

Multisensory experience for mental health in higher education classroom design

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Abstract. The World Health Organization has incorporated mental health in September 2015 as one of the goals of the Sustainable Development Goals, especially those focusing on ensuring healthy lives and promoting well-being for all at all ages. One of the things that affect mental health is a sensory stimulus that is inherent in the human body that rise to the perception of the environment. The problem that often occurs is the architectural and built environment design dominates by the visual sensory, whereas it should, the perception of space is received through full spectrum of perceptual quality. This multisensory approach conducted with sensewalking – open questioner and semantic differential scales – to assess the perception of the classroom. The online data that been collected will be analyzed to determine the perceptual construct from each category of sensory and look for components that designers should be concerned with in classroom design.

1. Introduction

The World Health Organization - the agency that deals with health under the United Nation Organization - has incorporated mental health in September 2015 as one of the goals of the Sustainable Development Goals, especially those focusing on ensuring healthy lives and promoting well-being for all at all ages [1]. One of the things that affect mental health is a sensory stimulus that is inherent in the human body that rise to the perception of the environment. The adjective sensory itself describes something relating to sensation — something that you feel with the whole physical sensory [2].

The problem that often occurs is the architectural and built environment design dominates by the visual sensory. Since ancient Greek times, many philosophers - Heraclitus, Plato, Aristotle, and others - emphasize the importance of the visual sense with various analogies. Until modern era - which lead by Le Corbusier, architectural and built environmental design still *ocularcentrism* [3]. This often leads to a misperception of the quality of the environment. Whereas the quality of perception should be determined by the various stimuli perceived by all sensory such as sound/audition, smells/olfaction, touch/somatosensation, taste/gustation, must seriously be taken into account beyond the hegemony of visual aspect [3,4,5].

The multisensory studies were conducted in many fields, from the design of urban areas to the design of education facilities especially for people with intellectual disabilities. Bruce (2015) conducted a research on multisensory expectation and perception in English cities. He concluded that consideration of sensory aspects of urban ambience as part of mainstream urban design, development and management practices, also suggesting that attempts to alter or regulate olfactory and aural urban place characteristics,



require prior critical reflection. The urban ambience is not only determined by visual quality but also with multisensory qualities in this regard related to auditory and olfactory sensory [6]. Matos (2015) conducted multisensory story-telling on people with intellectual disabilities. He concluded that multisensory had an effect on education, where the multisensory methods achieve a better result than the audio-visual experience [7].

In this research, the methods to understand the perception qualities of environment with the auditory sensory is the soundscape and then evolved by involving another sensory. The term soundscape signifies a sonic environment, formed within a context, as it is experienced and perceived by a person and people [4,8,9]. The concept of 'soundscape' is originally rooted in the music and acoustic ecology research areas. It quickly expanded to other disciplines, such as acoustics, architecture, environmental health, psychology, sociology and urban studies, claiming for further attention and a holistic approach to the way we conceive the sound around us and its perception [10,11]. These fields have similarities in studying how human experience in the environment and trying to formulate the relationship between the physical world conditions with human responsiveness to it. This preliminary study aims to explore the perceptions of students based on multisensory and the expectations that are expected to be able to support the learning process.

2. Method

The method used in this study is basically derived from soundscape research which is then developed by involving other sensory. Aletta et.al. (2016) develop methods and tools to assess the perception of the environment based on the audio sensory. According to him, the acoustic environment can be divided into in-situ, experiment laboratory and recalled in memory. Each of acoustic environment have their specific methods such as: the behavioral observation, soundwalks, experiment laboratory [12]. A suitable method for research in in-situ locations is the soundwalk method and because it involves other sensory, so it is developed into a sensewalking method. Sensewalking is varied method by which researcher can investigate about the experience and perception in space [13].

In this study, sensewalking was done with online questioners with several question and semantic differential scales which involved 37 students – consist of 19 male and 18 females – from Architecture Department in Bina Nusantara University about the condition of their classrooms as seen in figure 1. The questioners explore the perception of visual aspect, auditory, olfactory and the thermal condition which breakdown to some questions as follows: What is your feeling in this environment? What sound(s) that can be identified? Positive or Negative sound? What is your expectation about the sound in the classroom? What visual element(s) that can be identified? Positive or Negative visual elements? What is your expectation in the classroom? What smell can be identified in this classroom? Positive or negative smell? What is your expectation about the smell in the classroom? Hot or Cold? Is it an ideal classroom? What is the main sensory to support learning condition?



Figure 1. Architectural Design Studio Classroom

Besides of the open questionnaire, the sensewalking also involved the semantic differential scales about the sensory above. The participant assessed the asked condition on a scale 1 to 10 as seen in table 1.

Table 1. Semantic differential scales that used in the study

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|----------------------------------|---|---|---|---|---|---|---|---|---|----|--------------------------------------|
| Big Room | | | | | | | | | | | Small Room |
| Ornamental | | | | | | | | | | | Plain |
| Interesting | | | | | | | | | | | Boring |
| Bright | | | | | | | | | | | Dull |
| Cheerful | | | | | | | | | | | Depressive |
| Spacious | | | | | | | | | | | Small |
| Dirty | | | | | | | | | | | Clean |
| Modern | | | | | | | | | | | Old |
| Noisy | | | | | | | | | | | Quite |
| Discord | | | | | | | | | | | Harmony |
| Loud | | | | | | | | | | | Soft |
| Variety | | | | | | | | | | | Uniformity |
| Vague | | | | | | | | | | | Clear |
| Annoying | | | | | | | | | | | Pleasant |
| Fragrant | | | | | | | | | | | Stinky |
| Strong Scent | | | | | | | | | | | Soft Scent |
| Fresh | | | | | | | | | | | Polluted |
| Like the environment | | | | | | | | | | | Unlike the environment |
| Comfortable | | | | | | | | | | | Uncomfortable |
| Support the learning environment | | | | | | | | | | | Not support the learning environment |

The online data that been collected from sensewalking, will be analyzed by using Orange Data Mining software version 3.13.0, IBM SPSS Statistic version 23 and Microsoft Excel. This software allows to

analyze data into Word Cloud to show the most common answer and Principle Component Analysis to search the dimension that influence classroom design.

3. Result and Discussion

From the data collected, sensory that plays an important role to support learning is still the visual sensory as much as 35%, followed auditory sensory by 31%. The olfactory sensation accounts for 21% and the thermal sensory is 8% as shown in figure 2. From the responses, 40% of student feels that the environment is already support enough for learning process and only 8% of the student feels that the environment is not support for learning community as show in figure 3.

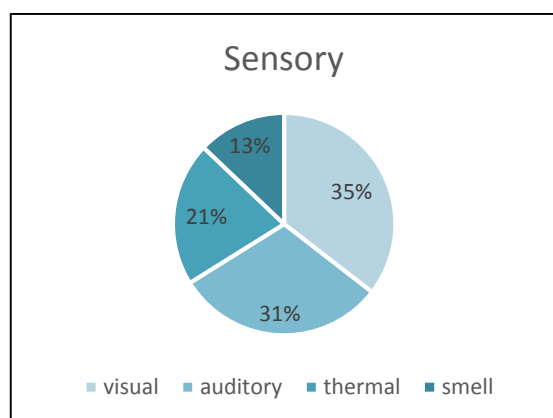


Figure 2. The senses that play a role in the perception of the environment

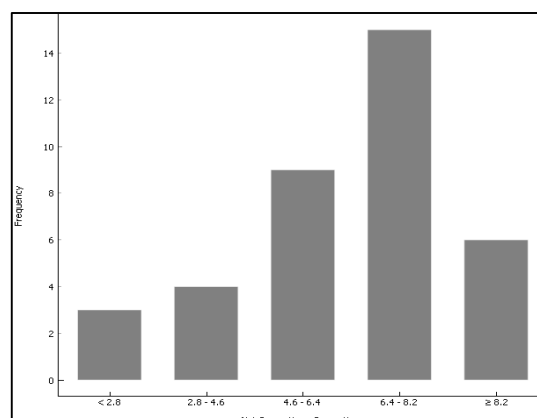


Figure 3. Not Supportive – Supportive Learning Environment. The result shows that the environment supportive enough for learning environment

The positive visual elements that support the learning environment still the presentation from the projectors as seen on word cloud below. Meanwhile, the students are very disturbed by colleagues who use mobile phones in the classroom. Their expectation is to see more videos as their learning materials as show in figure 4.

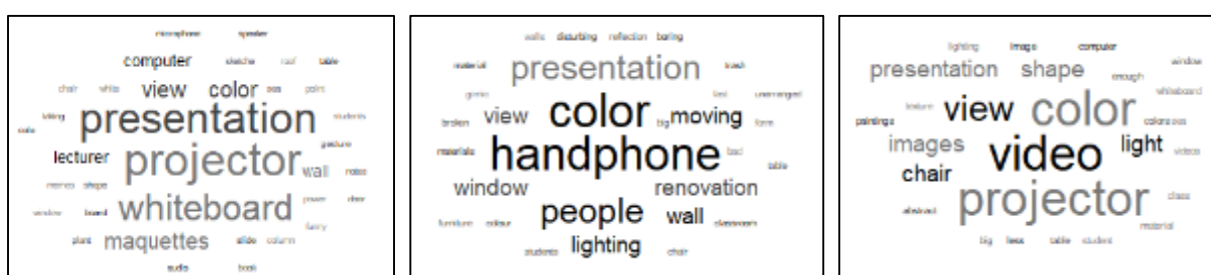


Figure 4. The visual elements that have positive impact on learning process (left), the visual elements that have negative impact on learning process (middle) and expectation visual elements to support learning environment (right)

Based on the auditory sensory, positive sound that plays an important role in learning is still a lecturer's voice and voice colleague who discussed the related topics. Most of the respondents state the unimportant peer chats as the negative sound that interfere the learning process in the classroom. In

addition, the other negative sounds they feel are negative voices from outside the classroom like the voice of people talking too loudly, the sound of vehicles, and the sounds from other classes that infiltrate into the classroom. They expect to hear a clear lecturer sounds to explain learning materials as well as sounds of music when they work individually. The word cloud related to auditory sensory can be seen in figure 5.

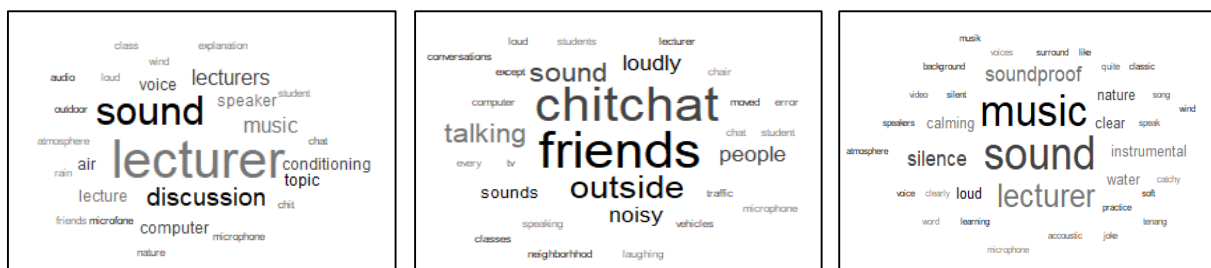


Figure 5. The positive sound to support learning process (left), the negative sound that interfere the learning process (middle), and the expected sound to support learning process (right)

In terms of air quality and thermal comfort, most of respondent does not have problems, because the room that uses air conditioning. The main problem just the placement of the air conditioning directly affected to their bodies. Therefore, in the classroom design the designers should pay attention to the continuity between the layout based on activity with the placement of utilities as support.

Moreover, the Principles Component Analysis was used to analyze the semantic differentials scales, to determined most influenced component. The significance components were determined by the eigenvalue (eigenvalue >1) and further test with the reliability test (Cronbach's Alpha >0.5). The data obtained from sensewalking has a value of 0.651 in the Kaiser-Meyer-Olkin index, which means that the data is sufficient to be analyzed and has a Bartlett's test of Sphericity value of .000.

The result of Principles Component Analysis shows that the indicators can be grouped into 5 component that covers 75% of cumulative variance as shown in table 2. The component 1 have 7 indicators, component 2 have 6 indicators, component 3 have 2 indicators, component 4 and component 5 only have 1 indicator.

In further reliability test using the Cronbach's Alpha, only two of the first component that significance to the classroom perception:

- Component 1 (Cronbach's Alpha .879) named **Spatialy** consist of interesting-boring, bright-dull, cheerful-depressive, spacious-small, modern-old, fragrant-stinky, and fresh-polluted.
- Component 2 (Cronbach's Alpha .797) named **Pleasantness** consist of big room-small room, noisy-quiet, discord-harmony, loud-soft, vague-clear, annoying-pleasant.
- This component is part of the component formulated by Sudarsono (2016) on soundscape research in urban space. He shares the soundscape components in urban areas in 6 components: calmness / relaxation (24%), dynamics/vibrancy (14%), communication (11%), naturality and meaningful (9%), spatialy (7%), and directivity (7%) [14]. Ikhwanuddin (2017) who conducted research on the soundscape in the library also get the components that need to be considered in the library that is pleasantness (31%) and dynamic (10%) [15].

Table 2. Principles Component Analysis from sensewalking data

| | 1 | 2 | 3 | 4 | 5 |
|-----------------------|------|------|------|-------|-------|
| Big Room - Small Room | .347 | .541 | .002 | -.577 | -.075 |

| | | | | | |
|---------------------------|-------|-------|-------|-------|-------|
| Ornamental - Plain | .167 | -.058 | .664 | -.318 | -.356 |
| Interesting - Boring | .831 | .034 | .317 | .117 | .027 |
| Bright - Dull | .579 | .483 | -.050 | .139 | -.381 |
| Cheerful - Depressive | .771 | .407 | .251 | .019 | .157 |
| Spacious - Small | .724 | .364 | -.273 | -.175 | -.146 |
| Dirty - Clean | -.770 | -.244 | .108 | -.133 | .294 |
| Modern - Old | .587 | .333 | .196 | -.006 | .544 |
| Noisy - Quite | -.791 | .395 | .013 | -.088 | .048 |
| Discord - Harmony | -.740 | .372 | -.077 | -.156 | .164 |
| Loud - Soft | -.576 | .460 | .168 | .366 | -.348 |
| Variety - Uniformity | -.434 | .366 | -.358 | .368 | -.099 |
| Vague - Clear | -.593 | .506 | .137 | -.166 | .335 |
| Annoying - Pleasant | -.756 | .337 | .066 | .225 | .003 |
| Fragrant - Stinky | .558 | -.017 | -.131 | .325 | .258 |
| Strong Scent - Soft Scent | -.205 | .014 | .858 | .338 | .045 |
| Fresh - Polluted | .807 | .163 | -.122 | .287 | .197 |

4. Conclusion

In this preliminary study of classroom perception shows that the senses that play an important role in supporting learning activities are still the visual sense, but other senses also play an important role in creating a good classroom perception. The use of audio-visual can be improved to support learning activities. The objects that can interfere with the learning process is when friends talk and play mobile phones. This disturbing object is perceived through the visual and auditory senses. In addition, the designer should consider two main components in the classroom design: Spatially and Pleasantness component.

Through this experiment, the quality of learning is determined by the perception of its users of the classroom, where perception is not only based on the visual senses, but also involves all the sensory that is in the human body. Further research is needed to compare and reassure the existing components in classroom design to improve learning. In addition, it is necessary to examine the response of user behavior based on given stimulus. Thus, this multisensory design research has the potential to develop better architectural design and built environment.

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