mainly building products;
- locally conducted social initiatives on the reclaiming and processing of post-consumption solid waste;
- legal regulations for the acquisition of used and removed building products from the refurbished objects, and their further reprocessing by the manufacturers;
- faculty courses on sustainable architectural design, with emphasis on the strategies related to resource conservation, held throughout the academic year for interior design undergraduate students;
- other sources, e.g. Web sites, conferences, exhibitions, trade fairs.

STUDENTS' ASSESSMENT OF THE EFFICIENCY OF THE ADAPTIVE REUSE METHOD

In the following section of the survey, students were to point out the main problems that, in their opinion, may occur in the use of reclaimed components in inner spaces. These barriers as revealed by multiple-choice questions included the following:

- health-related problems caused by exposure to harmful chemical substances;
- uncertain estimation of costs related to the acquisition of reclaimed or salvaged components from refurbished or demolished objects;
- costs related to the restoration of acquired components for adaptive reuse;
- structural obsolescence and poor durability of products as a consequence of faulty or inappropriate workmanship;

- visual obsolescence of components or furnishings for reintroduction in inner spaces;
- social obsolescence resulting from the appearance evoking unsatisfactory aesthetic or semantic connotations;
- low performance standards of reclaimed components.

In the next step, students had to identify problems that restrain them from the implementation of adaptive reuse design in their own projects. The questions were addressed to students as though they were already practising designers, as well as clients in terms of their knowledge, attitudes and behaviour. These are essential factors causing a lack of acceptance of indoor environment creation proposals based on this method. The possible problems included:

- negative semantic and aesthetic connotations linked to the firm or individuals' image related to the acquisition of used products from refurbished or demolished objects;
- students' own aesthetic preferences against the introduction of reclaimed items from refurbished or demolished objects;
- clients' aesthetic preferences against the introduction of reclaimed items from refurbished or demolished objects into designed inner spaces;
- lack of students' commitment to sustainable interior design strategies that extend the lifespan of building products by the implementation of adaptive reuse;
- lack of students' knowledge of the active role of internal space design in an environmentally responsible architectural design through effective resource management;
- deficiency in the recognition of the environmental context in interior design proposals due to the inadequate scope of information provided.

DISCUSSION

The set of questions was prepared to measure the students' knowledge of environmental problems related to indoor environmental construction and operation, with emphasis on attitudes toward the implementation of adaptive reuse sustainable design in the creation of inner spaces. The data obtained on the interior design students' recognition of sustainability issues in the internal environment creation, produced general and more detailed findings.

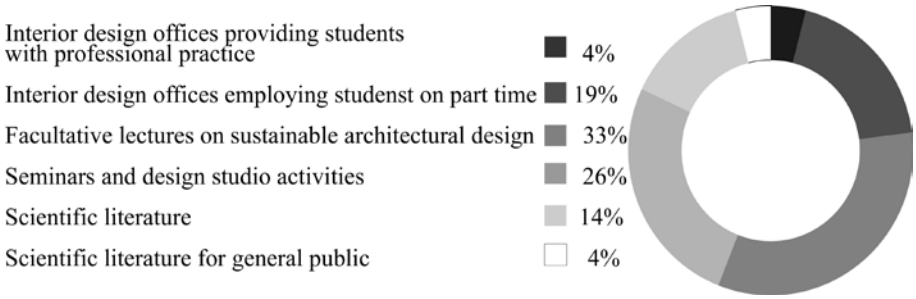

Figure 1: Sources of information on the environmental context in interior design (source: author's drawing).

The responses obtained in the first part of the multiple-choices questionnaire indicate that the Faculty lectures on the sustainable design, attended by 77% of surveyed students, remain the main source of information (Figure 1) by comparison to evidence obtained from design offices or offered within sustainability courses.

The second part of the survey indicates that students recognise the problem of resource management and the reduction in waste production realised through adaptive reuse. They obtained information on reuse mainly through lectures (Figure 2). Students have problems with the distinction between different methods of control of energy and water resource depletion. In 42% of answers, reduction, reuse and recycling are considered to be equally pro-ecological design methods.

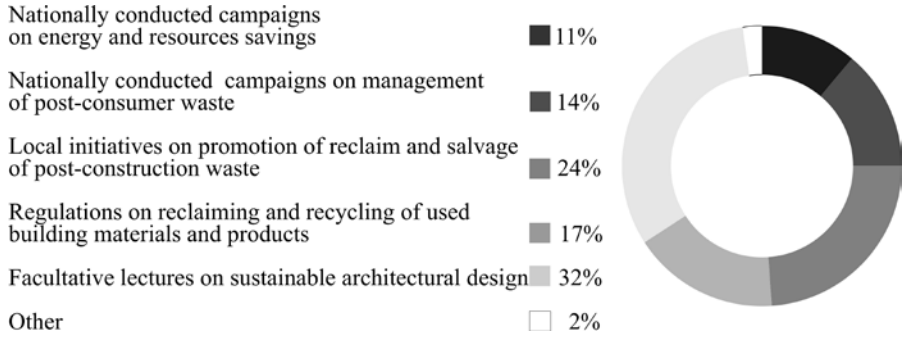

Figure 2: Sources of information on resource management and its realisation with adaptive reuse in sustainable interior design (source: author's drawing).

The results of the third part of the survey indicate that students assign an equal and meaningful role to the technical aspects related to adaptive reuse. As well, questions were raised of possible health problems related to unknown chemical substances present in reclaimed components (Figure 3). They assessed the functional standards of reclaimed products as having a smaller impact on their decision then the products' aesthetic appearance or unfavourable connotations.

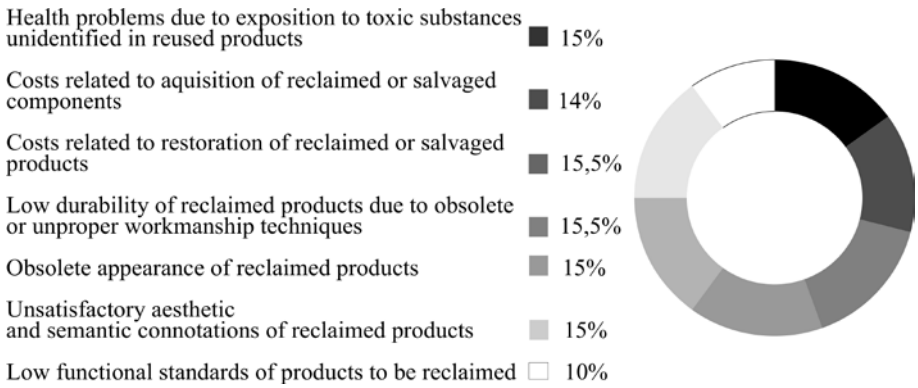

Figure 3: Students' assessment of barriers related to the reintroduction of reclaimed or salvaged building materials and products (source: author's drawing).

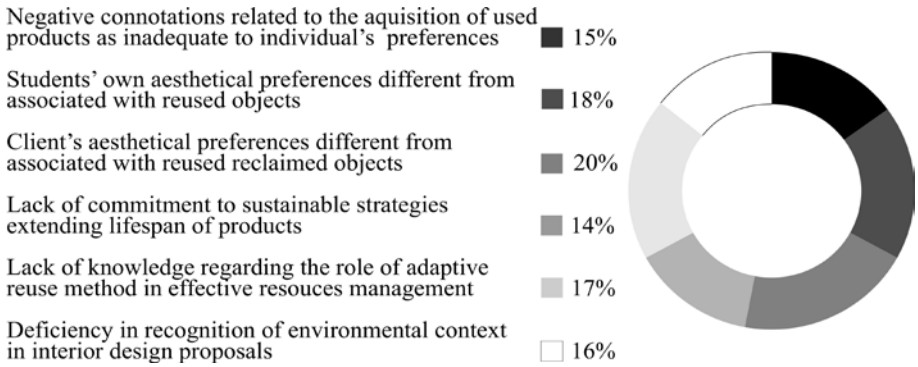

Figure 4: Student preferences, attitudes and scope of knowledge to the reintroduction of reclaimed or salvaged building materials and products through adaptive reuse (source: author's drawing).

The results of the fourth part of the survey indicate that students' attitudes toward incorporating sustainable design methods are influenced by their lack of knowledge, capabilities and recognition of valid sources of information (Figure 4). As a result, the students were reluctant to apply knowledge of sustainability for effective resource management to their own school projects. Although they incorporated some sustainable principles (e.g. introduction of internal green walls, installation of inner light shelves) into their projects on the refurbishment of existing office space, none of them considered the reuse of reclaimed products from dismantled components as a solution. Their proposals did not include interior components in the shaping of a sustainable built environment. The lack of appropriate knowledge and skills was among the factors preventing a wide reuse of building products in their projects. Along with the aesthetic preferences expressed by clients, lack of knowledge was essential in rejecting adaptive reuse in interior design. All the respondents who did not attend the lectures opined their lack of insight as decisive in avoiding adaptive reuse.

CONCLUSIONS

Teaching programmes in higher education do not sufficiently integrate sustainability into their courses. A significant modification of course content is required to include sustainability principles as important design criteria. The study findings reveal the necessity for interior design education to provide students with a comprehensive approach to sustainability issues, and an emphasis on resource management. This includes the adaptive reuse of reclaimed or salvaged building materials and products for resource conservation, which is at the core of an environmentally responsible interior design.

Since the integration of sustainability principles into every course is not possible, there is an alternative based on a currently delivered course on sustainable architectural design, covering the multi-faceted issues of environmental responsibility in architectural design. This comprehensive compulsory course on sustainability in design should be built on lectures, multimedia presentations, discussions, analysis of selected case studies, multidisciplinary workshops with the participation of professionals practising interior design and consultants of green building, laboratory experiments, as well as projects on the practical exercise of sustainable requirements.

The radical adjustments within the existing teaching framework postulated by the author are to provide students with information on sustainability through the *establishment of an autonomous module based on lectures, seminars and multidisciplinary student workshops* [11]. The compulsory course on sustainable design may lead to the development of an integrated teaching programme with sustainability principles as a main objective. The proposed curriculum should, in particular, promote adaptive reuse as the relevant environmentally responsible interior design criterion. The reuse of building materials should be treated as essential for the reduction in construction and demolition waste [12]. It should be understood by students as:

- a technique for the extension of a building's internal components lifespan;
- a sustainable design method assuring the diversion of a significant percentage of waste from landfills;
- a means of protection of environmental resources through their rational management.

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