different tools more or less evenly (note that the use of CAD software was mandatory as the ChairDNA back-end). After using ChairDNA they mostly used models (that were mandatory to print a scale model) and other CAD software (which were largely used to edit the 3D model, as aforementioned).

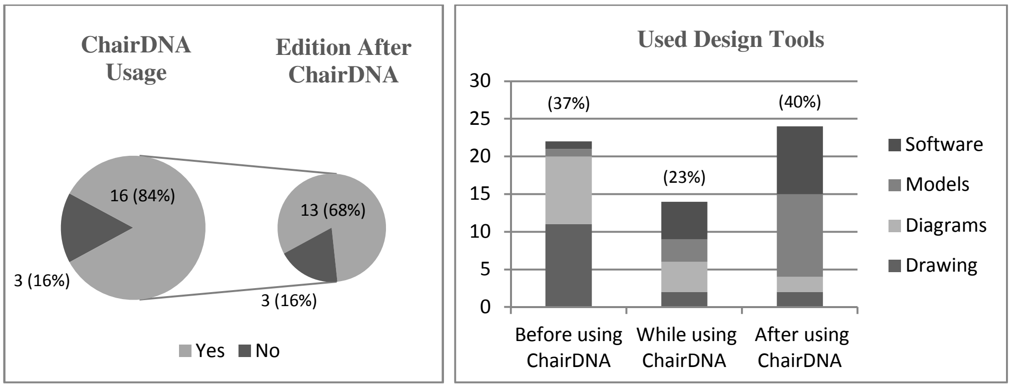

Fig. 7.5 Design tools used in E1 (on the left: ChairDNA; on the right: other tools – INC data)

The materials that the participants envisioned for the final designs are detailed in **Fig. 7.6** (left). For each of the two main parts of the chair (frame and seat/back panels), one material (from the categories: wood, metal, plastic and textile) was assigned. The preferred materials were metal (for the frame) and wood (for the seat/back panels). Most participants (11; 73% – INC) did not consider materials as a constraining factor during the generation process (**Fig. 7.6**, right). Incidentally, the choice of the material did not affect the section shape (for instance, the metal frame sections where equally round and square).

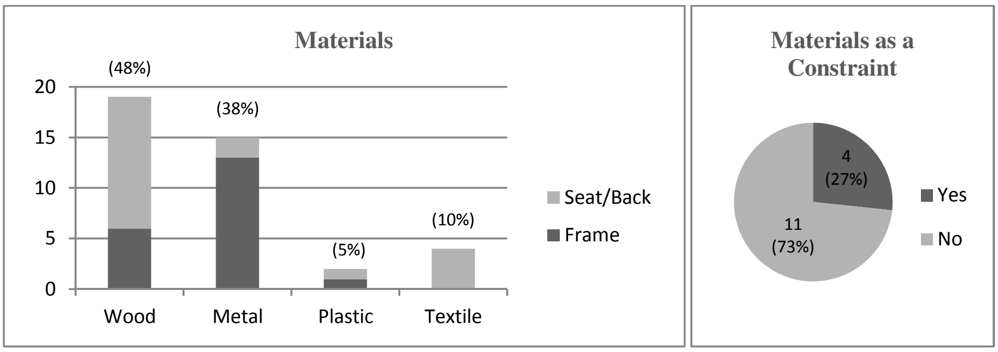

Fig. 7.6 Envisioned materials of E1 resulting designs (left) and materials as a constraint (right – INC data)

Thirteen 3D printed scale models, generated with the aid of ChairDNA 1.1, are presented in **Fig. 7.7**. Two models also generated with ChairDNA are not shown (**S4** and **S10**) because they broke during or after printing, and the design **S6** was not printed. The scale models were printed from one of the two following technologies, available at the faculty Lab: Fused Deposition Modelling technique (FDM) and 3D Printing technology (launched by Z Corporation). The majority of the participants used the former technology, since it was the cheapest option. The printers comprised some restrictions that obligated nearly half of the participants to make changes in the 3D model, mostly to increase the thickness of the frame or, in one case, to refine the union between the parts of the chair.

Fig. 7.7 Above: the solution S12 being printed; below: thirteen E1 resulting scale models (author's photos)

Other results obtained from the user test, comprising the analysis of some generation sequences and the types of resulting designs are available in **Appendix 7.A.9**.

ChairDNA Usability

The evaluation of the ChairDNA 1.1 usability and usefulness was mostly done through five-point Likert scale questions, where the lower score (1) corresponded to 'strongly disagree' and the higher score (5) corresponded to 'strongly agree'. The results are presented in the present section and the subsequent section in the format (Mean; Standard Deviation).

In general, the participants revealed a positive overall appreciation of the ChairDNA 1.1 usability (**Fig. 7.8**, left). The results are, from best to worst: ease of learning (4.27; 0.80 – INC), ease of use (3.87; 0.74 – INC), overall coherence (3.80; 0.68 – INC), user experience (3.13; 0.83 – INC), efficiency on the response speed (3.07; 1.16 – INC), and flexibility in adapting to the user needs (2.93; 0.46 – INC). The low appreciation regarding ChairDNA 1.1 efficiency was justified by a poor performance, recurrent crashes, and inability of the program to save states of the solution. The ChairDNA flexibility in adapting to the user's needs was also poorly evaluated, which may be a situation to consider in future developments.

The ChairDNA 1.1 commands were positively evaluated (**Fig. 7.8**, right), in relation to their terminology (4.13; 0.83 – INC), distribution in the interface (4.20; 0.77 – INC), quantity (3.13; 0.74 – INC), and activation sequence (4.13; 0.64 – INC). The dissatisfaction of the users regard-