Abstract: An educational construction apparatus typically as a kit, including in combination, a plurality of elongate tubular members of various lengths, a plurality of joining connectors, adapted to enable an angular joining of the tubular members, the lengths of the tubular members in mathematical relationship to one another, wherein in use, connectors enabling assembly of the tubular members to form a structure of sufficient size to allow a user, typically a child, to move in and out of the structure.
This invention relates to educational apparatus in particular, but not exclusively to an educational construction apparatus adapted to convey spatial mathematical, geometrical, volumetric and musical relationships in a structure of sufficient size for a child to move in and out of.

There are numerous prior art apparatus designed to teach children mathematical relationships.

Among more of the well-known prior art include that of Cuisenaire™ rods and products developed or invented, by Georges Cuisenaire (1981-1996) comprising colored rods wherein rods of equal lengths are assigned the same color in order to teach young children mathematical and common fractional relationships.

The limitations to this prior art and to others of similar ideology and educational theory include their limitation to a two-dimensional aspect wherein the rods are laid on a flat surface to construct patterns or two-dimensional structures. Other colored rods include those developed by Dr Catherine Stem, which include a set of colored rods produced by staining wood with different aesthetically pleasing colours and those produced by Seton Pollock in 1961 wherein rods with odd numbered lengths were given cold colours and wherein rods with even numbered lengths were of warm colours.
In all the prior art, colours were the dominant feature used to impart the educational content and there was no three-dimensional structured aspect to the systems.

**OBJECTION OF THE INVENTION**

The object of the present invention is to seek ameliorate or remove some of the limitations or disadvantages of the prior art by providing a novel and innovative three-dimensional educational construction apparatus which is able to impart mathematical, spatial, geometrical, volumetric and musical educational knowledge or to at least provide the public with a useful choice.

**STATEMENT OF THE INVENTION**

An educational construction apparatus typically as a kit, including in combination,

a plurality of elongate tubular members of various lengths,

a plurality of connectors or joining knuckles, or elbows adapted to enable an angular joining of the tubular members,

the lengths of the tubular members in mathematical relationship to one another, wherein in use,

the connectors enabling assembly of the tubular members to form a three dimensional structure adapted to teach spatial, mathematical, geometrical, volumetric and musical relationships of sufficient size to allow a user, typically a child, to move in and out of the structure.
Preferably each of the tubular members are marked alpha numerically to reflect their various lengths.

In a preferred version, the tubular members can also be colour coded to reflect their lengths.

Preferably the joining connectors or knuckles or elbows have two or more projecting stubs projecting at given angles, the projecting stubs adapted to be inserted into the ends of the tubular members in angular relationship.

Preferably the angles between the stubs include angles of 90°, 60°, 45°, 180° (or straight connections).

In addition there may be swivel connectors to enable joining of tubular members at any angle.

In another version, the tubular members may be of a clear or transparent material wherein the tubular members may be adapted to contain water to provide a further dimension of play or education, for example, the observation of volumetric relationships or the general flow of water through a structure.

In this example, the joining connectors may have holes or apertures to allow water to be poured into the structure.

Preferably, the apparatus when supplied in the form of a kit comprises a set of tubular members of varying length and a number of connectors in a portable container and includes written instructions and plans to construct various types of structures.
Where clear or transparent tubular members are used, various musical instruments for example, a xylophone may be assembled by using tubular members of gradually varying length.

The tubular members may also be filled to various levels with water to reflect a musical register or scales.

**BRIEF DESCRIPTION OF THE DRAWINGS**

In order for the invention to be better understood and put into practical effect, reference will now be made to the accompanying drawings wherein:

Figure 1 shows a cube structure according to the invention,

Figure 2 shows a further structure according to the invention,

Figure 3 shows a fence structure according to the invention, and

Figures 4A and 4B show a musical application of the invention.

**DETAILED DESCRIPTION OF THE DRAWINGS**

Referring now to the drawings and initially to Figure 1, there is shown a cube structure 10 which may be assembled by using the tubular members 12-32 and joining connectors 34-48 of the invention. This structure is constructed from tubular members of varying lengths. The connectors are used to join sides comprising of tubular members 14, 18, 20, 22, 26, 27, 30, 31 of preferably one metre in length together with upright poles 12, 16, 24, 28 of fifty centimetres in length.
The joining elbow or knuckles have male protruding stubs inserted into the ends of the tubular members. It will be obvious that other structures may be formed of sizable dimensions wherein a child can easily crawl in and out of the structure.

Figure 2 shows a further structure of a free crenellated design 40 in three directions which imparts, in educational content wherein the child must realise that the legs 43, 45, 47 formed by the vertical tubular members of different lengths must equate to the same height. An example of a structure is a play castle wherein spatial relationships and building or constructional problems are to be solved by children.

Figure 3 shows a fence design 50 constructed from tubular members having cruciformed 70, 72 and triangular 74, 76 joining connectors wherein the tubular members 52, 54, 56, 60 must all be the same height and where two shorter tubular members 56, 58 are connected must equate to a longer length, of single tubes 52, 54, 60. The tubular members 54, 56. 58 are also shown alpha numerically marked with their individual lengths.

In this example, a child has to realise that the posts used to construct the fence should all be the same height. While actual measurements are not critical, the child will eventually choose matching links so that the fence is of a level design. The child will also realise that he or she can climb under the fence but not if the fence is inverted. The child will also discover that he or she has to build pillars or corners for the fence for it to stand securely. In particular, the child must choose a four-way or cruciform connector to construct a pillar.

In the teaching of vertical or horizontal concepts, once a square is constructed on the ground, a child can investigate anything lying in it or on it depending on the size of the structure. When the structure is placed in the upright position, the child can contemplate whether he or she can walk through
it or has to crawl through it. For example, if a child constructs two matching squares, the child is stimulated into questioning how this maybe converted into a cube such as by the inclusion of uprights.

Figures 4A and 4B show a musical instrument 70 that may be constructed with the tubular members 72 - 86 and joining members 88 - 110 of the invention. When the tubular members are clear, water may also be poured into the tubular members to varying heights so that a musical scale or register may be constructed to construct a form of a xylophone. The instrument 70 is supported by triangular 112, 114 or alternatively, rectangular supports 115 at either end.
VARIATIONS

It will of course be realised that while the foregoing has been given by way of illustrative example of this invention, all such and other modifications and variations thereto as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of this invention as is herein set forth.

Throughout the description and claims this specification the word "comprise" and variations of that word such as "comprises" and "comprising", are not intended to exclude other additives, components, integers or steps.
1. An educational construction apparatus, including in combination
   a plurality of elongate tubular members of various lengths,
   a plurality of joining connectors, adapted to enable an angular joining of
   the tubular members,
   the lengths of the tubular members in mathematical relationship to one
   another, wherein in use, connectors enabling assembly of the tubular
   members to form a three dimensional structure adapted to teach
   mathematical, spatial, geometrical, volumetric and musical relationships
   of sufficient size to allow a user, typically a child, to move in and out of
   the structure.

2. An educational construction apparatus as claimed in claim 1, wherein
   the joining connectors have two or more projecting stubs projecting at various
   angles, the projecting stubs adapted to be inserted into the ends of the tubular
   members in angular relationship.

3. An educational construction apparatus as claimed in claim 1, wherein
   each of the tubular members are marked alpha numerically to reflect their
   various lengths.

4. An educational construction apparatus as claimed in claim 3, wherein
   the tubular members are also colour coded to reflect their lengths.

5. An educational construction apparatus as claimed in any of the above
   claims, wherein the tubular members are of a clear or transparent material and
   are adapted to contain water to provide a further dimension of play or
education, for example, the observation of volumetric relationships or the general flow of water through a structure.

6. An educational construction apparatus as claimed in claim 5, wherein the connectors have holes or apertures to allow water to be poured into the structure.

7. An educational construction apparatus as claimed in claim 1, wherein various musical instruments are assembled by using tubular members of gradually varying length.

8. An educational construction apparatus as claimed in claim 7, wherein the tubular members are filled to various levels with water to reflect a musical register or scales.

9. An educational construction apparatus as claimed in any of the above claims, wherein the apparatus is supplied in the form of a kit comprising a set of tubular members of varying length and connectors in a portable container and includes written instructions and plans to construct various types of structures.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl.
G09B 23/04 (2006.01)  G09B 23/14 (2006.01)  A63H 33/04 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT and Keywords (education, teaching, training, connect, relation, ratio, move, change, elongate, tubular, toy)

USPTO, EPO

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>X</td>
<td>US 5180323 A (JUSTICE) 19 January 1993, Abstract, Figs 1-5, column 1, line 50-column 2, line 7, column 2, line 51-column 4, line 15</td>
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<td>Y</td>
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<td>US 5480336 A (BLANCHARD) 2 January 1996, Abstract, Fig 1, column 1, lines 36-37</td>
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<tr>
<td>Y</td>
<td>US 3752472 A (SNEAD) 14 August 1973, Abstract, Fig 1, column 1, lines 22-31</td>
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Further documents are listed in the continuation of Box C

See patent family annex

* Special categories of cited documents:
  "A" document defining the general state of the art which is not considered to be of particular relevance
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  "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  "O" document referring to an oral disclosure, use, exhibition or other means
  "P" document published prior to the international filing date but later than the priority date claimed
  "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
  "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
  "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document, is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  "&" document member of the same patent family

Date of the actual completion of the international search: 24 November 2006

Date of mailing of the international search report: 2006

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Form FCT/ISA/210 (second sheet) (April 2005)
### DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>A</td>
<td>US 4080752 A (BURGE) 28 March 1978 Abstract, Figs 51, 70, column 1, line 63 - column 2, line 66</td>
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Note: For the Y indications US 5180323, US 5480336 and US 3752472 can be combined together with relevance to the same claims.
This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX